NASA

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California

ARC 275 (Nov 75)

FINAL INSTITUTIONAL
ENVIRONMENTAL IMPACT STATEMENT

AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA 94035

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

(FINAL JULY 1977)

SUMMARY

( ) Draft (X) Final Environmental Statement

Responsible Federal Agency: National Aeronautics and Space Administration
Ames Research Center
Moffett Field, CA 94035

Official Contact: Dr. Lewis Hughes, Chief
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1. Name of Action: (X) Administrative Action
( ) Legislative Action

2. Brief Description: This statement supersedes the original Institutional Environmental Impact Statement for Ames Research Center, Moffett Field, California, dated July 1971. It describes the current mission, facilities, community setting, and environmental effects associated with the present baseline activities at the installation.

3. Summary of Environmental Effects: The operations of certain wind tunnels impose adverse noise effects upon the surrounding communities. Minor environmental effects include emissions infrequently exceeding the 1-hour NO_2 standard on-site and a visual impact of the 40 ft. x 80 ft. Wind Tunnel.

4. Summary of Major Alternatives: The only major alternative to the ongoing activities described in this Institutional Environmental Impact Statement is the cessation of these activities, at major scientific, technological, environmental and economic cost. Minor alternatives relating to mitigating adverse noise effects are discussed.

5. Copies of the draft statement were sent to the following parties along with a solicitation of their comments:

Regional Administrator IX
U.S. Environmental Protection Agency

Office of Federal Activities
U.S. Environmental Protection Agency

Moffett Field Naval Air Station

Department of the Navy

Environmental Project Review
Department of the Interior

Office of Architectural and Environmental Preservation
Advisory Council on Historic Preservation

Advisory Council on Historic Preservation

Office of Environmental Affairs
Department of Health, Education and Welfare

Office of Environmental Quality
Department of Housing and Urban Development

Office of Environmental Quality
Department of Transportation

California State Water Resources Control Board

California State Department of Fish and Game, Region III

California State Lands Commission

California State Department of Public Health

California State Air Resources Board

California State Historic Preservation Office
Resource Management and Protection Division
Department of Parks and Recreation

California State Department of Transportation

California State Office of Planning and Research

California Regional Water Quality Control Board
San Francisco Bay Region

San Francisco Bay Conservation and Development Commission

Association of Bay Area Governments

Bay Area Air Pollution Control Board

Santa Clara Valley Water District

Santa Clara County Board of Supervisors

Santa Clara County Planning Commission

City of Palo Alto

City of Mountain View

City of Sunnyvale

City of Menlo Park

6. Comments on the draft statement were received from the agencies listed below.

Regional Administrator IX
U.S. Environmental Protection Agency

Department of the Navy

Environmental Project Review
Department of the Interior

Advisory Council on Historic Preservation

Department of Transportation
Federal Highway Administration
Region IX

California State Resources Agency

California State Air Resources Board

California State Historic Preservation Office
Resource Management and Protection Division
Department of Parks and Recreation

California State Department of Transportation

City of Mountain View

7. Submittal Date. Draft statement submitted to Council on Environmental Quality (CEQ) Executive Office of the President, and made available to the public in July 1976. Final statement submitted to CEQ and made available to the public on JUL 5 1977.

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INTRODUCTION

1.0

INTRODUCTION

Soon after the passage of the National Environmental Policy Act in 1969 and the issuance of implementing regulations by the Council on Environmental Quality (CEQ) and the Office of Management and Budget (OMB), NASA developed a system for taking environmental factors into consideration in the planning, decision-making and implementing of its actions. The NASA system provided for the development of both "Institutional Environmental Statements" and "Program Environmental Statements."

The program statements represent the full description of the likely environmental effects of a proposed action falling in the category of "major Federal action having a significant effect upon the human environment" and are used in the process of making program and project decisions. Institutional Environmental Impact Statements were prepared to describe the ongoing activities at each major NASA field installation and, as all were originally prepared in the 1971-1972 time frame to describe activities already underway, they were not considered decision documents and did not describe any proposed actions. They instead described the cumulative effects of all the typical activities at the field installation in question, most of which would be minor from an environmental viewpoint. They then provided a baseline against which the environmental effects of proposed new actions at that installation could be assessed as a part of the decision process.

NASA also provides for amendments to environmental statements of either type. Program Environmental Statements can be amended if, during the course of the research and development program in question, changes occur in the program that are likely to result in a significant change in the environmental effects described in the original statement. Institutional Statements may be amended to cover the proposed construction of new facilities or buildings at a field installation or the initiation of new research activities which might have a significant environmental effect different from that described in the baseline Institutional Statement prepared earlier. On the other hand, minor construction at a field center and changes in field installation activities within the general scope of the baseline environmental statement would not necessarily require an amendment.

The Institutional Environmental Impact Statement for the Ames Research Center, Moffett Field, California, was prepared in draft, circulated for comments, and published as a final EIS in 1971. A number of minor construction and modification actions and changes in activities have taken place at various times in the period since 1971 and, although no one of these was deemed to require preparation of an amendment to the original EIS, the overall changes tend to make the 1971 EIS obsolete. This document has therefore been prepared to supersede the 1971 EIS, and will serve in the future as the baseline against which any proposed actions at the Ames Research Center will be assessed.

2.0

PROJECT DESCRIPTION

2.0

PROJECT DESCRIPTION

2.1 HISTORY

The concepts and ideas which would later evolve into what is now known as the NASA Ames Research Center began to develop during the late 1930s. During this period, it became known that the expansion capabilities of the National Advisory Committee on Aeronautics' (NACA) Langley Memorial Aeronautical Laboratory were limited by both the lack of space and the availability of electrical power. To get even limited amounts of power at off-peak rates, operation had to be limited largely to the period from midnight to 6 a.m. The men in charge of NACA also recognized that the pace of aeronautical research in other countries was accelerating and would eventually overcome the superiority America had developed through research and development efforts at Langley.

After considerable effort in the Congress, NACA officials were finally able to persuade both the House and Senate of the urgency of a new research facility. On August 9, 1939, a bill appropriating $10 million for a new research facility became law. As site selection was left up to the NACA, communities from all over the U.S.A. submitted applications. Some of the communities in the running for selection included such places as Buffalo, New York; Dismal Swamp, Virginia; Indianapolis, Indiana; Menunketesuck Point, Connecticut; Chicago, Illinois; Fort Worth, Texas; Spokane, Washington; and within California -- Los Angeles, San Diego, Sacramento, and Mountain View. The NACA staff then recommended a site on the basis of these applications and the following site selection criteria:

- The station should, if possible, be on an Army or Navy base.
- The site should have, or allow for the construction of, a flying field of about one mile square and should not be in an area of high air-traffic density. Moderate temperature and good flying weather through most of the year were desirable.
- Adequate quantities (50,000 kva) of electric power should be available on site at reasonable rates.
- The site should be readily accessible to the aircraft industry on the West Coast.
- The site should be near an industrial center capable of providing labor, supplies, communications and transportation facilities, and other logistic support.
- The site should be in an area providing attractive living conditions, schools, etc., and, if possible, should be near a university of recognized standing.

After a month of analysis, the NACA staff recommended Mountain View, California, which satisfied all the criteria very nicely. Other West Coast communities also received high scores. On September 22, 1939, the Committee followed the staff recommendation and officially announced the selection of the Mountain View site for the location of the new research station. For more information regarding those events and the history of the Center between 1940 and 1965, Adventures in Research, A History of Ames Research Center 1940-1965* should be consulted.

2.2 LOCATION

Ames Research Center occupies 421.4 acres on the northerly part of the Santa Clara Valley floor at the south end of San Francisco Bay. San Francisco lies about 35 miles to the northwest and San Jose is about 10 miles to the southeast. The Ames site is of low relief, with the natural ground declining gently in a northerly direction toward the Bay at a slope of around

*Library of Congress Catalog Card Number 78-601606.

1 percent. The average elevation of the site above mean sea level is about 20 feet. The Ames site experiences a mild climate, typical of the San Francisco Bay Area. The city of Mountain View is contiguous to Ames on the west. The U.S. Naval Air Station, Moffett Field, occupies property to the south, east, and west. The area north of Ames is essentially uninhabited; Leslie Salt ponds and marshlands of San Francisco Bay lie about 1 mile to the north. Figure 1 shows the regional setting of Ames Research Center. Major populated areas are to the west and south of Ames in the cities of Mountain View, Palo Alto, and Sunnyvale. Existing developments within the boundaries of the City of Mountain View in closest proximity to Ames are sparse; currently the land is devoted primarily to agriculture.

2.3 PURPOSE

The major Program Areas of Ames Research Center are directed toward research and development of new aerospace technology. They are: aeronautics, space science and exploration, space research and technology, applications, space transportation, and energy. The Center is also concerned with the application of this science and new technology to current social problems and national goals. Although the emphasis is on peaceful applications and activities, NASA is responsive to the military services on problems which affect the National Defense, e.g., making aircraft safer and more efficient. The Center also performs a supporting role to other NASA Centers in research and development of technology for manned spacecraft such as the Space Shuttle.

The present principal and supporting roles of the Center in relation to its Program Areas are listed below:

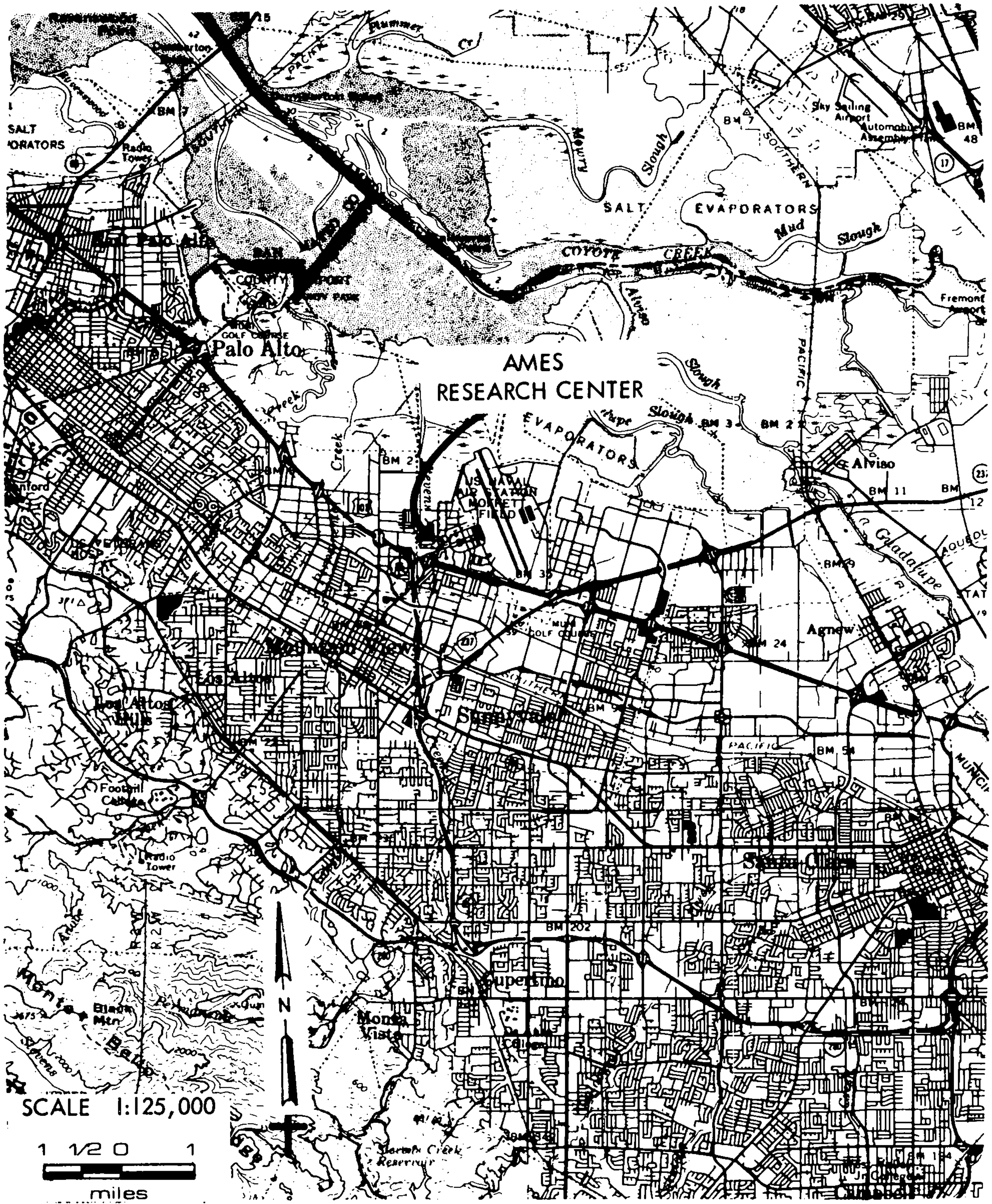


Figure 1. REGIONAL SETTING OF AMES RESEARCH CENTER

PRINCIPAL AND SUPPORTING ROLES WITHIN MAJOR PROGRAM AREAS OF AMES RESEARCH CENTER

Principal and Supporting Roles

- Principal
  - Fundamental Aerodynamics - advancing the general state-of-the-art, both theoretical and experimental.
  - Short-Haul Aircraft Technology - developing a technology base for facilitating incorporation of short-haul aircraft into overall air transportation systems.
  - Helicopter Technology - developing a technology base for improving efficiency and flexibility for both civil and military use.
  - Computational Fluid Dynamics - furthering the state-of-the-art through the definition of new systems, both hardware and software, and application to aeronautical and other related areas.
  - Flight Simulation - improving the state-of-the-art to permit more effective use of simulators in aircraft design and validation-of-flight simulation.
  - Military Support - provision of technical support to military aviation in areas consistent with other ARC aeronautics roles and unique ARC capabilities.
  - Airborne Science and Applications - operating instrumented jet aircraft for the purpose of conducting airborne science and applications experiments.
  - Planetary Probes - developing thermoprotection systems required for planetary atmosphere entry probes and managing probe development.
  - Planetary Spacecraft Development and Mission Operations - completing the currently approved Pioneer series, including associated mission operations. Activity to be phased out after Pioneer Venus.

- Life Sciences

  - Human-Vehicle Interactions - furthering the state-of-the-art through the study of man-machine and other human factor interactions and considerations involved in aircraft operations.

  - Biomedical Support Systems - developing advanced technology for development of long duration life support systems and protective systems.

  - Biological Experiments - developing, integrating and operating experiments for determining effects of space flight on (non-human) living organisms and for providing information applicable to solving space medicine problems.

  - Extraterrestrial Life Detection - developing and applying the analytical basis for life detection in space, including experiment design and management. Developing the technology to support the search for extraterrestrial intelligence with focus in the areas of sensor and end-to-end data management.

- Supporting

  - Space Transportation Passenger Selection Criteria - development and evaluation of medical criteria for non-crew passenger selection.

  - Astronomical Observation Techniques - focus on airborne science and the development of IR techniques and supporting systems for use in spacelab payloads.

The present use and capabilities of the existing facilities are displayed in Table 1. Their location within the present boundaries of the Center is shown in Figure 2, while an aerial photo of the facility is shown in Figure 3. A more detailed discussion of the technical research facilities including wind tunnels, flight simulators, computers, laboratories, aircraft, and other miscellaneous facilities is presented below.

Table 1

NAMES AND USES OF EXISTING FACILITIES

FACILITY NUMBER	FACILITY NAME	TOTAL GROSS FLOOR AREA	NO. OF FLOORS	CURRENT PRIMARY USE	CURRENT SECONDARY USE
N-200	Administration Building	27,670	2	Management Offices and Conference Rooms	Communications
N-201	Auditorium	14,932	1	Auditorium	Basement Offices
N-202	Main Library	26,517	2	Library	None
N-202A	Systems Studies Building	9,454	2	Systems Studies Div. Offices	None
N-203	Phototechnology Lab.	23,080	2	Phototechnology	Fiscal Mgmt. Offices
N-204	Space Technology Bldg.	14,017	2	Plasma R&D, Public Aff. Office, Administr. Office	Same
N-204A	Space Technology Bldg. Annex	6,314	2	Vertical Gun and Labs	Supporting Shops
N-205	Pilot Model 3.5-Ft. Hypersonic W.T.	2,517	1	Pilot Model 3.5-Ft. Hypersonic W.T.	None
N-206	12-Ft. Pressure Wind Tunnel	17,279	3	Landing Aero. Characteristics	Offices for Prop. Management Branch
N-206A	12-Ft. Wind Tunnel Auxiliaries Building	11,996	2	12-Ft. Wind Tunnel Auxiliaries Building	None
N-207	HQ, Army Air Mobility R&D Laboratory	22,915	2	Offices Rehabilitated for U.S. Army	Vertical Electrical Arc Jets Labs and Support Areas
N-207A	HFF Shock Tube Laboratory	3,000	1	Transition Probabilities and Dissociation Energies	None
N-208	Underground Ballistics Range	2,255	1	None	None
N-209	Pressurized Ballistics Range	1,740	1	None	None
N-210	Flight Simulation Lab.	71,223	2	Flight Research	Flight Simulators
N-211	Flight Support Facility	149,487	2	Hangar	Offices and Shops
N-212	Model Development Bldg.	15,380	1	Model Shop	None
N-213	Research Support Bldg.	100,633	2	Offices and Laboratories	Shops
N-214	Paint Shop	2,860	1	Paint Shop	None
N-215	Army Air Mobility R&D Ames Dir. (7 X 10-Ft. W.T. No. 1)	15,571	2	Subsonic Wind Tunnel	Dispensary
N-216	7 X 10-Ft. W.T. No. 2	5,599	1	Subsonic Wind Tunnel	None
N-216A	Model Preparation Bldg.	3,769	1		
N-216B	Army Model Assembly Bldg.	3,840	1	Army Model Assembly Bldg.	Storage
N-217	Magnetics Standards Lab	846	1	Standards Laboratory for Calibrating Instruments	Certification of Flight Magnetometers
N-217A	Magnetic Test Facility (20-Ft. Coil)	1,066	1	Null Field for Magnetic Mapping of Spacecraft	Magnetically Controlled Environment for Development Projects
N-218	14-Ft. Transonic W.T.	38,244	4	Aero Tests in 14-Ft. Transonic Wind Tunnel	Facilities, Services Shops, Offices and Supplies
N-218A	Electrical Equipment Building	5,392	1	Electrical Equipment Building	None
N-218B	Fan Verification Bldg.				
N-219	Electrical Services Bldg.	16,160	2	Materials Research, Development and Fabrication	Electrical Maintenance Shop
N-220	Technical Services Bldg.	37,888	2	Machine Shops	None

Table 1
(Continued)

NAMES AND USES OF EXISTING FACILITIES

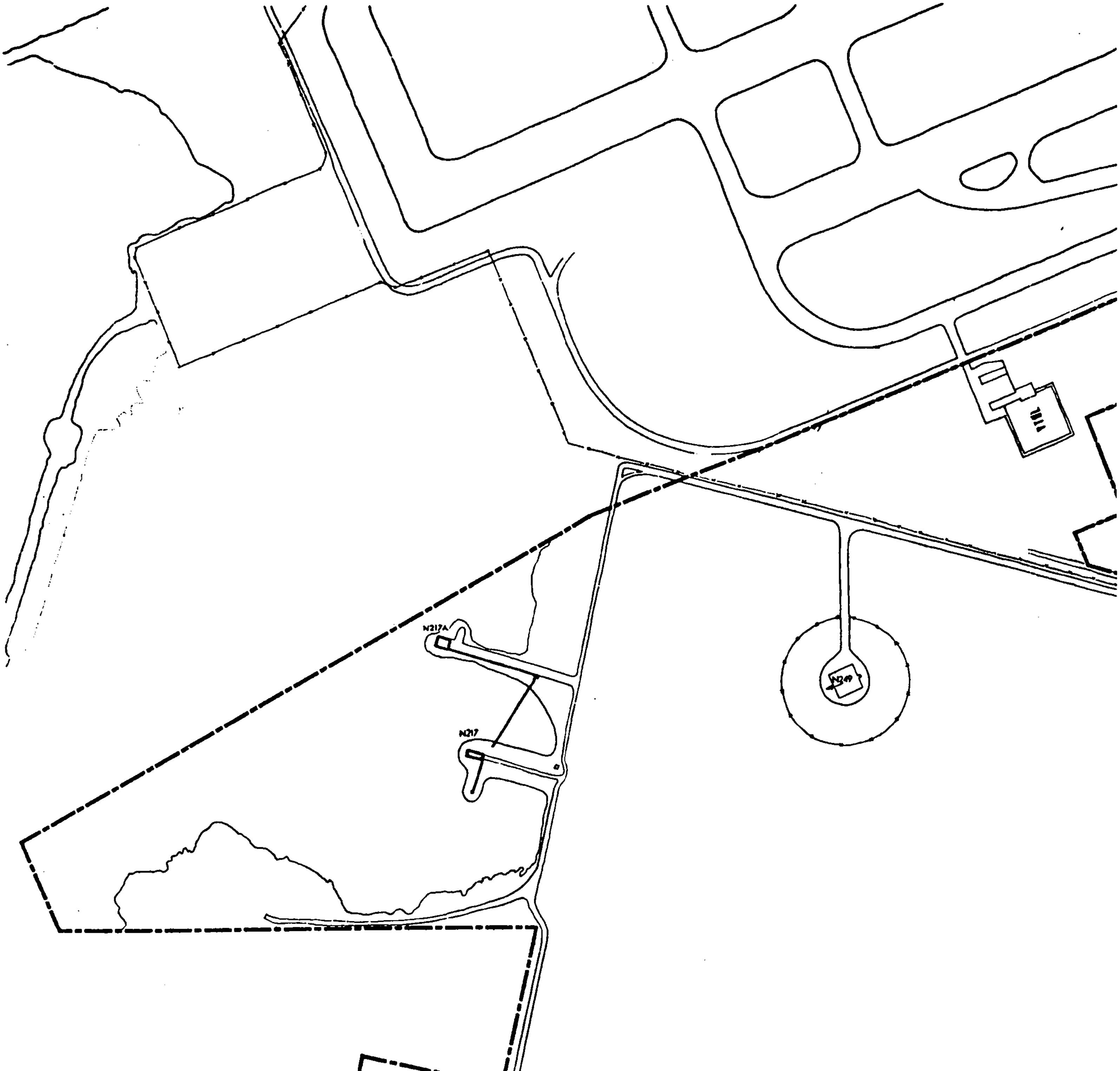
FACILITY NUMBER	FACILITY NAME	TOTAL GROSS FLOOR AREA	NO. OF FLOORS	CURRENT PRIMARY USE	CURRENT SECONDARY USE
N-221	40 X 80-Ft. Wind Tunnel	147,418	3	High Lift and V/STOL Aerodynamics	Shipping and Receiving Warehouse
N-221A	20-G Centrifuge	5,554	1	G-Tolerance	None
N-221B	Height Control Simulator	640	1	Aircraft Research	None
N-222	2 X 2-Ft. Transonic Wind Tunnel	3,348	1	Basic Airfoil Research	Testing with Heavy Gases
N-223	Chemical Research Projects Facility	29,155	1	Offices	Shops, Labs and Parts of Obsolete Range
N-224	Polymer Development Facility	4,750	1	Physical Test Area of Polymers	None
N-225	Substation	Yard Area (162,280)		Substation	Same
N-226	6 X 6-Ft. Supersonic Wind Tunnel	33,383	2	Aerodynamic Tests	Offices for Contractor Operating This and Other Tunnels
N-227	Unitary Plan Wind Tunnel Building	48,735	3	Offices, Labs and Shops	None
N-227A	11-Ft. Transonic W.T.	19,960	2	Inlet and Aero Test	None
N-227B	9 X 7-Ft. Supersonic W.T.	19,820	2	Inlet and Aero Tests	None
N-227C	8 X 7-Ft. Supersonic W.T.	13,800	2	Inlet and Aero Tests	None
N-227D	Unitary Plan W.T. Auxiliaries Bldg.	12,100	1	Unitary Plan W.T. Auxiliaries Building	None
N-228	42-Inch Shock Tunnel	8,000	1	Shock Flow Around Aircraft	Laser Tests
N-229	Experimental Fluid Dynamics Facility (3.5-Ft. H.W.T.)	46,426	2	Stability and Aerothermal Tests	Offices, Laboratories, Shops
N-229A	3.5-Ft. Hypersonic W.T. Auxiliaries Bldg.	23,926	1	3.5-Ft. Hypersonic W.T. Auxiliaries Bldg.	None
N-230	Physical Sciences Research Laboratory	31,523	2	Basic Research	None
N-231	Fluid Dynamics Lab	5,870	1	Tests to Verify 3-D Codes for Viscous Flow	Polymeric Coatings
N-232	Pilot Model of Hypervelocity Free Flight Facility	4,200	1	None	None
N-233	Central Computer Facility	52,268	2	Various Computers .	Offices and Labs
N-233A	Institute for Adv. Computation	31,664	1	Illiac IV Computer	Offices and Labs
N-234	Thermal Protection Lab	24,667	2	Heat Shield Tests	
N-234A	Thermal Prot. Lab Boiler	2,215	3	Thermal Prot. Lab Boiler	
N-235	Cafeteria Building	9,350	1	Cafeteria	Conference and Employee Recreation Activities
N-236	Bio-Science Laboratory	35,320	2	Laboratories and Animal Holding Areas	Offices
N-237	Hypervelocity Free Flight Facility	60,384	2	Office, Shops, and Labs	Hypervelocity Free Flight Facility on Standby
N-238	Arc Jet Laboratory	15,104	1	Heat Shield Panel Testing and Arc Jet Development	60 MW Nozzle is Under Construction
N-239	Life Sciences Research Laboratory	125,876	3	Life Science Research	None
N-239A	Life Sciences Research Laboratory High Bay	28,485	2	Life Sciences Research Laboratory	A Few Offices

Table 1
(Continued)

NAMES AND USES OF EXISTING FACILITIES

FACILITY NUMBER	FACILITY NAME	TOTAL GROSS FLOOR AREA	NO. OF FLOORS	CURRENT PRIMARY USE	CURRENT SECONDARY USE
N-240	Materials Science Lab	36,170	2	Materials Science Lab	None
N-241	Administrative Management Building	62,370	2	Offices	Mail Room, Files, Communications, Printing
N-242	Systems Development Facility	27,794	2	Project Management	Reliability and Quality Assurance Tests
N-243	Flight and Guidance Simulation Laboratory	97,150	2	Test Areas, Computer Labs, Offices	See Primary Uses Under (a), (b), and (c)
	(a) Flight Simulation for Adv. Aircraft		2	Aircraft Handling Qualities	Aircraft Certification and Accident Investigations
	(b) Space Flight Guidance Residence Facility		2	Manned Space Mission Simulation	
	(c) Vertical Motion Simulator	6,345	2	Approach and Landing Simulation	
N-243A	Simulation Equipment Building	9,900	2	Simulation Equipment Bldg.	
N-244	Space Projects Facility	81,626	2	Pioneer Project Management and Systems Development	Reliability and Quality Assurance Tests
N-245	Space Sciences Lab	76,200	2	Space Sciences Lab	Lecture Room for 100 People
N-246	Model Construction Facility	36,455	1	Shops and Model Check Out	
N-247	40 X 80-Ft. Wind Tunnel Offices	11,224	2	Office	
N-248	Aircraft Servicing Facility	26,600	1	Hangar	
N-248A	Ground Support Equipment Building	4,010	1	Aircraft Support Equipment Garage	
N-249	Static Test Stand	--	--	Test of Powered Models and Aircraft Prior to Tunnel Tests	
N-250	Compressor Building	3,113	1	Compressor Building	
N-251	Motor Pool	3,744	1	Motor Pool	
N-252	Propane Fuel Facility	--	--	Propane Fuel Facility	

Source: Master Plan, Ames Research Center, 1975-76 Draft.


N217A
N217
N249
S T E V E N S

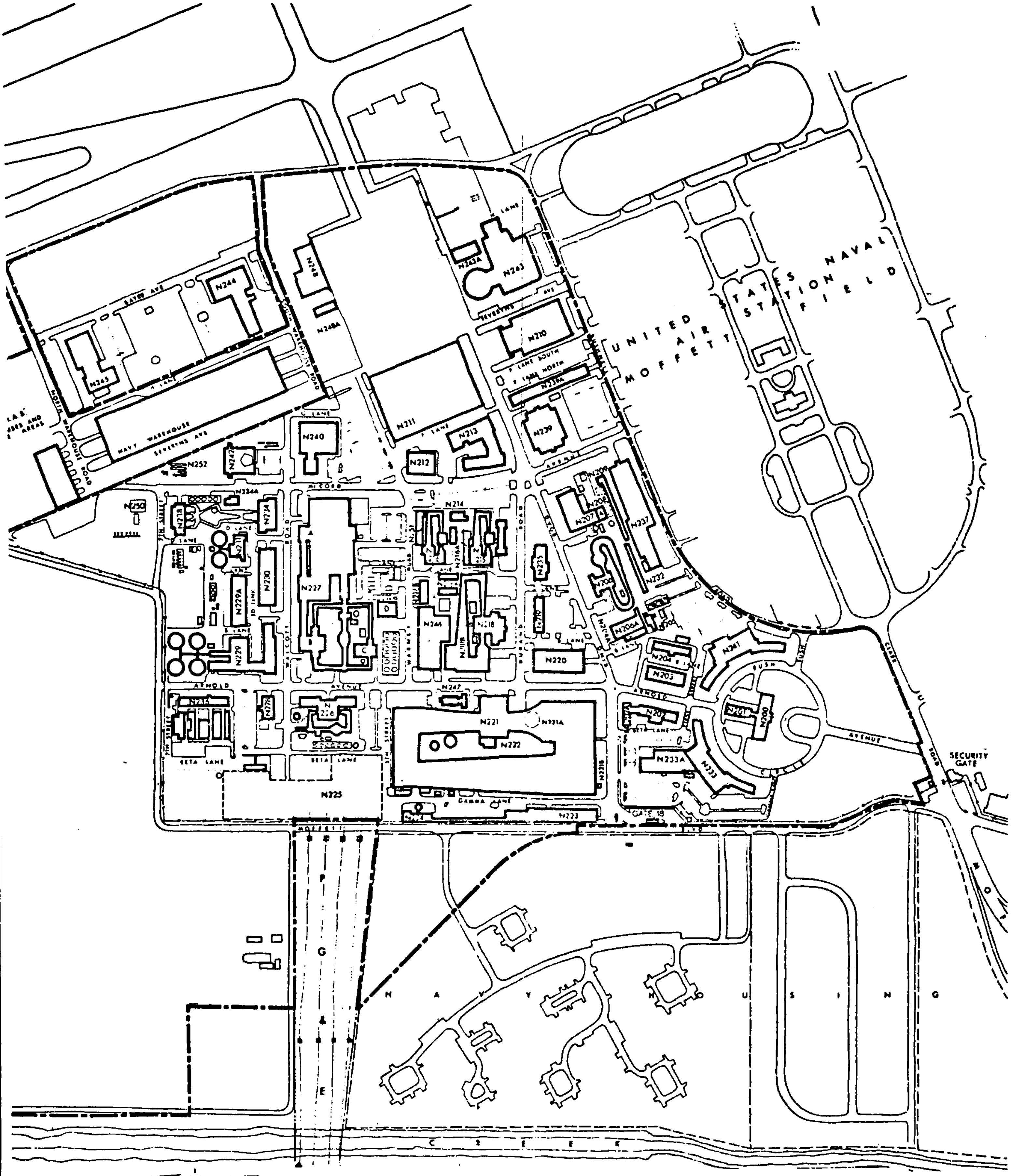


Figure 2.

FACILITIES SCALE MAP OF
AMES RESEARCH CENTER

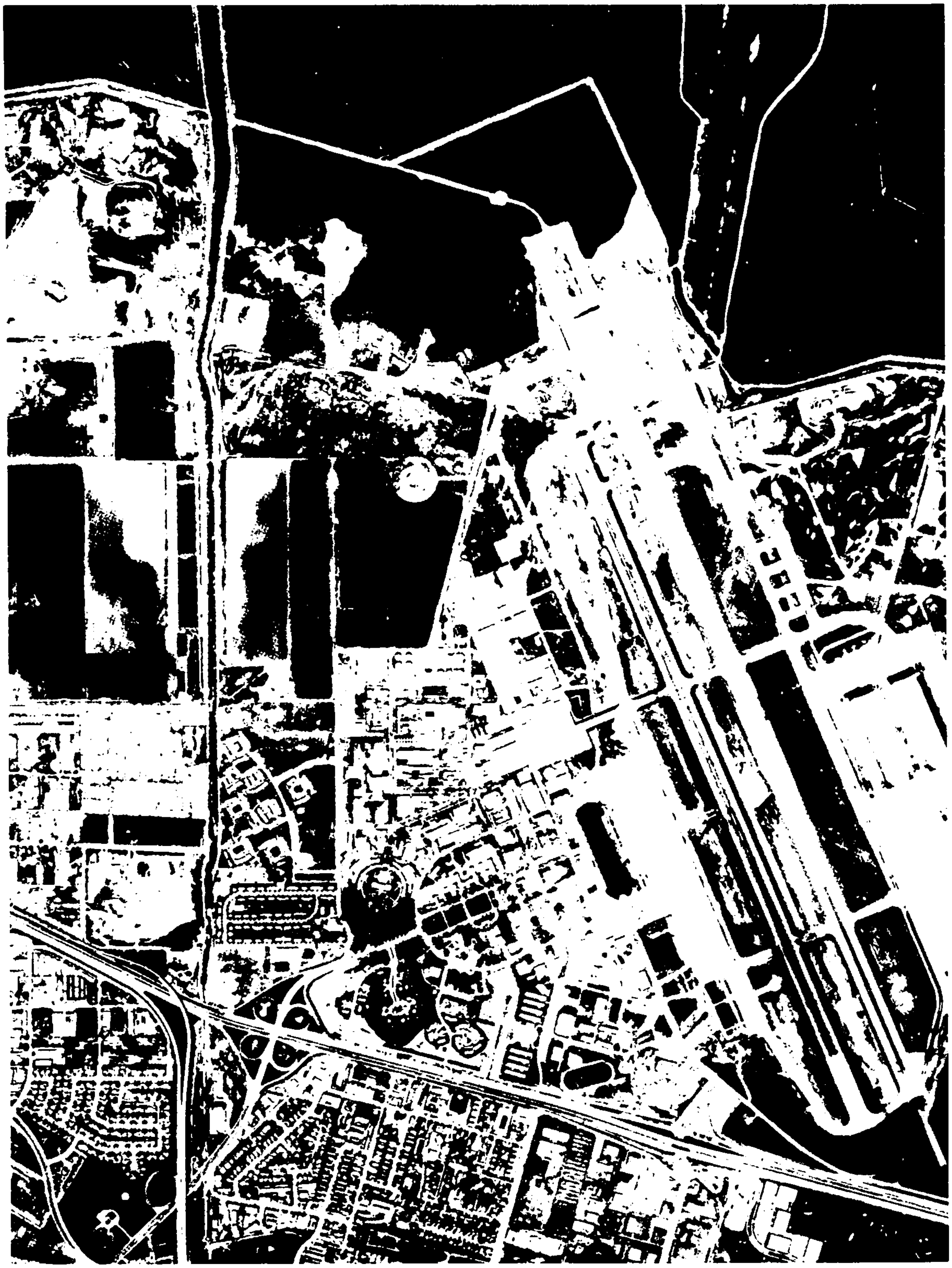


Figure 3. AERIAL PHOTOGRAPH OF AMES RESEARCH CENTER

2.4 FACILITIES

a. Wind Tunnels and Related Aerodynamic Research Facilities

1. 40 X 80-Foot Wind Tunnel, N-221

This tunnel is presently a closed-throat, closed-circuit wind tunnel used primarily for determining the low-speed aerodynamic characteristics of high-performance aircraft and spacecraft (particularly landing and take-off operations, and V/STOL aircraft and rotorcraft). Air is driven through the 40 X 80-Ft test section by six 40-feet-in-diameter fans, each powered by a 6,000 hp electric motor. The speed of the fans and of the airflow through the test section is continuously variable from zero to 200 knots.

2. Unitary Plan Wind Tunnel, N-227A-C

This facility is a unique system of wind tunnels comprised of three test sections: the 11-Ft Transonic Wind Tunnel (Mach 0.5 to 1.4); the 9 X 7-Ft Supersonic Wind Tunnel (Mach 1.55 to 2.5); and the 8 X 7-Ft Supersonic Wind Tunnel (Mach 2.45 to 3.5). The major common element of the tunnel complex is its electric powerplant consisting of four interconnected motors capable of generating a total of 180,000 hp continuously or 216,000 hp for one hour. Research in support of subsonic, transonic, and supersonic aerodynamics is performed at this facility.

The 11-Ft Transonic Wind Tunnel is a closed-return, variable-density tunnel with fixed geometry. Airflow is produced by a 3-stage, axial-flow compressor. This facility operates on the average of 35 hours a week between noon and midnight. To reduce the noise from its operation, Ames has installed an acoustical enclosure around the tunnel. The 9 X 7-Ft Transonic Wind Tunnel is also a closed-return, variable density tunnel; high-speed air flow is produced by an 11-stage axial-flow compressor. The

8 X 7-Ft Supersonic Wind Tunnel is a closed-return, variable-density tunnel also driven by an 11-stage, axial-flow compressor. The last two facilities operate infrequently.

3. 6 X 6-Foot Supersonic Wind Tunnel, N-226

This closed-circuit, single-return tunnel has an asymmetric sliding block nozzle and a test section with perforated floor and ceiling to permit transonic testing. The air is driven by an 8-stage axial-flow compressor powered by two electric motors, rated at 60,000 hp and mounted outside the wind tunnel. Research in both space and aircraft aerodynamics and launch vehicle structural loads is performed at both transonic and supersonic ranges (Mach number is continuously variable from 0.25 to 2.2).

4. 3.5-Foot Hypersonic Wind Tunnel, N-229

This facility is a blowdown-type facility having four contoured, axisymmetric nozzles utilizing air film cooling to control water temperature. Heat is supplied to the test gas by a storage heater containing aluminum oxide pebbles, which are heated by burning natural gas during the recycle period. Usable test time, dependent on test runs, averages 1-1/2 hours. Aerodynamic studies, heat transfer and ablation research are conducted here (Mach; 5, 7, 10 and 14).

5. 7 X 10-Foot Wind Tunnel No. 1 & No. 2, N-215 & N-216

These tunnels are closed circuit, low speed and atmospheric. Each facility is powered by its own variable speed 1800-hp motor which drives a fixed-pitch fan. Wind speeds within the tunnel are continuously variable up to 250 mph (220 knots). Tunnel No. 1 is used for research in support of low-speed aerodynamics, using small-scale aircraft, V/STOL aircraft, and space vehicle reentry body models. Typical uses for Tunnel No. 2 include research in low-speed aerodynamics, stability and control, and configuration studies of helicopters and V/STOL aircraft.

6. 12-Foot Pressure Wind Tunnel, N-206

This variable-density, low-turbulence tunnel operates at subsonic speeds up to slightly less than Mach 1.0. Power is supplied by a 2-stage, axial-flow fan driven by electric motors totaling 12,000 hp. Both aircraft and spacecraft models are tested at the facility; analysis of launch vehicle aerodynamics with emphasis on take-off and landing characteristics is also studied.

7. Advanced Entry Heating Simulator, N-207

This unit consists of an arc-heated supersonic wind tunnel employing vortex and magnetic field methods of arc-stabilization, which operates in conjunction with a radiative heating system that can furnish an additional 2,000 BTU/ft^2/sec to 3/4-in. diameter models. It is used for aerodynamic heating and thermal protection materials studies of vehicles entering planetary atmospheres.

8. 1 X 3-Foot Supersonic Wind Tunnel, N-207

This is a closed-circuit supersonic wind tunnel which can be operated continuously at Mach numbers from 0.4 to 0.9, and from 1.4 to 6.0. The air is driven by four compressors in parallel for Mach numbers less than 2.2. At higher Mach numbers two or three of the same compressors are operated in series with a larger compressor. Aircraft aerodynamics at supersonic and hypersonic ranges are investigated here.

9. 2 X 2-Foot Transonic Wind Tunnel, N-222

The transonic tunnel possesses a 2-ft square test section through which air at speeds continuously variable between Mach numbers 0.2 to 1.4 can be driven. A 2-stage, axial-flow compressor powered by four induction motors mounted in tandem and rated at 4,000 hp provides the driving power. Space vehicle aerodynamics, aircraft aerodynamics, and structural dynamics for aircraft loads and structures are studied here.

10. 14-Foot Transonic Wind Tunnel, N-218

This tunnel is a closed-circuit tunnel with an adjustable, flexible wall nozzle and a test section with four slotted walls. Air flow is produced by a 3-stage, axial-flow compressor powered by three variable-speed electric motors mounted in tandem outside the tunnel and rated at 110,000 hp continuously or 132,000 hp for one hour. Research in aircraft aerodynamics and structural loads for launch vehicle structures is performed in this facility. Mach numbers between 0.6 to 1.2 are possible.

11. Thermal Protection Laboratory, N-234

This laboratory is composed of five separate facilities: an aerodynamic heating tunnel; a heat transfer tunnel; two supersonic turbulent ducts; and a high-power CO_2 gasdynamic laser. All these facilities are driven by arc-heaters, with the exception of the large, combustion-type laser. Their effluent gas stream (test gases: air, N_2, He, CO_2, and mixtures, flow rates between 0.05 to 5.0 lb/sec) discharges into a 5-stage steam-ejector-driven vacuum system. The vacuum system and power supply are common to the test facilities in Building N-238. The arc-heated facilities are powered by a 20-megawatt, DC-power supply. Materials research in heat-shield applications and aerodynamic studies of vehicles in planetary atmospheres are conducted here.

12. Pressurized Ballistic Range, N-209

This 295-ft-long facility is used to measure the aerodynamic characteristics of bodies and wing-body combinations in quiescent air at speeds below 11,000 ft/sec and at Reynolds numbers low enough to approach those of full-scale flight.

13. Electric Arc Shock Tube, N-229

The 12-inch, arc-discharge shock tube consists of an exploding wire, arc-discharge driver, powered by capacitor discharges which can produce air shock velocities in the 4-inch-diameter-driven tube between 2 and 25/km/sec. Considerably higher velocities can be obtained using hydrogen, helium or combinations of these two gasses instead of air. The facility is used for investigations in quantum electrodynamics, laser development, laser matter interactions, and planetary atmosphere entry.

14. Space Technology Annex, N-204A

This industrial-type building contains a permanently installed ballistic range, shop facilities, a small wind tunnel for Mars erosion studies, and a microparticle accelerator. Lunar and planetary environments are studied here.

15. Hypervelocity Free-Flight Facility

This structure includes three gun-range combinations: (1) the Aerodynamic Hypervelocity Free-Flight Facility; (2) the Gun Development Hypervelocity Free-Flight Facility; and (3) the Radiation Hypervelocity Free-Flight Facility. These facilities are used for research on aerodynamic problems of hypervelocity flight, particularly atmosphere reentry problems.

b. Flight Simulators

1. Flight and Guidance Simulation Laboratory, N-243

This building contains four simulation devices -- a Flight Simulator for Advanced Aircraft, a Vertical Motion Simulator, a Flight and Guidance Centrifuge, and a visual display generator -- along with a computer laboratory, and supporting maintenance and service facilities. The current status of the Flight and Guidance Centrifuge permits 3-man operation up to

4 g's. The Flight Simulator for Advanced Aircraft consists of a 3-man cockpit with closed-loop, 6^{O}-of-freedom motion. It is used for investigations of landing, take-off, and general handling qualities of large aircraft as well as evaluation of crew tasks. The Vertical Motion Simulator, designed to simulate critical maneuvers of aircraft during take-off and landing, can expose research pilots riding in the simulator cab to vertical displacements of up to 18 meters (60 feet) and 12 meters (40 feet) horizontally.

2. Flight Simulation Laboratory, N-210

This large airplane hangar contains several human-rated, piloted, simulation devices including a 6^{O}-of-freedom motion device, a visual display generator, a moving-cab transport simulator, and a computer complex. The 6^{O}-of-freedom motion simulator is used to investigate the handling and general flying qualities of vertical-rising aircraft, particularly during takeoff and landing, while the moving cab transport simulator is used to evaluate a wide range of aircraft for handling qualities and control system parameters under approach, cruise, and taxi conditions.

3. Biosatellite Centrifuge, N-221A

This facility consists of a trusswork arm about 60 ft long, which is supported on a vertical shaft at the center. An electric motor and gear provide the necessary torque. The simulator has been man-rated for 12.5 g. Research in biotechnology, structural dynamics, environmental biology, and aircraft escape are performed here.

4. Vertical Height Apparatus, N-221B

This facility consists of a 2-man cab capable of traveling vertically for a total of 100 ft and is used for research requiring long-term vertical acceleration.

c. Research Aircraft

1. Airborne Platform

The Lear 23 and 24B aircraft are modified, twin-engine executive jets manufactured by the Gates Learjet Corporation and designated NASA 701 and 365-EJ, respectively. These aircraft are used primarily for aeronautical research and as high-altitude observation platforms. They have a practical operating range of about 2,000 nautical miles at 470 knots indicated airspeed, an operating ceiling of 45,000 feet, and a useful payload of 1,000 lb. Table 2 lists the total operating hours and estimated number of take-offs for these and other research aircraft, as well as other NASA aircraft.

2. Augmentor Wing, Jet-STOL

The C-8A Buffalo Augmentor-Wing Jet-STOL Research Aircraft is a modified version of a high-wing, high-tail military transport originally manufactured by deHaviland, Ltd., of Canada and designated NASA 716. It is used to study the design and operational characteristics of Jet-STOL aircraft using split-flow, turbo-fan engines to provide both vectored thrust and augmented jet flaps for powered lift. This aircraft has a practical operating range of about 300 nautical miles at 160 knots indicated airspeed, an operating ceiling of about 15,000 ft and a useful payload of about 2,000 lb.

3. Earth Resources Survey

These facilities consist of two high-altitude, U-2 aircraft, designated NASA 708 and 709 and manufactured by Lockheed Aircraft Corporation. They are single-space aircraft with a practical operating range of 2,500 nautical miles at Mach 0.69, an operating ceiling of about 65,000 ft, and a useful equipment payload of 460 lb. These planes are used primarily for

Table 2

SUMMARY OF AMES FLIGHT OPERATIONS

AIRCRAFT	FLIGHT HOURS[1]	NUMBER OF FLIGHTS[2]
Lear 23 (NASA 701)	187.3	87
Lear 24 (365-EJ)	361.2	121
U-2 (NASA 708 and NASA 709)	800.0	210
CV-990A (NASA 712)	501.3	67
C-141A (NASA 714)	466.8	62
CV-340 (NASA 707)	72.0	43
UH-12E	91.3	30
AWJSRA	51.5	61
CESSNA 402	5.3	29
UH-1B	161.3	53
DHC-6	1.5	8
T-38	165.3	56
CV-990 (NASA 713)	-	1
UH-1H	41.5	Not Flown[3]
X-14B	3.2	Not Flown[3]
C-8	5.5	Not Flown[3]

1 - Based on NASA data for FY 1975.

2 - Based on NASA data for 5/1 - 10/31/75.

3 - The apparent inconsistency between the number of flight hours and the number of flights is due to the different time base for the two records.

Earth resources survey investigations as well as astronomical, meteorological, and geophysical experiments.

4. CV-990A Airborne Research Laboratory

This facility is a 4-engine turbojet low-wing commercial transport aircraft manufactured by Convair/General Dynamics Corporation, and is designated NASA 712. It has a practical operating range of about 3,300 nautical miles, an operating ceiling of about 41,000 ft, and a useful payload of 20,000 lb. Its uses include both space science investigations and aeronautical research.

5. C-141A Airborne Infrared Observatory

This aircraft is a modified, 4-engine, high-swept-wing, heavy logistics transport manufactured by Lockheed Aircraft Corporation and designated NASA 714. It has a practical operating range of about 5,200 nautical miles at 440 knots indicated airspeed, an operating ceiling of about 45,000 ft, and a useful payload of 70,000 lb. The aircraft is used primarily for infrared astronomy.

6. Flight Systems Research Aircraft

The CV-340 is a modified, 2-engine, low-wing monoplane manufactured by the Convair/General Dynamics Corporation and designated NASA 707. It has an operating range of about 1,100 nautical miles at 210 knots indicated airspeed, an operating ceiling of about 20,000 ft, and a useful payload of 6,000 lb. It is used for aeronautics research, primarily in support of navigation, guidance, and control studies, as well as avionics systems and cockpit display concepts for STOL operations.

7. YOV-10A STOL Research Aircraft

The YOV-10A STOL research aircraft is a modified, twin-engine turboprop aircraft manufactured by Rockwell International and designated NASA 718. It has a practical operating range of about 100 nautical miles at 130 knots indicated airspeed, an operating ceiling of about 10,000 ft and a useful payload of 940 lb. It has been flown at indicated airspeeds as low as 47 knots. The YOV-10A is used to research the aerodynamic characteristics of deflected slipstream vehicles and to evaluate the handling qualities and operating restrictions of powered-lift STOL aircraft.

8. VTOL Research Aircraft

The X-14B VTOL research aircraft was originally manufactured by the Bell Corporation and has been modified to incorporate variable-stability, variable-control features. It is a single-space, fixed-wing aircraft that has twin engines with cascade-type diverters to vector the jets for any combination of vertical lift or forward thrust. Hovering time is limited to 15 min; cruise flight time is limited to 20 min in normal flight at 120 knots.

d. Advanced Computer Technology

1. Institute for Advanced Computation (IAC), N-223A

This facility contains the IAC computer system, which can be used for computational aerodynamics, global climate dynamics, distant seismic event simulation, and optimization problems arising in logistics or economics. The Illiac IV processor, which represents a new form of computer architecture, is a part of the IAC system.

2. Central Computer Facility, N-233

This facility houses an IBM 360/67 Duplex System, an IBM 7040-7094, a Honeywell 800/200 and an IBM 1800 for interactive graphics. Other available services include commercial time-sharing and batch operations. Applications include wind tunnel data processing, life sciences experimental data processing, aerodynamics computations, satellite data processing, data management, plotting and systems support for small, dedicated computers and numerical control.

e. Laboratories

1. Space Projects Facility, N-244

This facility includes three main parts: (1) Spacecraft Project Management, which includes offices and facilities for management of Project Pioneer; (2) Flight Project Development, which includes laboratories and office space for developing and conducting flight projects involving aircraft, balloons, sounding rockets and spacecraft; and (3) Flight Systems Development, which includes laboratory and office space for developing advanced components and subsystems for flight systems. An environmental laboratory and a "clean room" are also located within the facility.

2. Magnetic Standards Laboratory and Test Facility, N-217 and N-217A

This facility was originally built to perform the formal magnetic-acceptance testing of scientific experiments to be flown in the Pioneer series of spacecraft. Its present capabilities include the ability to cancel the earth's magnetic field and to calibrate or perform other performance tests on low-field magnetometers.

3. Physical Sciences Research Laboratory, N-230

This laboratory contains a number of specific facilities including a 1-megajoule arc-discharge shock-tube, a combustion-driven shock tube, 3-meter grazing and normal incidence vacuum ultraviolet spectrometers, a 1/2-meter normal incidence vacuum ultraviolet spectrometer, a high-power Nd:glass laser system and various other lasers (dye, ruby, He:Ne and argon). Quantum electronics, laser-matter interactions, X-ray laser investigations and supersonic-electric discharge laser studies are performed here.

4. Space Science Laboratory, N-245

This building includes 59 offices, a large auditorium, two conference rooms, a penthouse computer center, 40 laboratory rooms and a partial, open high bay. Specific facilities include microprobe, laser probe, atomic absorption, photo interpretive, electron microscope, and X-ray laboratories. Research in planetary atmospheres, planetary interiors, solar wind astrophysics, infrared astronomy, earth science and applications, and planetary geology is conducted here.

5. Life Sciences Research Facility, N-239, N-239A

This facility is composed of a five-story main building and a two-story high bay building. The main building houses visual research devices, a life science library, a 100-seat conference room, an electron microscope lab, a photo-micrographic lab, and a pressure suit lab. Other special facilities include soundproof testing booths, flight simulators, analog and digital computers, an 8-bed human research facility, and various chemistry and physiology laboratories. The high bay building contains a number of specialized facilities including: (1) the human environmental test facility, which is used to study the effects of various environmental parameters (atmosphere, pressure and temperature) upon human physiology and performance, and (2) the environmental chamber, which is used for studies involving altitude, atmospheric composition and temperature, or temperature cycling. An animal centrifuge is used to study the effects of acceleration, g-stresses, heat and exercise. Another facility, the man-carrying rotation device, is used to determine physiological effects on human subjects and their ability to perform various tasks when subjected to precise angular accelerations and rates for specific periods of time, while a vertical acceleration and roll device with vertical-translation and roll-rotation capabilities is used for flight simulations requiring visual contact, as well as aircraft, spacecraft, and medical investigations requiring vertical and roll accelerations. Lastly, a fixed-base transport simulator is used primarily to study flight management procedures and crew performance with advanced cockpit display/control configurations.

6. Systems Development Facility, N-242

This building consists of test areas and shops. The principal test area is a central, pentagon-shaped tower surrounded by smaller test areas which utilize the tower walls for strong-back mounting. Advanced flight projects are studied here.

f. Other Research Facilities

1. VTOL Hover Test Stand

This facility is used to test flight systems in tethered mode for flight research acoustic studies and pilot familiarization.

For more detailed technical descriptions of the above facilities, the Ames Research Center Technical Facilities Catalog and Ames Research Facilities Summary should be consulted.

3.0

EXISTING ENVIRONMENT

3.0

EXISTING ENVIRONMENT

3.1 SOILS AND GEOLOGY

The following description of the existing geologic environment in the vicinity of the Ames Research Center was taken largely from two previous geologic and foundation investigations at the Ames Research Center site.[1, 2] Descriptions contained in these reports were supplemented with published maps and reports of the U.S. Geological Survey, U.S. Soil Conservation Service and the California Division of Mines and Geology.

a. Topographic Setting

The Ames Research Center (ARC) lies near the outer edge of a broad, nearly flat alluvial plain at the southern end of San Francisco Bay. This alluvial plain (which extends southward as the Santa Clara Valley) together with San Francisco Bay occupies a large northwest-trending structural trough located between the Diablo Range on the east and the Santa Cruz Mountains on the west.

The ground surface at ARC slopes imperceptibly northward toward the Bay at an average slope of approximately 0.5 to 1.0 percent. Elevations at ARC range from 33 feet above mean sea level at the southern edge of the property to 2 feet below mean sea level in the extreme northern portion of the property. High tides in this portion of the Bay can reach 6 to 8 feet above mean sea level.

b. Geologic Units

The Research Center is underlain by a thick sequence of unconsolidated sediments consisting of clay, silt, sand and gravel. Individual beds are highly variable both in thickness and texture and most beds cannot be traced laterally for any distance. Sediments of silt and clay texture predominate. The coarser sediments occur primarily as thin, discontinuous lenses and stringers, while clay layers often are considerably more continuous and can be traced over large areas. Most of the sediments represent floodplain deposition. However, most of the coarser sediments represent stream channel or natural levee deposition while the widespread clay layers represent past deposition in a San Francisco Bay which was more widespread than it is today.

The total depth of the unconsolidated sediments can vary considerably from place to place beneath the alluvial plain. The depth to bedrock is estimated to be on the order of 2,000 feet in the vicinity of ARC.

Bedrock upon which the unconsolidated sediments rest consist of rock units of the Franciscan Formation. The Franciscan Formation, which is the most widely exposed bedrock unit in the northern California Coast Ranges, consists primarily of highly folded and faulted sedimentary rocks. The nearest exposure of Franciscan rocks in the vicinity of the ARC occurs in the foothills of the Santa Cruz Mountains about 8 miles to the west.

A very stiff, highly plastic, black silty clay blankets most of ARC. Locally called "adobe," this surficial deposit is generally about 5 feet thick. Beneath the surficial clay layer, to approximately 100 feet, the sediments consist mainly of medium to very stiff silty clay interlayered with thin seams and lenses of medium, silty, fine- to medium-grained sand. Some sand layers up to 15 feet thick occur in the first 50 feet but most are less than 5 feet thick. Below the 100-foot depth, the sediments consist primarily of very stiff clay.

c. Engineering Properties of Unconsolidated Sediments

Field and laboratory tests run on samples taken from the test boring indicated that the engineering properties of the unconsolidated sediments are highly variable.[3]

The clay blanket is highly plastic and highly expansive. It undergoes large seasonal changes in volume with fluctuations in moisture content. When saturated under low confinement, it becomes weak.

The engineering characteristics of the silty clay sediments underlying the heavy clay blanket vary both laterally and with depth. Clay strengths generally increase with depth to about 65 feet below the surface where a slight reduction in shear strength is indicated. Clay strengths then increase again with further depth.

d. Soils

According to U.S. Soil Conservation Service[4] soil maps for the area, most of the Ames Research Center is covered with a silty clay soil known as "Sunnyvale silty clay, drained" (Sv). The extreme northern part of the ARC is covered with "Alviso clay" (An), while "Pacheco loams, clay substratum" (Pf) occurs as a rather narrow band along Stevens Creek. In addition, a small area in the northwestern portion of ARC is covered with soil derived from an Indian midden (KfB). Figure 4 shows the major soil patterns in the vicinity of ARC. Surface findings indicate that the Indian midden is probably further eastward than shown in Figure 4. Arrangements are being made to have a professional archaeologist from Stanford University define the location of the midden and evaluate its importance.

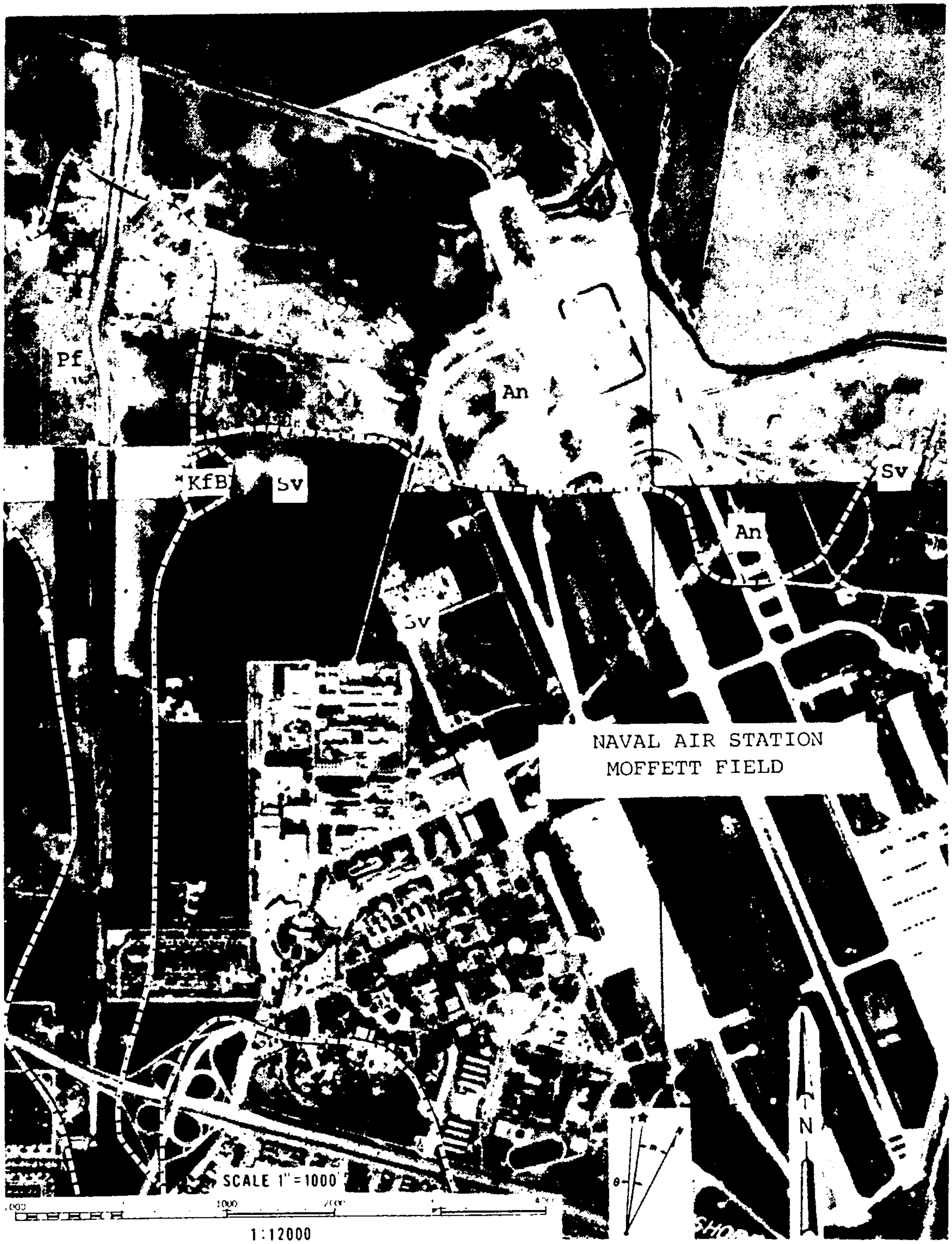


Figure 4. SOIL MAP OF AMES RESEARCH CENTER AND VICINITY

e. Seismic Setting

It is well-known that the San Francisco Bay Area is a seismically active area. Active faults lie on both sides of the Bay. From the Ames Research Center the San Andreas fault zone lies about nine miles to the west. The Hayward fault and the Calaveras fault lie approximately 8 and 13 miles respectively to the east. Although the exact time, place and magnitude of future earthquakes cannot be predicted, it is generally agreed that major structures in the Bay Area can expect to be subjected to at least one major earthquake during their economic life. For design purposes, it is usually assumed that an earthquake similar to 1906 (magnitude 8.3) will occur along the San Andreas fault, while a maximum 7.5 earthquake is assumed for the Hayward and Calaveras faults. In addition to these major earthquakes, several smaller but still potentially damaging tremors should be expected.

Figure 5 shows the site's proximity to the active faults of the region and the historic earthquake activity in the Bay Area.

A gravity survey conducted by the California Division of Mines and Geology[5] revealed the possible presence of three additional northwest-trending faults in the general vicinity of the ARC (Figure 6). As shown in Figure 6, one of these faults extends through the ARC. According to Brown,[6] none of these faults is considered active.

f. Potential Geologic Hazards

Geologic hazards, as discussed in this report, are defined as geologic conditions and naturally occurring geologic events which could have an adverse impact upon Ames. By contrast, "geologic impacts" are defined as the potential environmental problems the Center's operations could create, either directly or as a result of a geologic hazard. For a discussion of "geologic impacts", see Section 5.1 of this report.

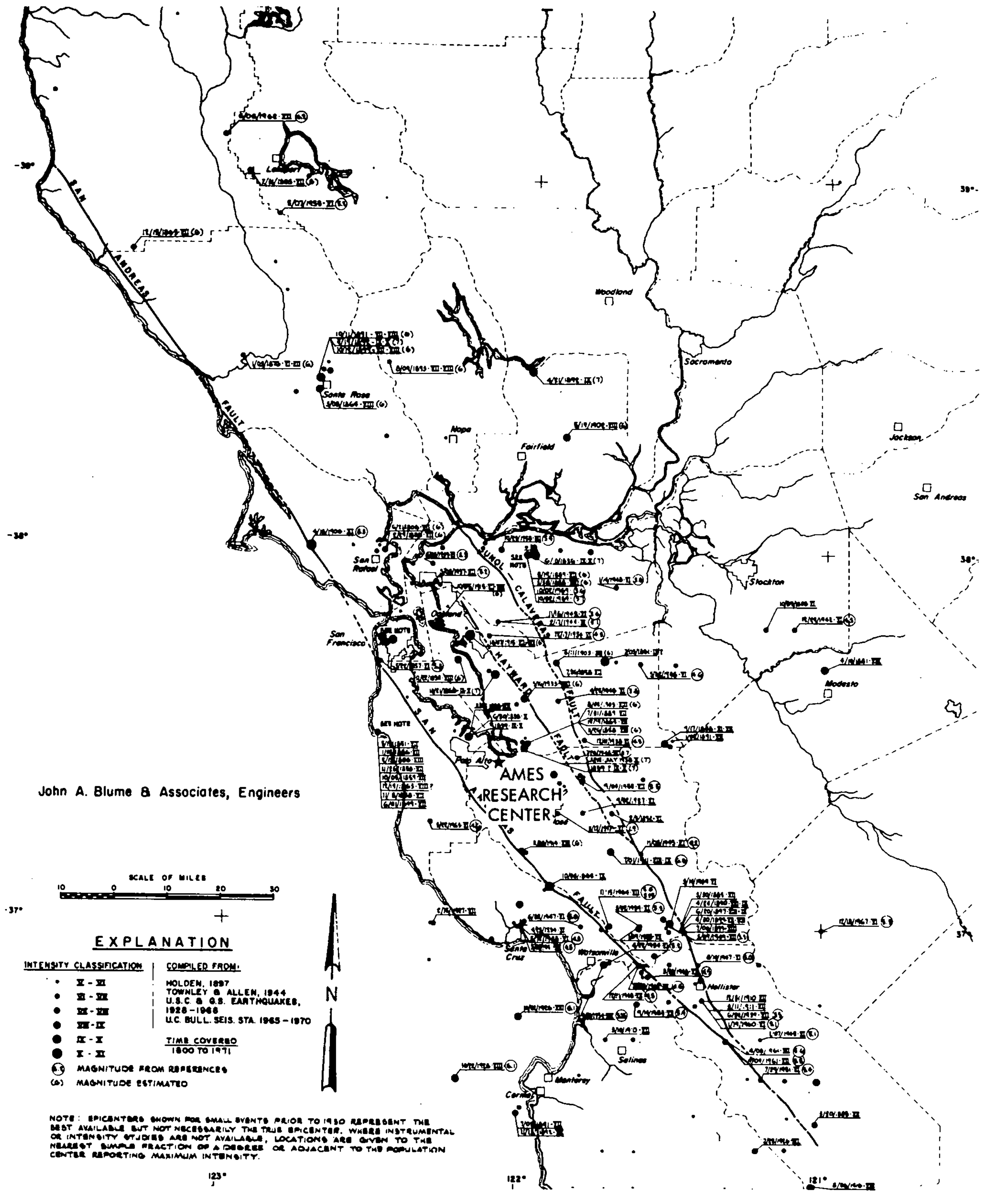
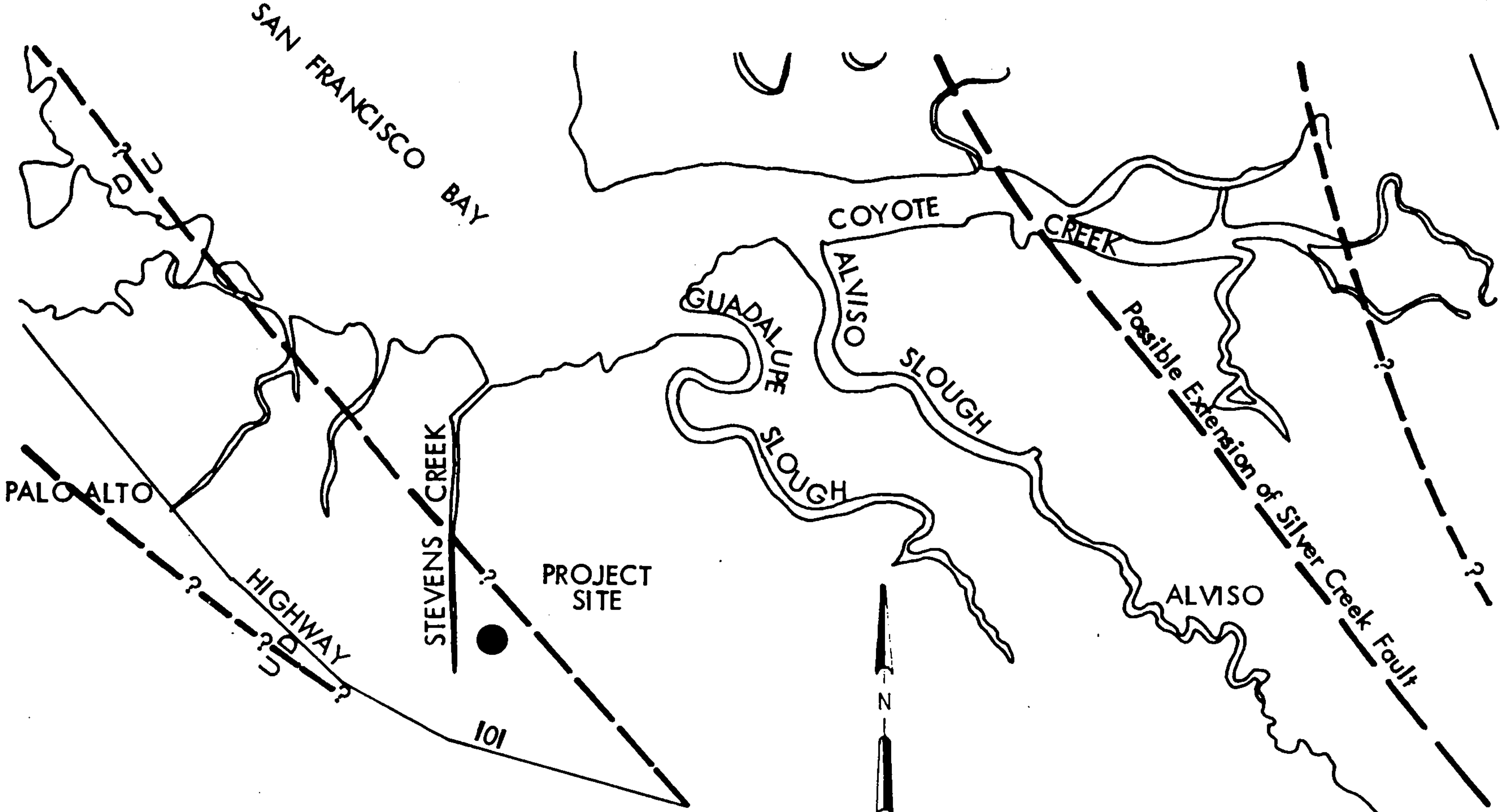


Figure 5. EARTHQUAKE EPICENTER AND ACTIVE FAULT MAP



LEGEND

—?— Inferred Fault in Bedrock Surface
U - Upthrown side; D - Downthrown side

SCALE

2000 4000 6000
feet

NOTE: Faults are based on gravity survey interpretations by the CALIFORNIA DIVISION OF MINES AND GEOLOGY & published in CALIFORNIA DEPARTMENT OF WATER RESOURCES BULLETIN 118-1 EVALUATION OF GROUND-WATER RESOURCES SOUTH BAY APPENDIX A: GEOLOGY AUGUST 1967

Source: The Planning Policy Committee of Santa Clara County, " A Policy Plan for the Baylands of Santa Clara County" County of Santa Clara.

Figure 6. VICINITY MAP OF INACTIVE FAULTS NEAR AMES RESEARCH CENTER

The following potential geologic hazards are discussed regardless of the fact that most, if not all, of the geologic limitations at Ames can be mitigated by sound engineering practices.

Potential geologic hazards at Ames include earthquake shaking, liquefaction, differential settlements, expansive and compressible soils, and areal subsidence. Since there are no known active fault traces on the ARC or in the immediate area, the hazards of fault rupture and tectonic creep are considered remote. Due to the essentially flat terrain, problems of slope failure and excessive erosion are considered insignificant. Although a 20-foot high tsunami wave at the Golden Gate (entrance to San Francisco Bay) would create a 2-foot high wave at the outer salt ponds north of Ames, maps indicate no inundation would result.

Because of the seismic activity of the San Francisco Bay Area, the major geologic hazards at Ames are related to groundshaking during an earthquake and the effect this has on the underlying sediments and existing structures.

1. Liquefaction

During an earthquake, ground vibrations may cause a tendency towards volume decreases within loose, water-saturated sands, causing a reduction in effective strength and resulting in the sands behaving as a liquid. Heavy surface structures resting upon such liquefiable sediments may settle, often differentially, while buried structures, such as utility lines, may be forced to the surface and ruptured. Although usually associated with loose, cohesionless, saturated sands, liquefaction can also occur in denser sands and silts containing some clay if the earthquake is strong and of a long duration.

In general, the vicinity of the Ames Research Center constitutes a high potential for liquefaction due to the presence of shallow groundwater or compressible bay mud.[9] The results of tests of the liquefaction potential of sediments underlying specific building sites indicate it is not a serious problem. A few localized sand layers have been identified that have the potential for liquefaction, but they are discontinuous, and are surrounded and covered by clay. The liquefaction potential of other areas will be evaluated when building sites and plans are developed for specific areas. Displacements of the ground surface, which would affect shallow foundations and slabs, are expected to be small and of minor consequence for Ames structures.[3]

2. Lurch Cracking

Irregular fractures, cracks, and fissures in the ground surface often occur in weathered rock, alluvium, and soil due to the settling, shaking, and passage of surface earthquake waves during a strong earthquake. According to Williams and Rogers (1974), the area of the Ames Center has a high potential for lurching, with lateral spreading potential being greatest along the banks of Stevens Creek.[9]

3. Groundshaking

In addition to the above described phenomena which are precipitated by groundshaking, the ground motion itself can be a hazard to the works of man. The extent of the groundshaking hazard is dependent primarily on the characteristics of the structure and the underlying soil. Thus, in large measure, the potential damage of groundshaking is ultimately determined by the foundation and building design utilized. Because it was known early on (since 1940) that the Sunnyvale site was located in a seismically active zone, all the structures have been built with the necessary structural integrity to resist such groundshaking.

4. Areal Subsidence

The overdraft of groundwater from the unconfined aquifer in the Santa Clara Valley has resulted in a large area of land subsidence. In the vicinity of the ARC, several feet of subsidence occurred during the period 1934 to 1967. However, since 1965, increased artificial recharge of the aquifer together with decreased pumping from confined aquifers have virtually halted subsidence in the Santa Clara Valley.

Problems caused by areal subsidence are limited primarily to lengthy linear structures such as canals, sewer lines, storm drains, and water mains in which slight changes in surface elevations may cause flow problems. Because of this fact, the structures at Ames were not significantly affected by the 1934 to 1967 subsidence period. Thus, if another cycle of subsidence in the Santa Clara Valley is initiated by overpumping, it should have little if any effect on Ames.

5. Expansive Soils

The silty-clay soil that covers much of the ARC including the project site is classified by the U.S. Soil Conservation Service as having a high shrink-swell potential. Analyses of soil samples taken from test borings at Ames indicate that approximately the upper four feet of soil are highly expansive.

The expansive soils contain certain clays which greatly increase in volume when wetted and shrink when they dry out. Thus, shallow slab foundations, floor slabs, and pavement placed upon these soils will rise and fall seasonally with fluctuation in the shallow water table. The amount of vertical movement often varies from place to place, thus creatting stress on the overlying rigid slabs, often causing them to crack and heave. The potential limitations created by the presence of expansive soils are not considered serious since preventive measures can be employed with little difficulty. Because the presence of such expansive soils at Ames has been recognized since 1940, such potential problems have been regularly mitigated.

3.2 ARCHAEOLOGIC AND HISTORIC FEATURES

The history of the northern Santa Clara Valley involves four phases: the Indian Era (early and recent) from several thousand years ago up to 1848 (1769),* the Spanish-Hispanic Period from 1542 (1769) to 1822 (1836), the brief Mexican-Hispanic Period from 1822 (1836) to 1848 and the American Period from 1848 to the present. Although some remains from each period exist within the northern Santa Clara Valley, remains have been destroyed over large areas.

In the general vicinity of Ames and Moffett Field at least nine areas of Indian remains have been recorded. Only one such site, though, an Indian refuse disposal site ("kitchen" or shell midden) designated as Santa Clara 23 (see Figure 7), has been located within the boundaries of Ames. Field reconnaissance and maps of the Treganza Museum, San Francisco State University, indicate it is located in the cultivated fields within the western portion of Ames. Although many buildings were constructed in the Moffett Field area during the Spanish-Hispanic and Mexican-Hispanic periods, a review of records indicates that no structures were built within Ames' boundaries.

During the American period which followed, many structures were built in conjunction with the farming activities in the area. Thompson and West's map of 1976 indicates that structures were located on two farms within Ames' boundaries. These structures were located on the Crittenden

*Dates in parentheses are important to California history, while those without are taken from the California History Plan (California State Department of Parks and Recreation, 1973).

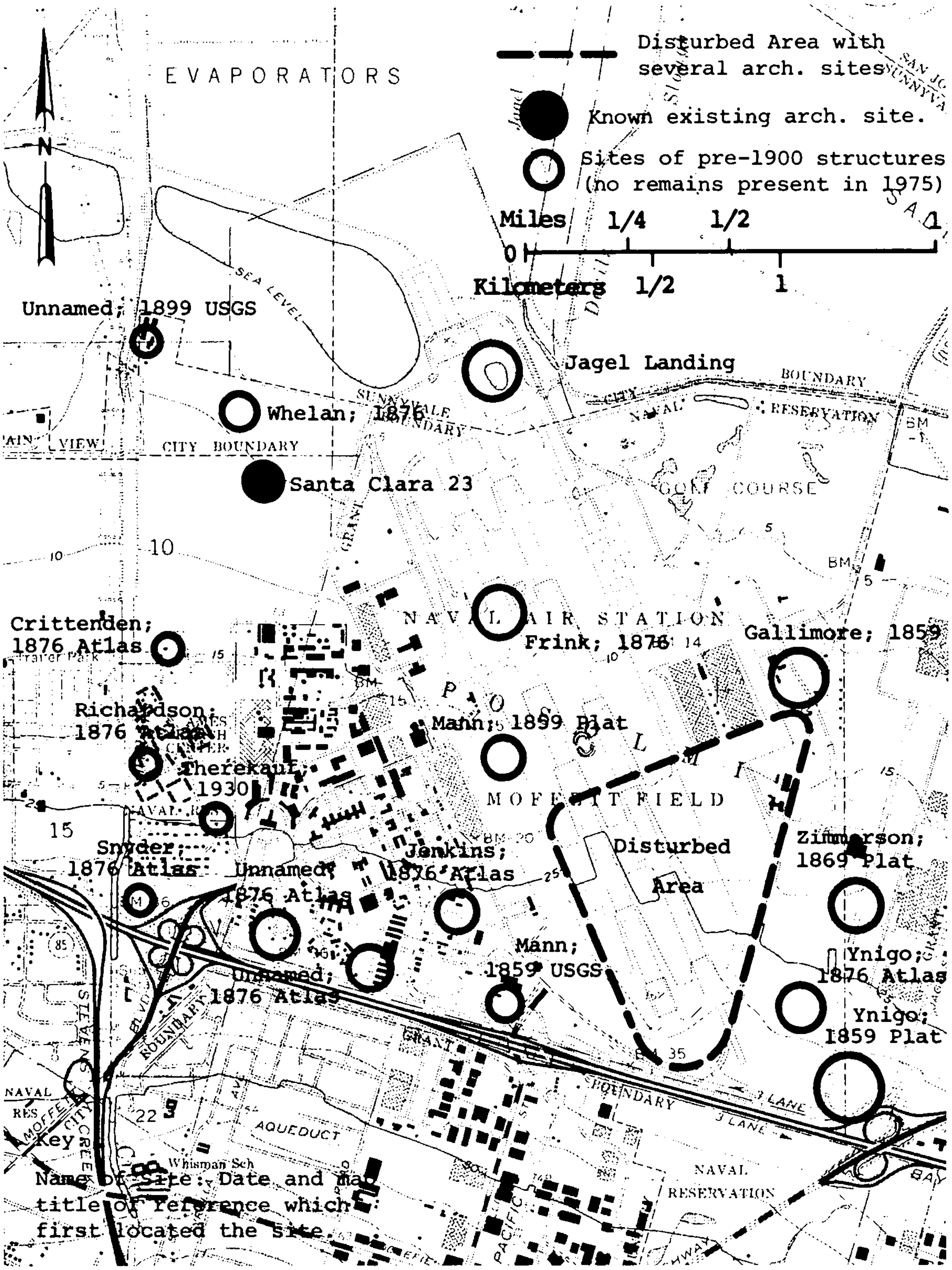


Figure 7. ARCHAEOLOGIC AND HISTORIC FEATURES IN THE VICINITY OF AMES RESEARCH CENTER

and Whelan farm sites and hence had the same names. A U.S.G.S. map of 1899 (the Palo Alto 15-minute quadrangle) indicates that another building site was located in the northwest corner of Ames. However, none of these buildings are found on the U.S.G.S. map of 1944 (a new map based on aerial photos and new surveys; the map included the runways and facilities of Moffett Field). No evidence is presented as to whether these buildings were moved or destroyed.

In summary then, one recorded Indian midden, designated as Santa Clara 23, exists in the northwest sector of the Ames area. Three historic building sites occur within the present boundaries of Ames, near the known archaeologic site. The building sites are 100 years old and were part of the farming development of the Santa Clara Valley that followed the Civil War. Because the buildings themselves no longer exist, no building within the Ames area is known to be more than 50 years old and most structures are 30 years old or less. No federal or state landmark of historic significance is located within ARC. However, the Thererkauf farmhouse, which is located west of ARC near the existing naval residences, would have been registered as a federal historic landmark but burned down July 7, 1976. A more detailed description of the archaeologic and historic features of Ames' area is contained in Appendix A-1.

3.3 WATER

a. Hydrology

1. Surface Water

The two major surface water bodies near Ames are Stevens Creek and the San Francisco Bay south of Dumbarton Bridge. Stevens Creek flows parallel to the western edge of the Center, and the saltwater marshes and Leslie Salt evaporator ponds which lie between south San Francisco Bay waters and the northern edge of the Center. It extends from its mouth on the Bay southerly ten miles to Stevens Creek Reservoir and then another three miles southerly and six miles northwesterly to its headwaters in the Santa Cruz Mountains. The most northerly portion is a slough subject to tidal action to a point near the middle of the undeveloped Ames property. High flows occur during the winter, and little or no flow occurs during the summer. Table 3 statistically summarizes flow quantities in Stevens Creek for the years 1971-1974.

South San Francisco Bay, which has an average depth of 15 feet, receives the drainage of Stevens Creek and the other major streams in the region, Guadalupe River and Coyote Creek. The shallow depth tends to maintain the high turbidities and oxygen transfer rate, characteristics which make the south Bay unique in comparison to other parts of the Bay. For instance, naturally low stream inflows limit the flushing action of the south Bay and consequently hinder pollutant dispersion. This is especially important during the summer when the flushing action of the Sacramento and San Joaquin rivers is also limited. In addition, evaporation during the summer causes the south Bay to act as a negative estuary in which net flow is southward toward Coyote Creek rather than northward toward the ocean. Diurnal tidal action causes south Bay surface water elevations to rise about 3.9 feet above sea level at mean higher high tide and 6.8 feet above at highest high tide. Leslie Salt evaporator pond dikes and the SCVWD dikes provide only marginal protection to Ames from regular tidal inundation. Additional protection will be provided by the perimeter road presently under construction.

In addition to the Ames facility, the existing site drainage system serves both the Navy's on-site warehousing complex and its 218-acre housing development just south of the Center. Runoff is conveyed northerly in an underground collection system and discharged into an open ditch which runs from the north end of the facility to a point near the north end of the adjacent Moffett Field runway. The flow is transported in a conduit under the Navy lift station and then pumped into an open ditch

Table 3

STATISTICAL SUMMARY OF FLOW QUANTITIES
IN STEVENS CREEK FOR THE PERIOD 1971-1974

WATER YEAR	AVG. FLOW (cfs)	MAX. DAILY FLOW (cfs)	MIN. DAILY FLOW (cfs)	INSTANTANEOUS PEAK FLOW (cfs)
1971-1972	1.43	26.70	0.00	148.72
1972-1973	27.51	469.01	0.00	780.97
1973-1974	15.04	294.19	0.00	1,096.52

Source: Santa Clara Valley Water District, 1971-1974 records.

for disposal in Guadalupe Slough. When runoff exceeds ditch capacity, a pond forms in the northern portion of the site. Authorized improvements to the drainage of Building N-217 allow drainage water to flow to the saltwater marsh east of the building's diked area.

2. Groundwater

Groundwater occurs in the area in two basic aquifer zones: a shallow watertable zone extending to depths of 60 to 100 feet and a deep artesian zone from about 160 feet downward to perhaps 1,000 feet or deeper. Separating the two zones is a massive and impermeable clay layer, forming the bottom of the overlying unconfined aquifer and the confining top of the deep zone below. The shallow groundwater, generally encountered at depths varying seasonally from 7 to 10 feet downward, is generally in weak supply; most wells drawing from this zone have now been abandoned. The deep artesian wells support medium- to high-capacity wells and were the original source of water supply for most areas in the Santa Clara Valley. The deep aquifer is recharged along the forebay area of the valley and through pervious streambeds and man-made percolation ponds.

There are two water wells in the northern portion of the project site; one provides irrigation water for the agricultural lease operation and the other is not now operating. As indicated in the water supply section, the rest of the water used at the base is surface water supplied by the San Francisco Water Department.

b. Water Quality

1. Surface Water

The major surface water bodies of interest are Stevens Creek and south San Francisco Bay. Although no quantitative data with regard to Stevens Creek water quality have been collected, its quality during the winter months would be similar to urban runoff, while its quality during the summer would be similar to irrigation return flows. The winter flows would probably contain more solids and heavy metals, while the summer flows would have higher concentrations of pesticides and nutrients. Table 4 lists some typical values for parameters which characterize stormwater runoff in the Bay area and compares them to typical municipal sewage treatment plant effluent quality.

As indicated in the hydrology section, summer flows are small (rarely greater than 1 cfs (0.646 MGD) and frequently no flow at all) and therefore have very little effect on Bay water quality. Winter flows, because they are much larger (average daily flows frequently exceeding 100 MGD) and possess water quality characteristics as bad as or worse than municipal sewage effluents, can cause water quality degradation.

The total stormwater runoff contribution of Biochemical Oxygen Demand (BOD), nitrogen (N), phosphorus (P) and total heavy metals (THM) into the Bay from the Palo Alto, Los Altos, Mountain View, and Sunnyvale areas is listed in Table 5.

The quality of south Bay water is primarily affected by the discharge of urban runoff, treated municipal effluent, and its basic hydrology. At the moment, effluent discharge has the greatest effect on south Bay water quality. However, when the South Bay Dischargers plan to remove such discharges from the south Bay is implemented, stormwater runoff loadings will become the pollutant source of most concern.

Both the federal and state governments regulate wastewater discharges into the south Bay. The U.S. Environmental Protection Agency (EPA) is responsible for the regulation of discharges from federal facilities, such as Ames, while the Regional Water Quality Control Board regulates both municipal and industrial dischargers. At the moment, stormwater runoff

Table 4

TYPICAL VALUES FOR STORMWATER RUNOFF AND MUNICIPAL EFFLUENTS

CONSTITUTENT mg/ℓ	STORMWATER[1] RUNOFF	MUNICIPAL EFFLUENT
Chemical Oxygen Demand[1]	140	--
Biochemical Oxygen Demand	28	20[2]
Suspended Solids	225	40[2]
Total Nitrogen	4.4	24[2]
Total Phosphorus	0.77	9[3]
Oil and Grease	16	5.5[2]
Cadmium	0.0062	--
Chromium	0.22	0.010[3]
Copper	0.41	-0.040[3]
Lead	1.16	0.010[3]
Mercury	0.15	--
Nickel	0.10	--
Zinc	1.4	0.060[3]
DDT Compounds	0.00026	--
PCBs	0.0024	--

1 - Water Quality Control Plan for the Bay Area, 1975.

2 - Weighted Average of Palo Alto and Sunnyvale effluent quality.

3 - Recycling Municipal Sludges and Effluents on Land, 1973.

Table 5

STORMWATER RUNOFF POLLUTION FROM
SURROUNDING COMMUNITIES

COMMUNITY	ANNUAL POLLUTANT LOADING, 1,000 LBS/YR. BOD$_5$	TN	TP	THM
Palo Alto, Los Altos, and Mountain View	768.3	153.4	23.3	89.4
Sunnyvale	367.8	77.4	11.4	43.6
Total	1,136.1	230.80	34.70	133.0

Source: Water Quality Control Plan for S.F. Bay, 1975.

is not generally regulated, although a recent court decision* has mandated EPA to develop a permit, hence regulatory, program for these discharges. However, EPA is appealing the decision; at the present time (March 28, 1976), the Department of Justice has filed the appeal for the EPA.

In response to this court decision, proposed regulations were issued on December 5, 1975, (40 CFR Parts 124, 125, F.R. page 56932) and final regulations were promulgated on March 18, 1976 (F.R. page 11303). Among other things, these regulations define separate storm sewers, identify urban areas as locations where the regulations apply and suggest that proposed procedures for the issuance of general permits for separate storm sewers will be prepared in the future. They also stipulate that point sources discharging into separate storm sewers must obtain a conventional NPDES permit and that the permitting authority may at any time require the owner-operator of a separate storm sewer system to obtain a NPDES permit. These regulations would have little effect on Ames unless the EPA decides that storm sewer discharges from Ames represent a major source of pollution.

2. Groundwater

Groundwater quality in the area can be determined by examining Table 6 which lists the quality characteristics of two wells near NASA Ames and the EPA drinking water standards. Both wells are located near the intersection of Charleston and Stierlin Roads.

The table indicates that local groundwater is of good quality, with no evidence of seawater intrusion, and low nitrate concentrations. The low boron level, below 0.5 ppm, indicates sufficient quality for Class I irrigation water.

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*The U.S. District Court for the District of Columbia ruled on June 10, 1975 (Natural Resources Defense Council vs. Train, No. 1969-73), that regulations expanding the National Pollutant Discharge Elimination System (NPDES) permit requirements to include animal feedlots and stormwater runoff must be proposed.

Table 6

GROUNDWATER QUALITY NEAR NASA AMES

CONSTITUENT	WELL NUMBER 06S/02W-09H01 (1968 Data)	WELL NUMBER 06S/02W-09Q02 (1972 Data)	EPA	CLASS I IRRIGATION WATER
μmhos at 25°C (electrical conductivity)	583	566	-	-
NA (percent cations)	48	53	-	<60
HCO_3 (ppm)	250	266	-	-
Cl (ppm)	45	37	250	<175
NO_3 (ppm)	1.1	1.0	45	-
B (ppm)	.20	.20	-	<0.5
Total Dissolved Solids (ppm)	320	325	500	<700
SO_4 (ppm)	35	62	250	-

Source: Santa Clara County Water District, 1974.

3.4 AIR

a. Climate of Ames

Ames Research Center experiences a mild climate, common to the San Francisco Bay Area. The Center is located 2 miles south of the Bay. This close proximity to the Bay helps alleviate temperature extremes at the Center. The annual average daily maximum and minimum temperatures are $67^{O}F$ and $47^{O}F$, respectively. July's means are $73^{O}F$ and $56^{O}F$.

The average annual rainfall for the area is 16 inches. Ninety percent of the rainfall occurs from November to April. Coastal fog does not commonly extend far enough south to affect the area. Visual flight conditions are in existence 97 percent of the time at Moffett Field.

Wind flow through the Center is oriented in a general north-south pattern. The wind table (Table 7) illustrates this well. The flow follows the general valley topography. It is not unduly restricted or channeled, for the valley is quite wide at this point. Calm periods exist 24 percent of the time. The Center does experience more periods of low wind speeds than most other Bay regions. Light sea breezes are almost always present below the subsidence inversion during summer months.

Temperature inversions are very common throughout California. The graph (Figure 8) illustrates their persistence in the Bay Area. The summer subsidence inversion occurs in association with the semi-permanent high pressure system off the California coast. Under these conditions air aloft sinks, is warmed, and lies above the cooler surface air mass. Inversions inhibit vertical mixing and dispersion and also trap emissions, leading to the potential for elevated ambient pollutant levels.

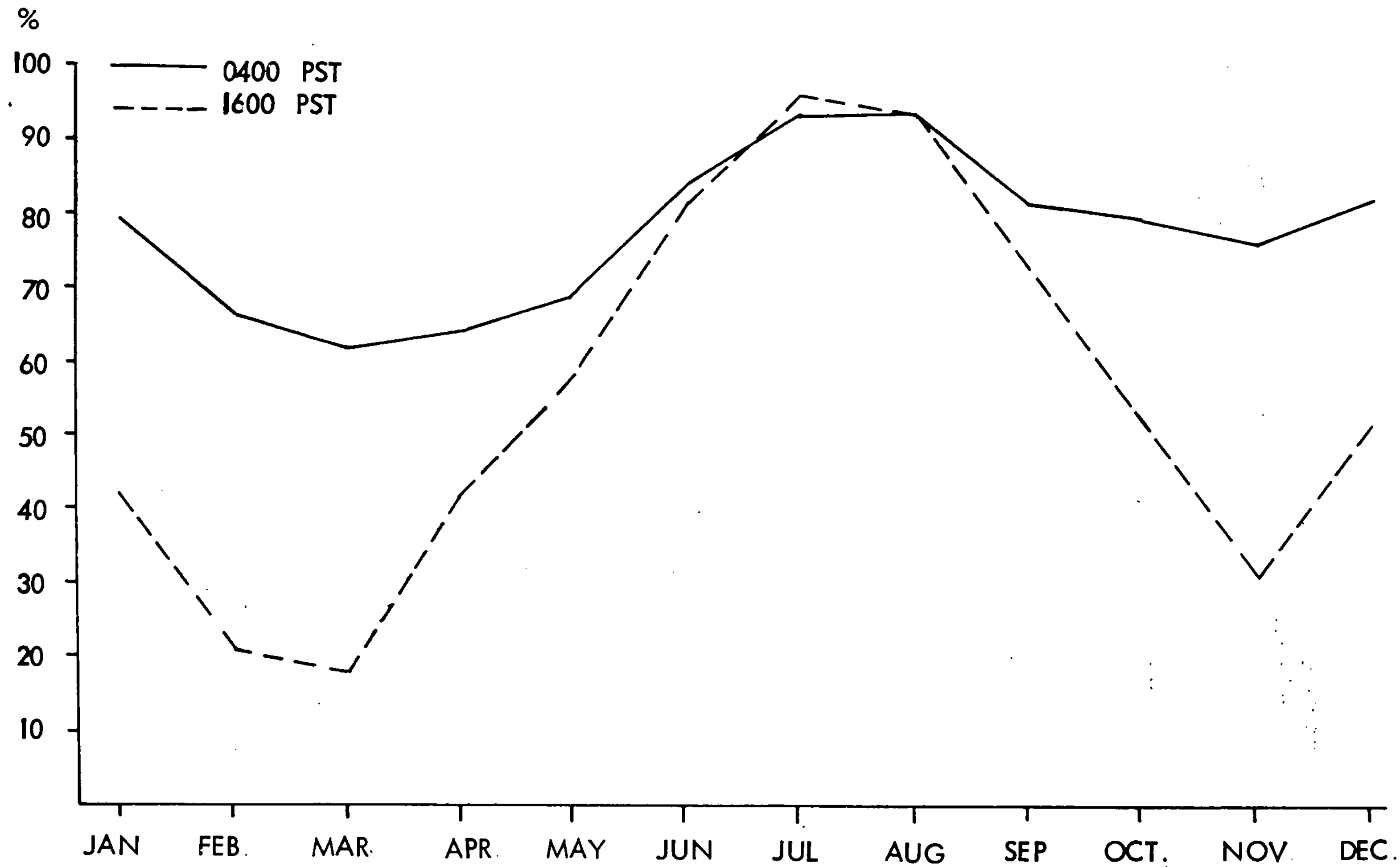
Table 7

WIND DIRECTION AND SPEED FOR
SUNNYVALE, CALIFORNIA/MOFFETT FIELD
(FROM 1945-1970 HOURLY OBSERVATIONS)*

DIRECTION	SPEED (KNOTS) 1-3	4-6	7-10	11-16	17-21	PERCENTAGE FREQUENCY	MEAN WIND SPEED
N	4.4	3.8	1.2	.1	.0	4.9	4.2
NNE	2.8	2.1	.4	.1	.0	5.4	3.8
NE	2.9	1.0	.2	.0	.0	4.5	3.2
ENE	1.3	.6	.0	.0	.0	1.9	2.9
E	2.7	.9	.1	.0	.0	3.7	2.9
ESE	2.0	1.0	.2	.0	.0	3.3	3.9
SE	4.4	3.2	.9	.5	.3	9.5	5.1
SSE	3.1	1.6	.4	.2	.1	5.5	4.4
S	2.8	.8	.1	.1	.0	3.8	3.1
SSW	.4	.2	.0	.0	.0	1.1	3.1
SW	2.0	.3	.1	.0	.0	2.4	2.6
WSW	1.2	.3	.1	.0	.0	1.6	3.1
W	3.5	1.3	.2	.0	.0	6.0	3.1
WNW	2.5	1.4	.3	.1	.0	4.3	3.7
NW	3.5	2.4	1.0	.2	.0	7.0	4.2
NNW	2.8	2.9	1.3	.2	.0	7.2	4.7
VARBL							
CALM						24.1	
TOTAL	42.7	24.2	6.5	1.6	.6	100.0	3.0

*Table values are subject to rounding errors.

Source: MFNAS Meteorological Station



Source: Aviation Effect on Air Quality, BAAPCD

Figure 8. PERCENTAGE OF FREQUENCY OF INVERSION BASED AT 2,500 FEET OR LESS BY MONTH BASED ON OAKLAND RADIOSONDE DATA FOR THE PERIOD 1957-1967

b. Air Quality Standards

National Ambient Air Quality Standards (NAAQS) have been set up by the federal and state government to protect the public's health and welfare. The standards define the maximum allowable levels of pollutants which can legally exist in the open air. Standards are set for photochemical oxidants, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates, and hydrocarbons. Primary standards refer to those limits which will ensure the public health. Secondary standards ensure property will not be damaged. An exposure time is provided for each standard. Table 8 illustrates the pollutants, standards, and exposure time.

Air pollutants are most broadly classified in two categories, primary and secondary pollutants. Primary pollutants are emitted from a source and dispersed in the air in their original chemical compounds. These include emissions of carbon monoxide, sulfur dioxide, particulates and hydrocarbons. Secondary pollutants are created by chemical reactions between primary pollutants. Photochemical smog is the chief example of this class of pollutants.

Carbon monoxide gas (CO) is a product of incomplete combustion. Any burning fossil fuel can emit CO gas. In the Bay Area 95 percent of CO is emitted by automobiles. Health hazards are known to occur at low concentrations, most commonly encountered in enclosed areas. Ambient air standards are written for this reason. Ambient air standards for CO are rarely exceeded in the general Bay Area, but are exceeded more frequently near highways during rush-hour traffic.

Oxides of nitrogen are created when free molecular nitrogen in the air is oxidized by high temperatures. Sources are automobiles, aircraft, and combustion processes. Nitrogen oxide (NO) and nitrogen dioxide (NO_2) are the two resulting gases. Nitrogen oxide is quite reactive and rapidly

Table 8

AMBIENT AIR QUALITY STANDARDS APPLICABLE IN CALIFORNIA

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS CONCENTRATION	FEDERAL STANDARDS PRIMARY	FEDERAL STANDARDS SECONDARY	BASIS FOR PRIMARY STANDARD
Photochemical Oxidants (Corrected for NO_2)	1 Hour	0.10 ppm	0.08 ppm	Same as Primary Std.	Prevention of eye irritation and possible impairment of lung function in persons with chronic pulmonary disease.
Carbon Monoxide	12 Hours 8 Hours 1 Hour	10 ppm - 40 ppm	- 9 ppm 35 ppm	Same as Primary Standards	Prevention of interference with oxygen transport by blood.
Nitrogen Dioxide	Annual Average 1 Hour	- 0.25 ppm	0.05 ppm -	Same as Primary Std.	Possible health effects could occur at slightly higher dosage. Produces atmospheric discoloration.
Sulfur Dioxide	Annual Average 24 Hours 3 Hours 1 Hour	- 0.04 ppm - 0.5 ppm	0.03 ppm 0.14 ppm - -	- - 0.5 ppm -	Prevention of increase in chronic respiratory disease on long-term exposure.
Suspended Particulate Matter	Annual Geometric Mean 24 Hours	60 $\mu g/m^3$ 100 $\mu g/m^3$	75 $\mu g/m^3$ 260 $\mu g/m^3$	60 $\mu g/m^3$ 150 $\mu g/m^3$	Long continued exposure may be associated with chronic respiratory disease. Exposure to a combination of suspended particles and sulfur dioxide may produce acute illness.
Lead (Particulate)	30-Day Average	1.5 $\mu g/m^3$	-	-	
Hydrogen Sulfide	1 Hour	0.03 ppm	-	-	
Hydrocarbons (Corrected for Methane)	3 Hours (6-9 a.m.)	-	0.24 ppm	Same as Primary Std.	
Visibility Reducing Particles	1 Observation	Visibility to less than 10 miles when the relative humidity is less than 70%.	-	-	
Sulfates	24 Hours	25 $\mu g/m^3$	-	-	Aggravation of respiratory diseases such as asthma or bronchitis. This action is enhanced by the presence of ozone.
Ethylene	8 Hours 1 Hour	.1 ppm .5 ppm	- -	- -	

ppm = parts per million

$\mu g/m^3$ = micrograms per cubic meter combines with other gases. Nitrogen dioxide is more stable and is a chief ingredient in photochemical smog. Nitrogen dioxide's role in smog formation is the main reason this gas is limited by a standard.

Sulfur dioxide results from the burning or processing of sulfur-containing fuels. In the Bay Area, sulfur dioxide is only a problem around large refineries.

Particulate standards are mainly set to assure visibility will not be reduced. In high concentrations, health hazards could also result. High particulate levels can also be a sign of the buildup of photochemical aerosols and smog.

Hydrocarbons are limited chiefly because of their action in the production of photochemical smog. They exist naturally in the air and are emitted by automobiles, fuel evaporation, and other sources.

The level of photochemical oxidants is the measure of photochemical smog in the air. Photochemical smog is the number one air pollution problem in California. It results from complex chemical reactions between nitrogen oxides and hydrocarbons, and is catalyzed by sunlight. The term oxidants refers to all oxidizing substances in ambient air of which ozone is by far the major constituent.

c. <u>Baseline Conditions at Ames</u>

The Bay Area Air Pollution Control District operates several monitoring stations near the Ames Center. Data from these were analyzed and compared for the past several years. The Redwood City station was chosen as the most representative of the Center. It is 12 miles from Ames and has equipment for monitoring all the major air pollutants. Limited stations, in terms of pollutants monitored and length of existence, are located in Mountain View and Sunnyvale.

The Bay Area presently and in the past has experienced a substantial smog problem. In 1975 the oxidant level exceeded the NAAQS (0.08 ppm) on 14 days at both the Redwood City and Sunnyvale Stations. Although the air quality is not now always acceptable, an improving trend is apparent. Figure 9 illustrates the decrease in the oxidant level from 1962 to 1974. The reduction is due to better automobile emission controls and stricter stationary source controls of oxidant precursor pollutants.

Table 9, illustrates frequency at which the applicable air quality standards were exceeded and the maximum annual concentration recorded at the Redwood City Station during 1975. Only the oxidant data presented can be construed as representative of conditions at Ames, since oxidants are the most regional of the pollutants monitored due to their formation mechanism.

During the winter months, primary pollutants (e.g., HC and CO) show an increase. This is the result of stagnation periods between storms, little vertical mixing, and little sunlight. Night and early morning temperature inversions keep the emissions near the ground. The winter increases in primary pollutants are usually not a serious problem. The air quality standards are seldom exceeded.

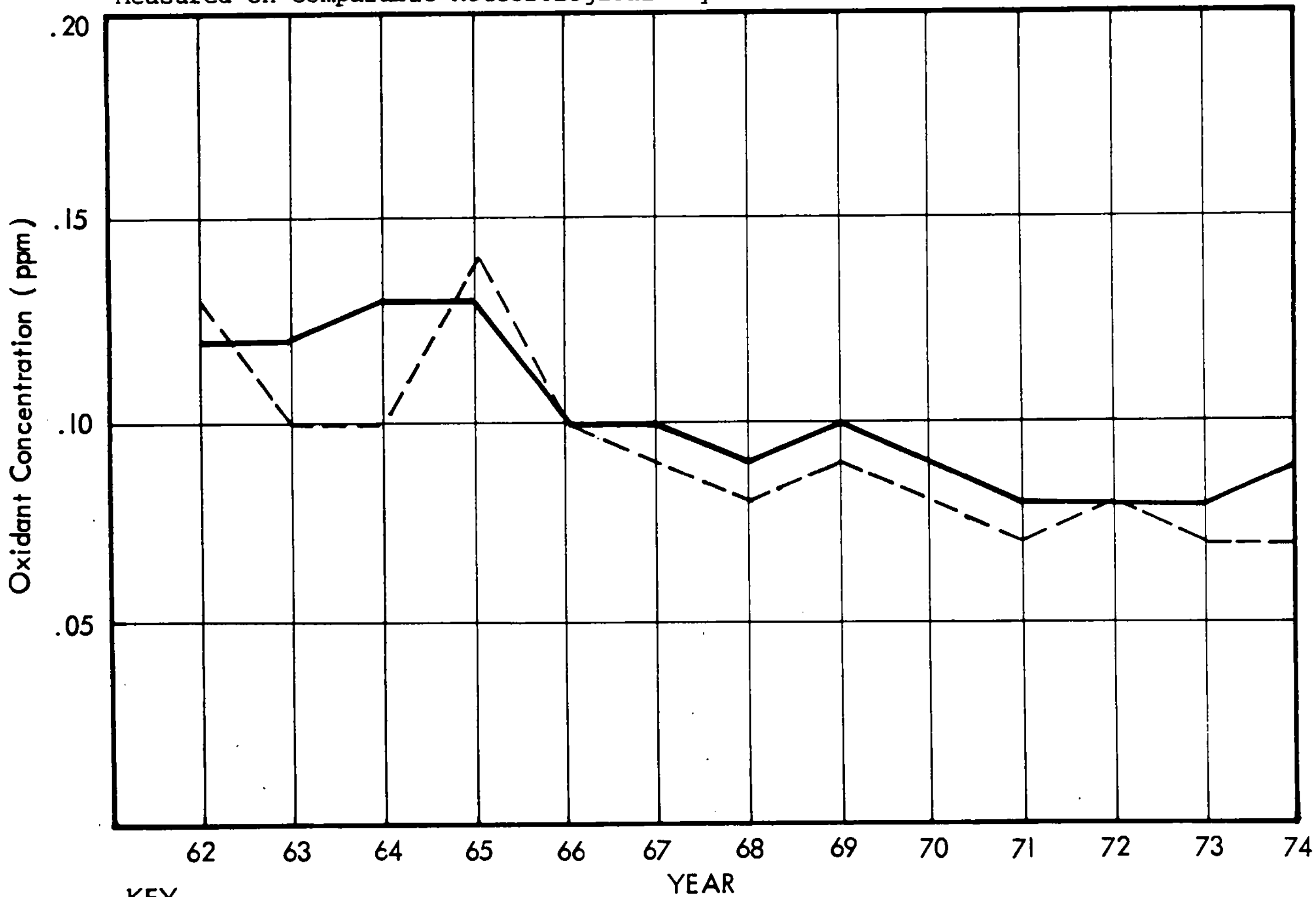
Summer is the photochemical smog season. Primary pollutants in conjunction with stable air masses and abundant sunshine cause the oxidant problem observed during the summer.

3.5 BIOTIC RESOURCES

The biotic resources at Ames comprise those animals and plants which occupy four relatively distinct habitats within the Center. The biota include both native and introduced plants. Some animals reside on the Center

OXIDANT TREND

Yearly Average of the Highest Hour Oxidant Concentration, Measured on Comparable Meteorological Days



Source: A Study of Oxidant Concentration Trends (1962-1974), BAAPCD.

Figure 9. OXIDANT LEVELS FROM 1962 TO 1974

Table 9

NUMBER OF DAYS AMBIENT AIR QUALITY STANDARDS WERE EXCEEDED IN REDWOOD CITY DURING 1975.

	POLLUTANT				
MONTH	OXIDANTS	CO	NO_2	SO_2	SUSPENDED PARTICULATES
January	0	2	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	0	0	0	0	0
May	4	0	0	0	0
June	1	0	0	0	0
July	2	0	0	0	0
August	3	0	0	0	0
September	4	0	0	0	1
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	1
	14	2	0	0	2
Annual Maximum[a] (ppm)	.13	10.1	.24	.014	42[b]

a. Annual maximum concentrations for oxidants, carbon monoxide and nitrogen dioxide are defined as those of the highest 1-hour period during 1975. Sulfur dioxide and suspended particulates are maximum 24-hour values.

b. Units of micrograms per cubic meter.

Source: Bay Area Air Pollution Control District, Technical Services Division, Containment and Weather Summary.

throughout the year, while other animals occasionally or seasonally visit the Center but are not continuous residents of the Center. Although seasonally covered by cultivated crops, the cultivated fields (Figure 10) represent the least biotically important habitat within the Center. The structured area at the southern end of the Center provides a highly disturbed habitat, but this habitat does provide shelter for several birds and mammals. The ornamental plantings and mature trees also provide many birds with food. The "oldfield" habitat includes those areas which have been disturbed and allowed to return to grasses, forbs and small woody bushes. In the northern sector and along the western boundary of the Center, marshlands and water habitats provide the most important and valuable habitat on or contiguous to the Center, although they have been disturbed by filling and other activities. The probable biotic composition is given in Appendix A-2 and the general distribution is indicated in Figure 10. Several rare and endangered species have been reported in the surrounding areas and could be expected to occur on or immediately adjacent to the Center. A wide variety of fully protected game and wildlife also reside on or visit the Center.

The biota of the cultivated fields has been barley and vegetable row crops and was tomatoes during FY 1975. During the growing season, some insects, birds, and mammals invade the crops, but most animals leave during the harvest. During the wintertime fallow period, little, if any, wildlife visit the cultivated field. Some wildlife pass over or through the fallow, cultivated fields, but such occurrences are infrequent.

The developed part of the Center is relatively compact and lies in the southern sector of the total area of Ames. This sector, and the farm and commercial buildings of the Anderson Bros. Company, form the elements of the "structured habitat." These areas are dominated by buildings, pavement, and introduced plants. Artificially planted trees, shrubs, and lawns form the major biotic resource. "Weedy" plants and disturbance-tolerant

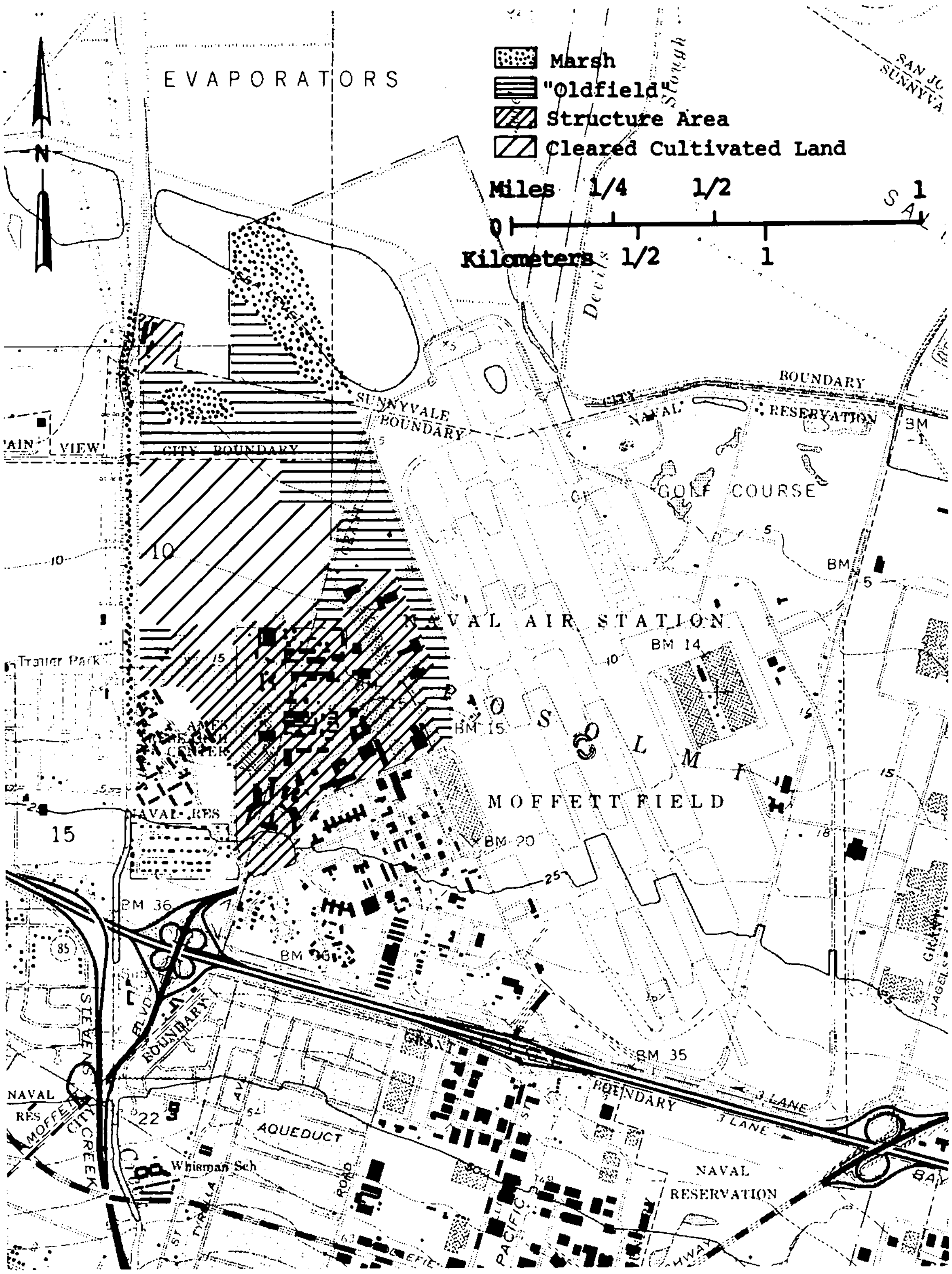


Figure 10. GENERALIZED MAP OF BIOTIC RESOURCES AT AMES RESEARCH CENTER

animals also occupy the areas. Both ornamental and weedy vegetation attract some birds and mammals. These animals are generally introduced European mice, rats, starlings, pigeons, and wrens, although many disturbance-tolerant native species are attracted by berries, seeds, and water available within the habitat. Over 20 species of native birds commonly visit structured or urban habitats (including swallows, jays, crows, a wide variety of small songbirds, mockingbirds, thrushes and blackbirds). Most native birds and some introduced birds either visit the structured areas or increase in abundance on a seasonal basis, generally being most diverse and abundant during the winter season.

The two most important habitats within the Center are the oldfields and the marshlands scattered around the perimeter of the cultivated fields and generally at the northern end of the Center's lands. The combination of low disturbance, few structures, and the shelter and forage provided by the vegetation attracts many native animals and supports many native plant species. The oldfield habitat also provides an additional service to the marshlands by buffering any adverse effects that may arise from the more disturbing land uses to the south. "Oldfield" habitat is generally defined as disturbed lands which have been allowed to return to more natural-appearing vegetation. Generally, the vegetation consists of grasses, forbs, and small bushes. A great variety of plants exist in this habitat (see Appendix A-2), and these annual plants provide an important source of abundant seeds for birds and mammals during the late spring and summer. The high productivity of annual and some perennial plants attracts and supports most of the birds found in the "structured habitat" and about 30 to 50 others. The abundance of birds and small mammals in the oldfields also attracts the predators common to most native habitats around the Bay. Some dogs and cats also catch small animals but are relatively infrequent compared to areas closer to residential neighborhoods.

The northern oldfields of the Center are also noted for their abundant pheasant and some other game birds. Pheasant, quail, and doves were observed on or over the oldfields, and ducks were sighted on Stevens Creek and can be expected to venture into the oldfield area during bad weather conditions or for seeds. Blacktailed jackrabbits are common, and brush rabbits can be expected. Near San Francisco Bay, these areas provide ideal hunting habitats for protected hawks, falcons, eagles, vultures, and owls. The sightings of sparrow hawks, white-tailed kites, red-tailed hawks, and one golden eagle over the Center confirm the attraction of the oldfield wildlife. However, no nests or suitable nesting habitats were seen on the Center and specifically in the oldfields. Some nests or roosts may exist on some of the larger structures but none were sighted.

Although many species of plants and animals are found within or immediately adjacent to the marshes, the characteristic pickleweed and cord grasses of the salt marshes clearly distinguish the marshes from the oldfield habitat. The marshes form a continuous habitat across the northern boundary of the Center, occupy a portion of the northern oldfield habitat, and enclose both sides of Stevens Creek (in the lands of the SCVWD, but under the influence of Center activities). The marshes within the Center are entirely of pickleweed. They are only inundated by rain water during the winter, but the leached salts from the soils (reclaimed Bay muds) provide sufficient salinity to inhibit the invasion of the marshes by more terrestrially adapted plants. The pickleweed marsh is fairly uniform in composition, although two species of pickleweed are commonly encountered. Wildlife in the pickleweed marshes is quite limited, due to the absence of the prolific, seed-producing annual herbs and shrubs. The wet or salt-encrusted soil conditions restrict ground-dwelling vertebrates to the Salt Marsh Harvest Mouse (a state and federal endangered species). The mouse is known to inhabit nearby marshes and probably also occupies the marshes within the Center. During the winter, some shorebirds may enter the marshes and oldfields in search of small insects and other invertebrates which are driven out of the soil by water-logging.

The cord grass and rushes marsh along Stevens Creek forms a series of marshes from the saline marsh of cordgrass near the mouth of the creek to the freshwater marsh of rushes, sedges, and willows. From the standpoint of total diversity and productivity, this riparian marsh (and some woodland) is the most important biotic resource on or adjacent to the Center. Most, if not all, of the birds found within the Center also occupy the creek marshes. Waterfowl, diving birds and shorebirds double the diversity of biota. Many amphibians and reptiles reside in this area, while rodents reside along the drier perimeters on the dikes. Most raptors are attracted by the abundance of small birds and mammals. Larger mammals include raccoons, skunks and opossums.

3.6 NOISE

There are two major sources of noise in the vicinity of Ames, traffic noise dominated by traffic on Bayshore Freeway, and Moffett Naval Air Station. Each of these contributes a different constituent to the noise picture. The criteria used in this report to evaluate the noise environment were derived from some commonly used federal criteria (DOT, HUD, EPA) for judging the effects of noise at different intensities, frequencies and durations. A comparison of these criteria with the recently approved Sound Element of the City of Mountain View General Plan indicates that the criteria identified in the Sound Element and those recommended by various federal agencies are quite similar.

The following discussion is based upon data from measurements performed by URS Research Company, Ames personnel and others,[16-20] and data and information available from scientific literature.

Bayshore Freeway, U.S. Route 101, located 1/2-mile to the south of Ames, is both a major artery between Los Angeles and San Francisco and a major commuter route. Noise levels are high and, because of heavy truck traffic at night, nearly constant throughout a 24-hour period. Since one heavy diesel truck exceeds the noise of automobiles by 15 dBA, trucks contribute heavily to the magnitude of noise. The noise contours for the freeway predicted from traffic data are shown in Figure 11. Figure 11 shows the predicted noise contours for L_{50} or average noise levels. These predictions indicate an average noise level of 60 dBA in the Navy housing adjacent to Bayshore Freeway. Measurements indicate the actual average is nearer 55 dBA. Buildings adjacent to the freeway apparently shield the remaining residential area.

The most significant contributors of noise from Moffett Field Air Station are P-3 "Orion" turbo-prop aircraft flying the pattern designated 32L VFR. These aircraft fly over at an altitude of 1,500 feet and speeds between 100 and 200 knots. Most of the fly-overs are training flights. On the average, the "Orions" represent 58 percent of Moffett Field operations. The remaining operations at the airport are jets and other aircraft -- respectfully being 12 and 30 percent of the annual operations. The present noise contours are shown in Figure 12[19] in CNEL units.

Aircraft operations at Moffett Field do result in community complaints, generally from residential areas south of Bayshore Freeway.[19] A few complaints have originated from the Naval housing north of and bordering Bayshore Freeway.

The only residential areas close to Ames are medium-density Naval housing and a trailer park complex. The Naval housing units are in two

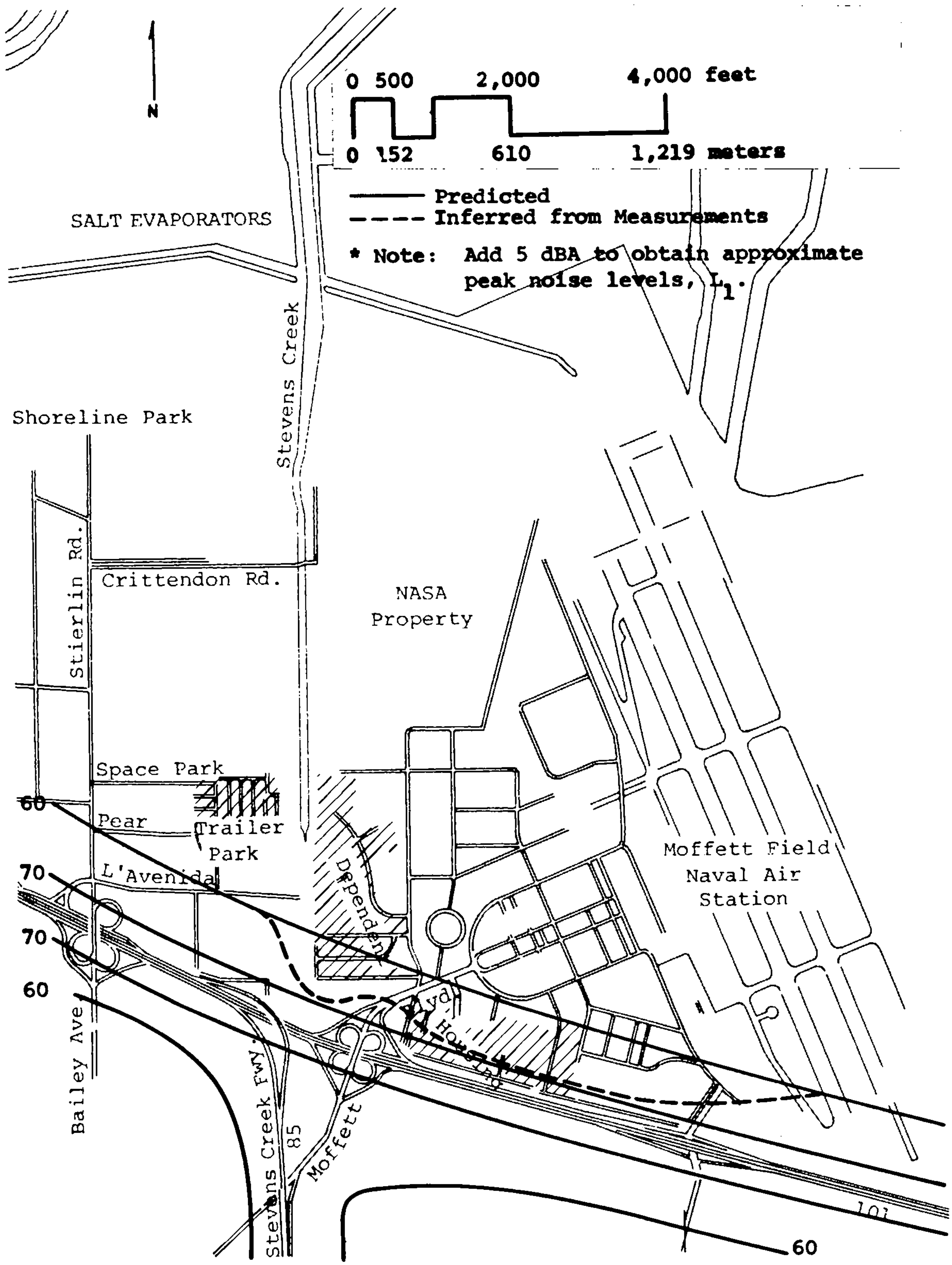


Figure 11. HIGHWAY NOISE CONTOURS L_{50} VALUES

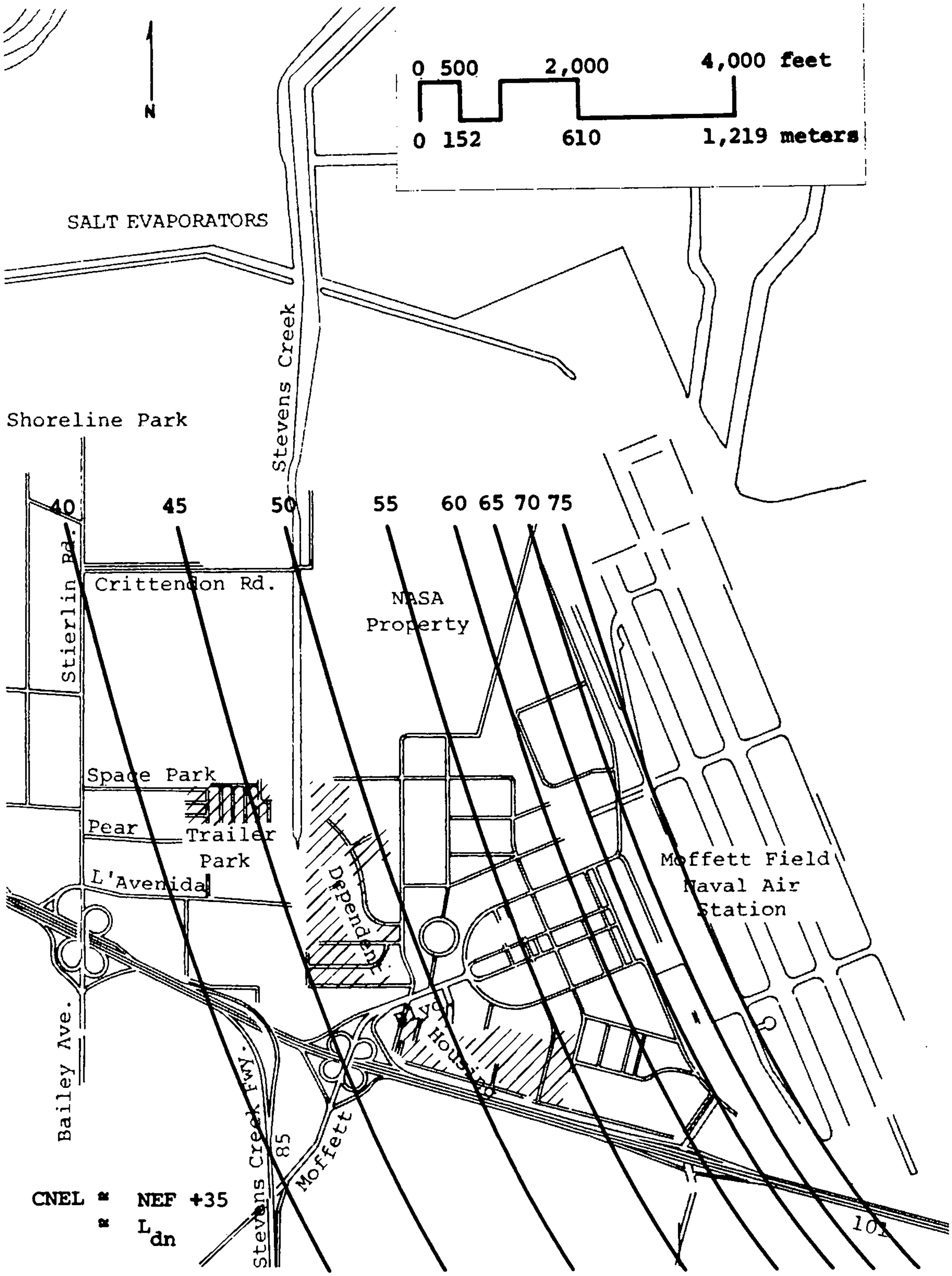


Figure 12. CURRENT MOFFETT FIELD CNEL CONTOURS FOR CIRCULAR PATTERN AND TRAINING FLIGHTS

general locations north of Bayshore Freeway -- east of Moffett Boulevard and west of the 40 X 80-Foot Wind Tunnel. The trailer park is located to the west of Stevens Creek and north of L'Avenida Street. The location of these noise-sensitive areas is shown in Figure 13.

Under the Family Housing Master Plan, vacant land adjacent to the existing housing to the west of Ames is considered by the Navy to be the primary building site for future housing; however, this is dependent upon shortage of other housing in the local area and Congressional appropriations.

The other possible noise-sensitive areas in the vicinity of Ames are Navy offices at Moffett Field, and residential housing to the south of Bayshore Freeway. Ames Research offices are scattered throughout the facility, mostly to the south and east of the lands occupied by ARC. Navy offices are primarily located between Ames and Naval housing north of Bayshore. The residential housing to the south of Bayshore is scattered throughout that area. The location of these areas is shown in Figure 13. The remaining areas around Ames are industrial, commercial, or open space, thus less sensitive to noise. The ambient noise levels shown in Figure 14 are based on measurements and represent the A-weighted, 24-hour, energy-averaged noise levels, L_{eq}.

The current noise environment of the Naval housing area from vehicle traffic on Bayshore Freeway ranges from acceptable to unacceptable, according to HUD and DOT guidelines, and EPA recommended levels. As noise from freeway traffic dominates ambient noise conditions, distance of the housing from the freeway is the deciding factor, the dwellings closest to the freeway being an unacceptable noise environment and the farther dwellings being in an acceptable noise environment.

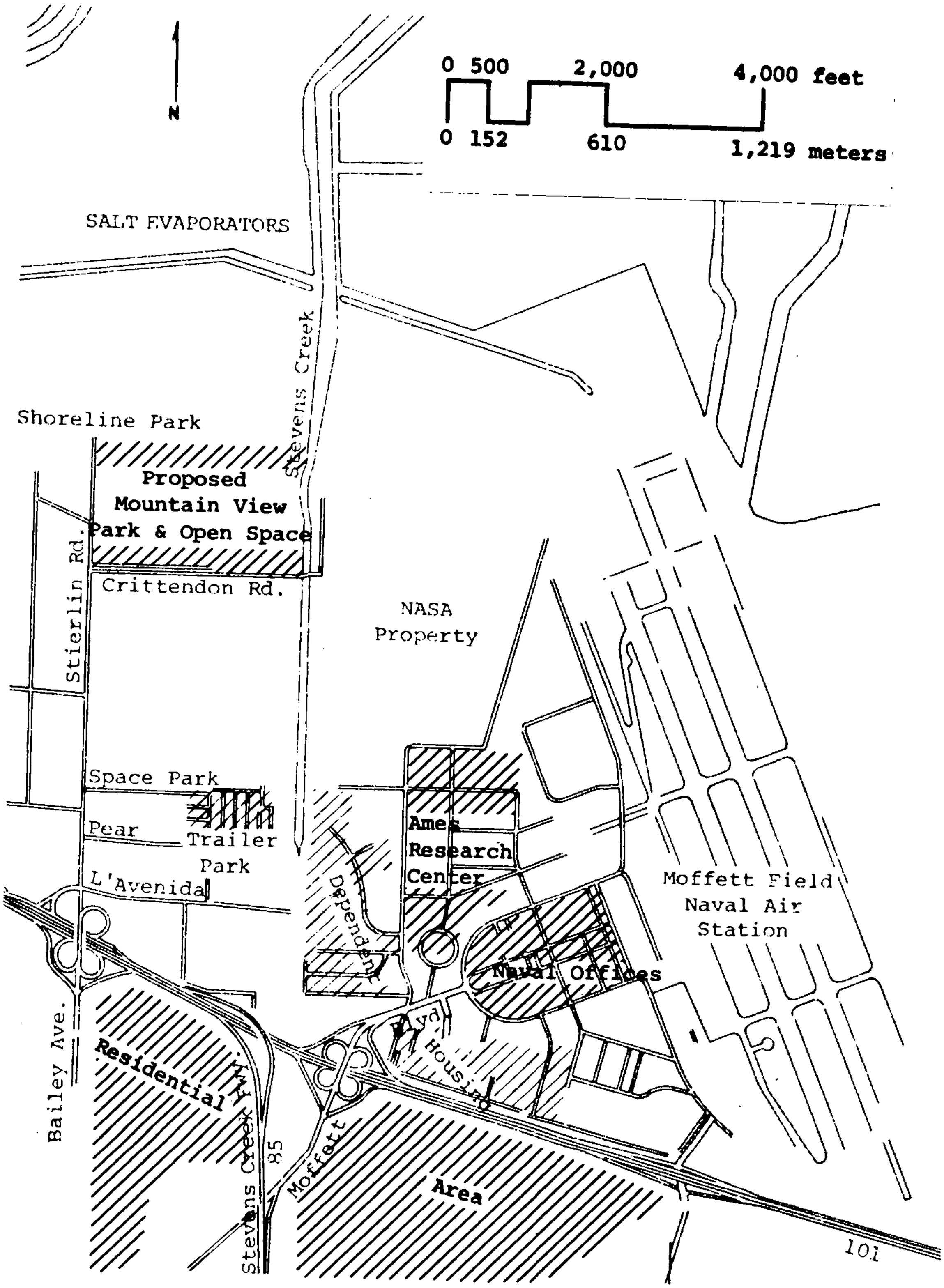


Figure 13. POSSIBLE NOISE SENSITIVE AREAS NEAR AMES RESEARCH CENTER

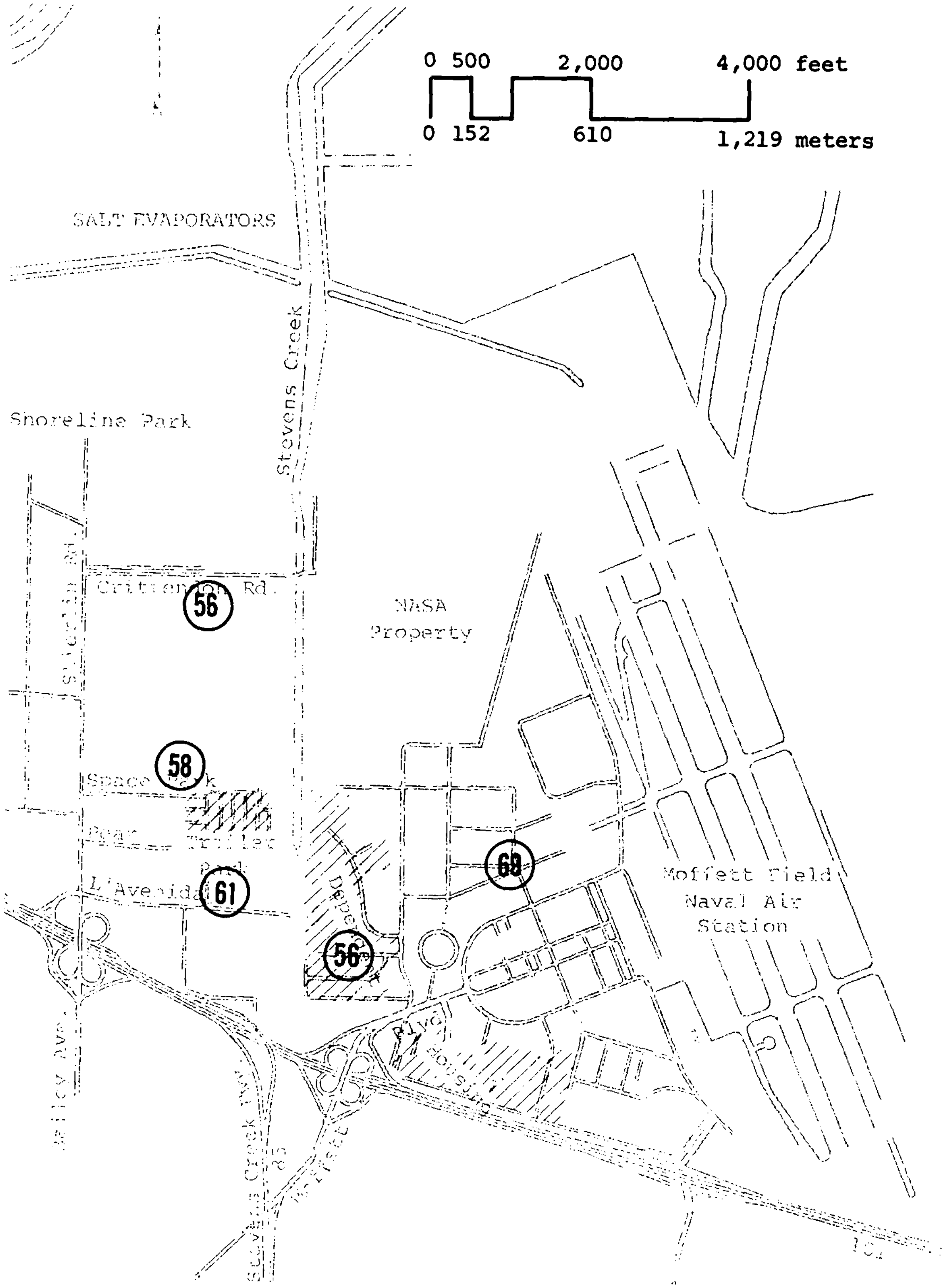


Figure 14. AMBIENT NOISE LEVELS, 24-HOUR L_{eq} IN dBA

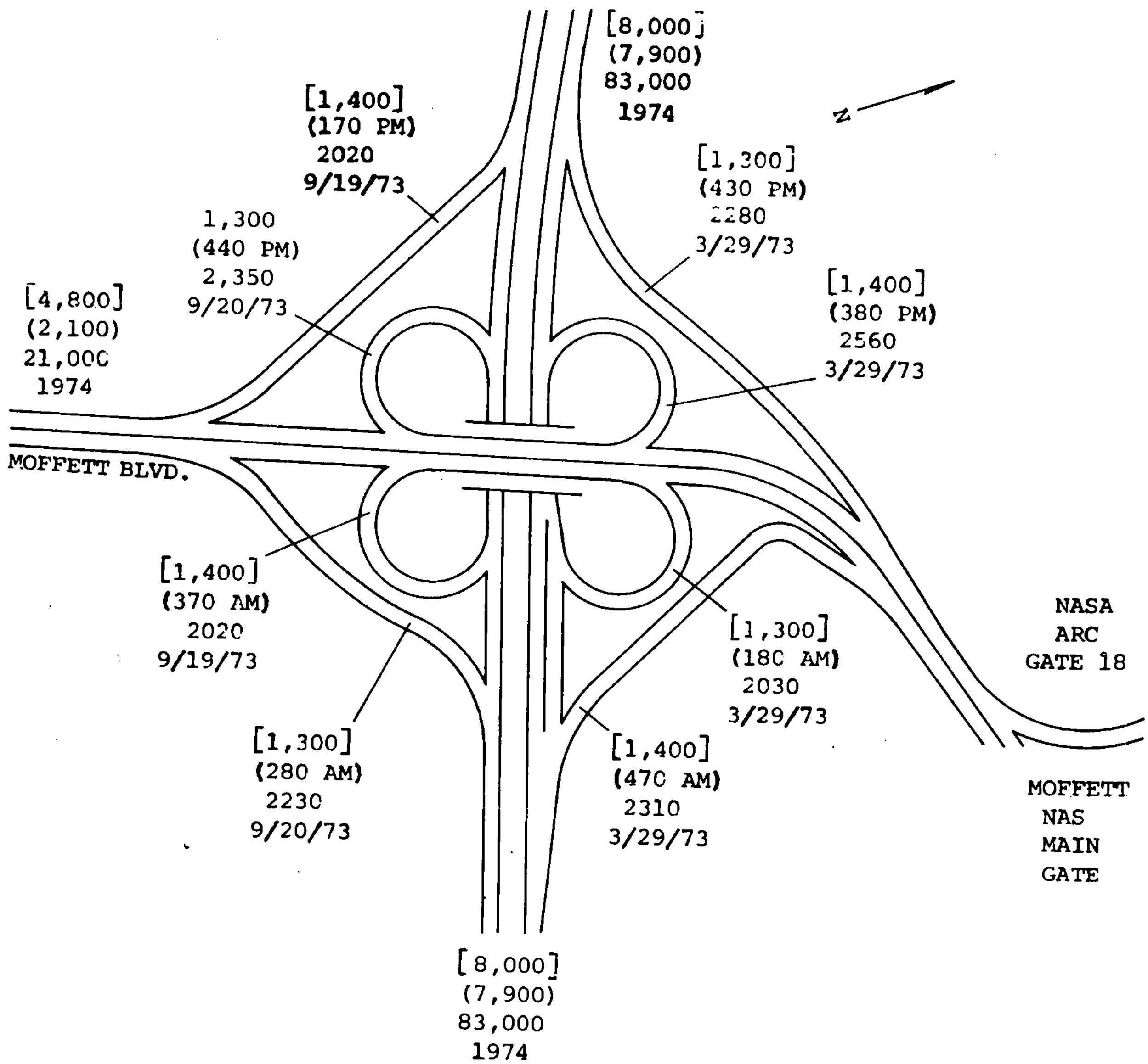
The noise environment associated with Moffett Field operations (Figure 12) is within the HUD and California guidelines (CNEL) of 65 dB[7] for the residential areas. However, peak noise levels from individual aircraft flyover frequently exceed the recommended levels for speech and sleep interference.

3.7 TRANSPORTATION

Local transportation to Ames is dominated by highways and automobiles. Public transportation does exist, but does not carry a significant load at this time. Pedestrian and bicycle access to Ames is limited. Aircraft facilities at Moffett NAS as well as at San Francisco and San Jose airports provide interstate access.

The following description of the existing traffic environment includes the elements attributed to Ames as an existing activity. Existing traffic conditions will be evaluated in terms of the "level of service," with "A" being the best and "F" the worst. Level C is an acceptable condition. A full definition is contained in Appendix A-3.

The Moffett Boulevard interchange on US Route 101 is the principal highway access to Ames. Other highway access is afforded by Ellis Street (Moffett East Gate) and State Route 237 (Moffett South Gate). The south gate receives little Ames traffic. Congestion in the vicinity of the Moffett interchange (Figure 15) is due to bottlenecks on the mainline traffic route (US 101), and at the Ames and Moffett entrance gates. The overpass and ramps are operating at better than acceptable levels, even at the peak hour. Mainline traffic is generally operating at an acceptable level of service (C) but is subject to congestion (a.m., northbound) stemming from the Route 85 merger with US 101. The Ellis Street Interchange (Figure 16) is operating at acceptable levels on the ramps, although the southbound ramps carry significantly



KEY

[HOURLY CAPACITY
LEVEL OF SERVICE C]

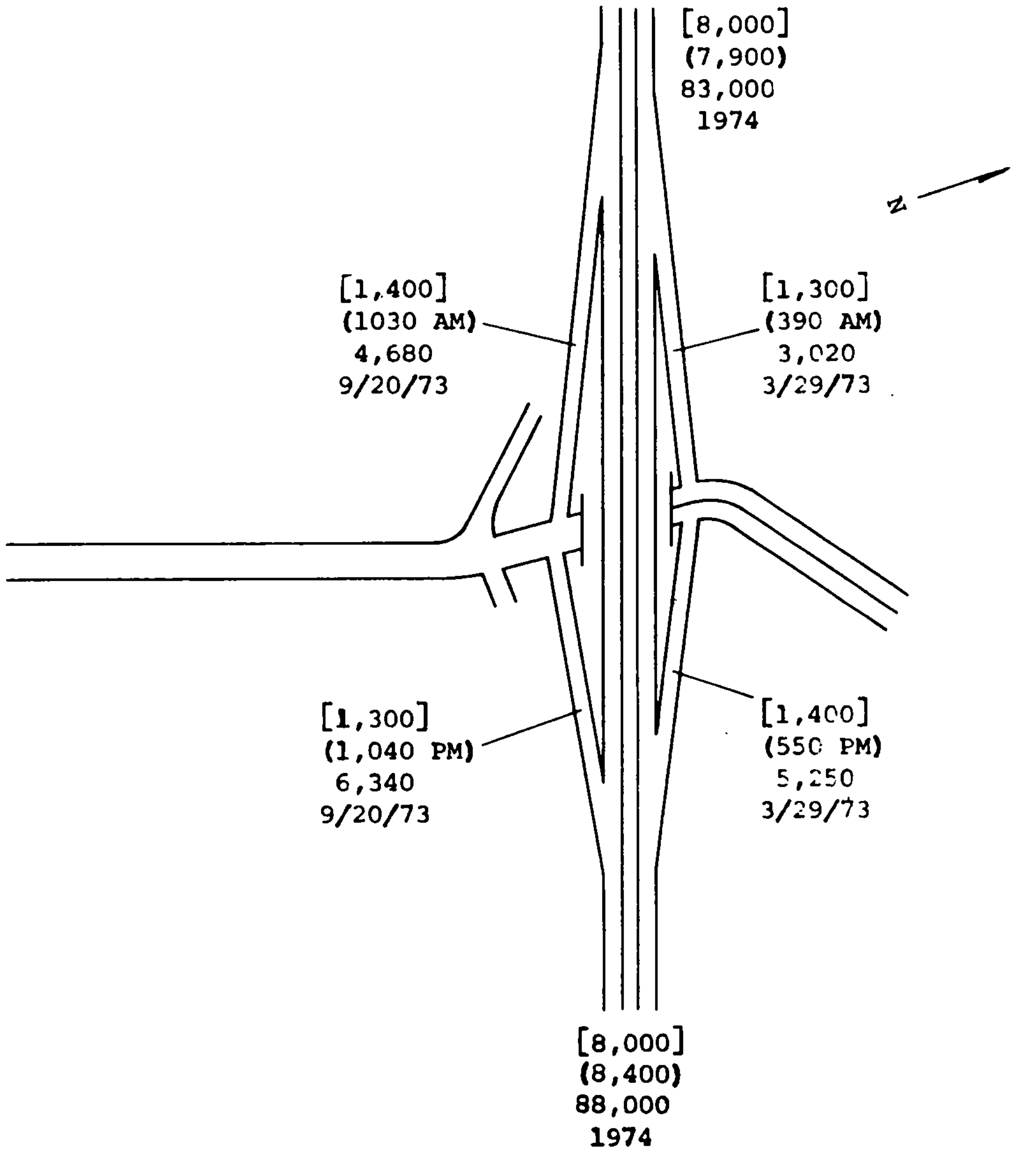
(PEAK HOUR VOLUME AM/PM)

AVERAGE DAILY TRAFFIC

DATE OF COUNT

Not Drawn To Scale

Figure 15. EXISTING TRAFFIC AT U.S. 101/MOFFETT BLVD. INTERCHANGE



KEY

[HOURLY CAPACITY
LEVEL OF SERVICE C]

(PEAK HOUR VOLUME AM/PM)

AVERAGE DAILY TRAFFIC

DATE OF COUNT

Not Drawn To Scale

Figure 16. EXISTING TRAFFIC AT U.S. 101/ELLIS STREET INTERCHANGE

more traffic than the northbound. No counts are available for the overpass traffic. Mainline traffic conditions are again at the level of service C, with less peak-hour congestion from the Route 85 merge, as it is more distant.

Route 85 also provides significant access to Ames via Moffett Boulevard, as shown in Figure 17. Moffett Boulevard is operating at acceptable levels. The two ramps are operating at lower levels, but still are acceptable. Route 85 is approaching level of service C south of the interchange. Slightly better conditions exist just north. However, as Route 85 quickly diminishes into 1-lane on- and off-ramps merging into US 101, serious congestion occurs both in the morning and afternoon peaks. Although no Ames traffic is directly involved at that point, the congestion is affecting Ames access.

Both Ames Gate 18 and the Moffett main gates are congested at peak hours. Such conditions have been tolerated in the light of stable employment levels at Ames and Moffett. The prognosis is for improvement of congested conditions on US 101. Caltrans is anticipating the metering of all freeway on-ramps on US Route 101 from the Santa Clara County line south to State Route 17 in San Jose.* The implementation schedule is not known at this time. The general effects of ramp metering should be to smooth freeway flows and improve flow onto the freeway. Congestion at the Ames and Moffett exits may occur if queuing is sufficiently severe at the freeway on-ramps during the late afternoon rush hour.

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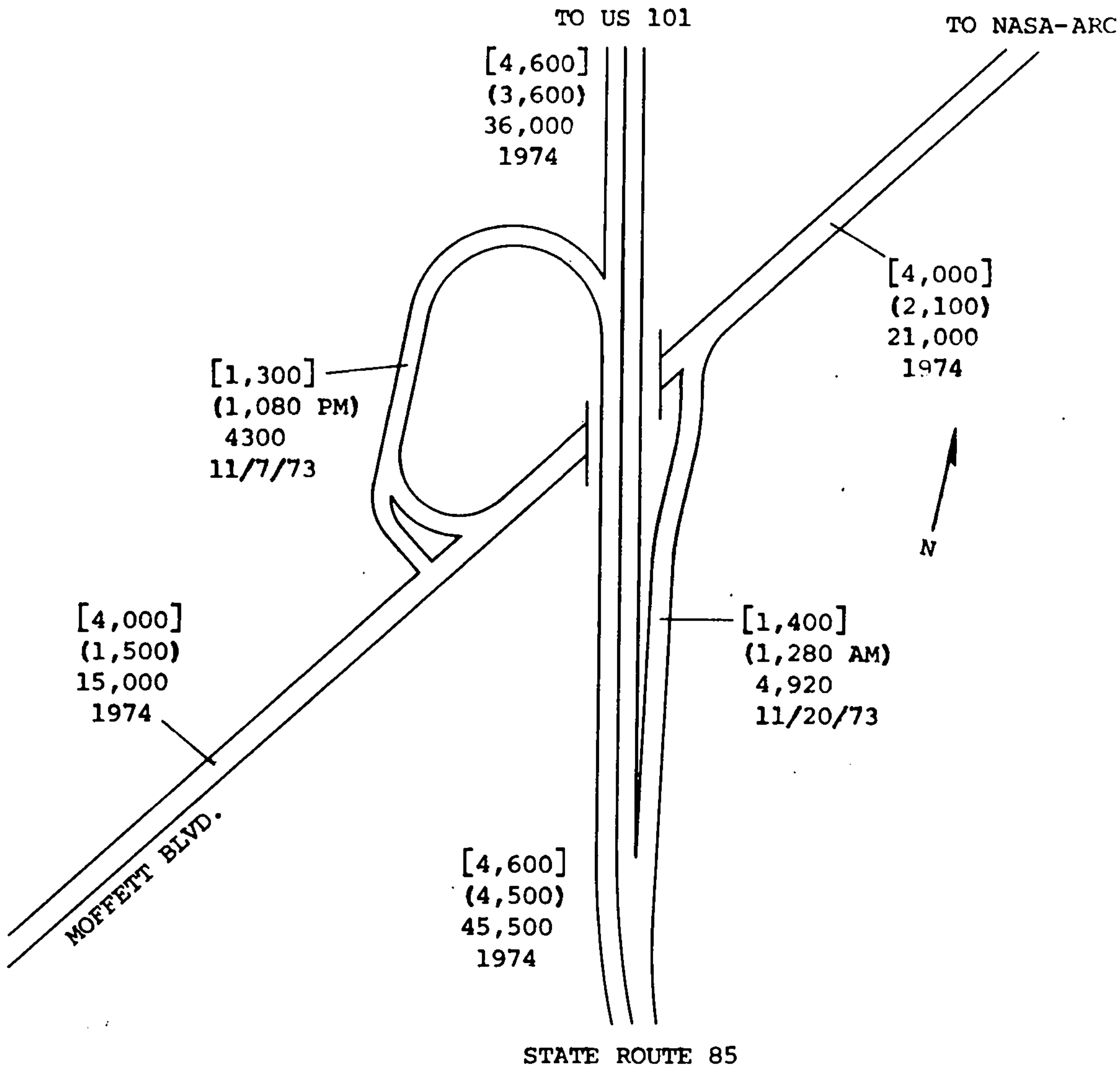
* Personal Communication with Mr. Sieker, Caltrans, Project Development Branch, November 13, 1975.



KEY

[HOURLY CAPACITY LEVEL OF SERVICE C]

(PEAK HOUR VOLUME AM/PM)

AVERAGE DAILY TRAFFIC

DATE OF COUNT

Not Drawn To Scale

Figure 17. EXISTING TRAFFIC AT STATE ROUTE 85/ MOFFETT BLVD. INTERCHANGE

Modifications to the local street system are planned by the City of Mountain View in the North Bayshore Area. In conjunction with this plan for roadway improvements, Ames is anticipating an extension of Charleston Road to provide further access to Ames in the vicinity of the present Gate 18. It is expected that this access would divert some trips from the Moffett interchange to the Stierlin Road and Charleston Road interchanges. Both of these are operating at better than acceptable levels. US 101 is at level C at this point as well. Some traffic is backed up from the Route 85 exit during the southbound, afternoon peak traffic.

Public transportation to Ames is provided by both Greyhound and the Santa Clara Transit District. Greyhound provides hourly service throughout the day to the Moffett Boulevard interchange. The Santa Clara County Transit District provides access via Line 52 which operates on 30-minute headways throughout the day. Typical access time via Line 52 service is one hour to downtown San Jose with one transfer to Line 21 or 22. Another transfer would likely be required to reach the employee's place of residence. One-hour access time could be compared to 15- or 20-minute access with a private automobile. At these current levels of service, public transportation does not present much potential for relieving automobile congestion in the area. Patronage on Line 52 is not excessive. The average load near the mid-point of the line is 15 persons; it carries a total of 400 to 500 passengers per day. A recent passenger count showed five persons boarding the bus at Ames at 4:00 p.m. Line 52 also serves the Castro station of Southern Pacific.

Pedestrian and bicycle access to Ames is not good. Although special bicycle routes have been planned, present access is over Moffett Boulevard interchange. The actual number of Ames employees riding bicycles to work is not known. However, there is an active group of employees pressing for better access facilities. The Mountain View

General Plan indicates a future bikeway along Stevens Creek. This has not been implemented.

3.8 UTILITIES AND PUBLIC SERVICES

a. Sewage Systems

Sewage collection, treatment, and disposal in the surrounding communities is provided by the cities of Palo Alto and Sunnyvale. The City of Mountain View operates a collection system also but no longer provides treatment as its sewage is pumped to the City of Palo Alto's facilities for treatment and disposal. The City of Palo Alto operates an activated sludge, secondary treatment facility with a design capacity of 35 million gallons per day (MGD) and a present average daily flow of about 27 MGD. Existing plans call for the addition of nitrification and filtration facilities by 1979. At the moment Palo Alto discharges its effluent into an unnamed slough east of the city. However, more distant plans, formulated by the South Bay Dischargers, call for the combined effluents from the San Jose/Santa Clara, Sunnyvale, and Palo Alto plants to be discharged into San Francisco Bay north of the Dumbarton Bridge.

The City of Sunnyvale operates a primary treatment plant with oxidation ponds that discharges effluent into Guadalupe Slough. The design capacity is 22.5 MGD and it now receives an average daily flow of 16 MGD. Existing plans also call for this plant to be upgraded to secondary treatment with nitrification capabilities.

Both the Palo Alto and Sunnyvale treatment plants receive sewage from Ames. An existing 33-inch Mountain View trunk sewer collects sewage from the western portion of the facility and carries it to the Mountain View plant for pumping to the Palo Alto plant. Sewage from the eastern portion of the facility is conveyed to the Navy collection system by a 20-inch main. This flow eventually reaches the Sunnyvale plant.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) have had a large effect on the operations of the Sunnyvale and Palo Alto plants, as they have been forced to provide or plan for improvements in treatment efficiency and more closely regulate the quantity and quality of wastes being discharged into their collection systems. For example, the Act and its implementing regulations allow public treatment plants to require that industrial waste flows greater than 50,000 gallons per day (gpd) or 5 percent of the plant capacity, or having the ability to reduce the efficiency of treatment or the quality of receiving waters, be pretreated to eliminate potential problems.

b. Water Supply

Local surface runoff, groundwater, imported water from the South Bay Aqueduct, and imported water from the San Francisco Water Department represent the four major sources of water for north Santa Clara County. The Santa Clara Valley Water District (SCVWD) and the San Francisco Water Department (SFWD) serve as import water wholesalers for the area. Import water treatment, groundwater recharge, and management and surface runoff storage are also provided by the SCVWD. Of the 183.40 MGD supplied to the north county area by large suppliers, groundwater supplied 94.9 MGD, stored surface runoff supplied 10.8 MGD and import water provided 77.7 MGD. Over 43 MGD of the import water are supplied by the SFWD, which is presently using about 74 percent of its 340 MGD capacity.

The water supply needs of local communities near Ames are supplied primarily by the SFWD. This distribution is clearly shown in Table 10, which lists the water supply sources for the cities of Palo Alto, Mountain View and the City of Sunnyvale. Water is supplied to Ames and the adjoining Navy facility by 18-inch and 20-inch supply mains which connect to the SFWD system. Long-term contract assures this supply. The 18-inch supply main parallels Moffett Road (with an inset necessitated by the placement of four PG&E transmission towers), with a small 6-inch

Table 10

SOURCES OF WATER SUPPLY FOR NEARBY COMMUNITIES

CITY	SOURCE OF SUPPLY, MGD			
	GROUNDWATER	LOCAL RUNOFF	SFWD	IMPORT WATER SCVWD
Palo Alto	--	--	16.4	--
Mountain View	3.7	--	6.9	--
Sunnyvale	5.0	--	11.3	0.6
	8.7	--	34.6	0.6

Source: Water Resources in Santa Clara County, A Plan for Conservation, 1973.

main extending to the farm area and the 18-inch main terminating in a 12-inch main which serves the still undeveloped portion of Ames. Ames also has a storage capacity of 200,000 gallons in an elevated tank and 750,000 in a surface tank; these are located within the "courtyard" of the 40 X 80 Wind Tunnel but do not serve it directly.

The recent passage of the Safe Drinking Water Act of 1974 (PL 93-523) will have little effect on the Center as Ames supplies no water, operates no injection wells, and uses high quality water. The quality of the water supply is illustrated in Table 11, which compares the value of selected characteristics in SFWD water with the primary standards of PL 93-523.

Table 11

COMPARISON OF SFWD WATER QUALITY
WITH THE PRIMARY STANDARDS OF PL 93-523

Constituent, mg/ℓ	SFWD	PL 93-523
Total Dissolved Solids	70.5	500
Chloride	8.2	250
Sulfate	12.1	250
Iron	0.11	0.3
Manganese	0.006	0.05

Source: Teledyne Isotopes, 1971

c. Natural Gas Consumption

Natural gas demand in the Bay Area is met by PG&E. In 1974, they purchased about 877 billion cubic feet for customers and for use in their thermal electric-generating facilities. The company currently has an adequate supply of natural gas to serve its firm customers for several years. Interruptible customers will be subject to increasing curtailment in the years ahead. Table 12 lists the natural gas consumption rates for the neighboring cities of Palo Alto, Mountain View and Sunnyvale.

Table 12

NATURAL GAS CONSUMPTION RATES FOR NEIGHBORING CITIES

COMMUNITY	RATE, MILLION CUBIC FEET/YEAR
Palo Alto	3,894
Mountain View	3,075
Sunnyvale	6,319

Source: 1974 PG&E Annual Report submitted to California State Public Utilities Commission.

Natural gas is supplied to the Ames-owned and -operated gas distribution system by PG&E. Because each facility has its own heating and cooling facilities, the distribution system is connected to each facility. In case of interruption, Ames maintains a central, liquefied petroleum gas standby plant.

d. Energy Consumption

Most of the electrical energy for consumer consumption in the Bay area is produced and distributed by Pacific Gas & Electric Company (PG&E). In 1974, the total system output amounted to about 60.9 billion kilowatt-hours (kwh), of which 53 percent was produced by thermal electric-generating facilities and 47 percent by the company's 65 hydroelectric-generating facilities and the facilities of other public water conservation districts. The total generating capacity available to the company was 13,873,000 kilowatts (kw) at the end of 1974. The Bureau of Reclamation provides electricity to selected federal facilities and communities throughout the Bay Area; PG&E provides the necessary distribution facilities. For instance, the Atomic Energy Commission operation at Stanford uses 206,529,072 kwh of Bureau power.

The communities near Ames purchase their electrical power from both PG&E and the Bureau of Reclamation. Citizens in Mountain View and Sunnyvale purchase power from PG&E, while the City of Palo Alto buys its power from the Bureau of Reclamation and provides its own distribution system. Table 13 lists the 1974 power consumption rates for the above communities.

Table 13

LOCAL COMMUNITY ELECTRICAL ENERGY CONSUMPTION, 1974

COMMUNITY	POWER CONSUMPTION, kwh
Palo Alto	707,692,046
Mountain View	524,280,943
Sunnyvale	744,280,943

Source: 1974 PG&E Annual Report, submitted to the California State Public Utilities Commission.

Ames contracts with both PG&E and the Bureau of Reclamation for its electrical power needs. Some of this power is generated by the Bureau of Reclamation and transferred over PG&E transmission lines under contract with the federal government; power in excess of that supplied by the Bureau of Reclamation is purchased from PG&E. This power is transmitted by 115-kv transmission lines on four parallel sets of steel towers on PG&E property to the Ames substation.

e. Solid Waste Management

Collection and disposal of solid wastes in the communities surrouuding Ames are and have been the responsibility of the individual municipalities. Wastes from the cities of Palo Alto, Mountain View, and Sunnyvale are all finally buried in landfills. The landfills receiving the wastes from Palo Alto and Sunnyvale will both be exceeding their capacities by the early 1980s, while Mountain View's sanitary landfill has an indefinite capacity, despite the fact that it receives over 2,000 tons/day of waste from San Francisco. Both the Palo Alto and Sunnyvale landfills receive about 300 tons/day of wastes.

Under the mandates of the Nejedly-Z'berg-Dills Solid Waste Management and Resource Recovery Act of 1972, Santa Clara County is preparing a solid waste management plan to define the collection, processing, and disposal operations and facilities required to alleviate present problems and eliminate future problems. The draft plan calls for the communities of Mountain View, Palo Alto, and Sunnyvale along with Cupertino, Los Altos, and Los Altos Hills to transport their wastes to a transfer station to be located in northern Santa Clara County. The transfer station would combine shredding facilities with ferrous metal recovery. The remaining wastes would be buried in the Mountain View landfill.

f. Public Services

Security, fire protection, and health services are either provided by on-base personnel or on a contract basis with MFNAS. The health clinic, staffed by ARC contract employees, is available to all Ames personnel. Fire protection is provided by contract with the Navy, while security is provided by Ames personnel in conjunction with MFNAS personnel.

3.9 VISUAL QUALITY

The Bayshore Freeway separates the almost continuous bayside Peninsula cities from the flatlands contiguous to San Francisco Bay, with dense urban development occurring to the west and south of the freeway.

The lands between the freeway and the Bay are characterized by sporadic residential and industrial development amidst wide expanses of lowlying grasslands and salt ponds. The freeway forms a visual as well as physical barrier, blocking views of the Bay shorelands from the urban areas. With the exception of exceptionally clear days, on which the Bay shorelands are visible from the foothills of the coast mountain range, the baylands are visible only to freeway travelers and persons out on the baylands themselves.

In the vicinity of Ames, the lands north of Bayshore Freeway afford wide vistas of the Bay Area and surrounding mountains. The flatness of the terrain is interrupted by occasional groups of trees and intermittent structures, particularly near the freeway. Structures in the north of Bayshore area lack architectural distinction and their somewhat random placement in the flat landscape together with the presence of power lines overshadow the subtle nonman-made views. It should be noted though that, with few exceptions, undeveloped Bay shoreland has been altered considerably by agriculture and diking. These alterations, because of their low relief, have considerably less effect on vistas of the baylands.

The baylands of the City of Mountain View are separated from the Federal lands on which the Ames/Moffett complex is located by the Stevens Creek corridor. On the west of the man-made elements, a mobile home park, Christmas tree farm, and scattered small structures abut the flood control dikes of the creek. The creek is congested with riparian vegetation and, as it is subject to tidal action, is a potential visual resource. Views of the creek are, however, hampered by limited public access and a distracting array of fences, wires, and structures.

3.10 PUBLIC HEALTH CONSIDERATIONS

A number of operations at Ames have the potential to affect public health. The use of radioisotopes is the operation of greatest continuing concern, while the use of toxic chemicals, corrosive acids and alkalis, and heavy equipment also pose hazards to users and operators alike. Pesticides are also used at Ames to control weeds and vermin.

The use of radioisotopes was first initiated at the Ames Research Center in December of 1961. Radioisotopes were initially used at the Center as biological tracers. The Ames Radioisotope and Radiation Safety Committee was established according to Title 10, Code of Federal Regulations, Part 30.24 (10-CFR-30). The primary purpose of this committee is to maintain radiation safety standards within the Center in conformance with the requirements of 10-CFR-20, 30, 31, 71, and the recommendations of NBS Handbook 69. The Committee reviews and regulates the use of all radioisotopes as well as all radiation-producing instruments and machines.

Disposal of radioactive waste is accomplished by a contractor, presently Nuclear Engineering. Both liquid and solid radioactive wastes are collected from individual laboratories and transported by the contractor in DOT-approved containers to a State of Washington-approved disposal site in Richland, Washington. In addition to radioactive waste, all toxic chemicals, corrosive acids and alkalis are disposed of by a waste disposal contractor. For example, all concentrated sulfuric acid-dichromate glass-washing solution used in biological research work is transported by the contractor to his waste disposal site.

Each radioisotope laboratory is furnished with a fume hood designed for radioisotope work. The exhaust system of each of these fume hoods is equipped with an absolute, Hepa-type filter.

The Center carries out a continuing monitoring program. In addition to regular, frequent monitoring of individual radioisotope laboratories, Ames has conducted an annual environmental monitoring program since 1964. Each year the programmatical approach has been to: (1) review and evaluate the radionuclide usage sites; (2) review and evaluate environmental sampling sites; (3) use uniform sampling procedures; (4) use uniform analytical procedures; and (5) report data in a manner which would permit comparisons with previous surveys conducted by Ames, and state and federal agencies. The radioactivity levels of both on-site and off-site soil, vegetation, and sewage samples are checked for any increase in activity levels above those expected fluctuations around normal background.

The objective of the pesticide program is conservation of the health and well being of personnel and protection of plants and buildings by effectively and efficiently controlling target pests while minimizing any associate hazard to the environment. The program is an ongoing one; however, it is under continual review and may vary from year to year in accordance with the pests to be controlled, pesticide effectiveness, registration restrictions, state and federal agency guidance, and other factors.

Pest control is accomplished by non-chemical methods whenever practical. The persistence of some pests, however, and the impracticality or unavailability of natural or alternate means of control dictate some degree of chemical usage. Pesticide selection is based on advise from pertinent federal and state agencies and information contained in handbooks and other publications, including those from the U.S. Department of Agriculture.

In the selection and use of pesticides, consideration is given to:

- Avoidance when possible of residual-type pesticides as well as those which are highly toxic.
- Protection of sensitive areas.
- Potential for adverse environmental effects.
- Impacts on aquatic, animal, and plant life.
- Protection of the applicator and other personnel.

Proposed pest control projects are submitted annually to NASA headquarters for incorporation into a "Report of Pesticides Used at NASA Installations." The report includes information relative to the pest to be controlled, pesticide to be used (together with the form, strength, and rate and technique of application), acreage to be treated, sensitive areas, precautionary measures, monitoring, etc. The collated projects are submitted to the Federal Working Group on Pest Management for their review and for any recommendations deemed necessary to achieve effective pest control while preventing or minimizing undesirable effects to health or the environment.

3.11 SOCIOECONOMICS

Santa Clara County developed rapidly in the period after World War II, led by the emergence of the County's electronics industry. From 1950 to 1970, as the County's economic base shifted from agriculture to manufacturing, the County's population grew from 290,000 to over one million. One nuclei of development is located along the built-up Bayside corridor extending from the San Mateo County line southward through Palo Alto, Mountain View, and Sunnyvale. To the west of this corridor is the extensive campus of Stanford University. "Around this corridor have developed low-density, auto-oriented residential areas incorporating high- and middle-income professional and executive households. Their incomes are based on employment in computer, aerospace, research and development firms, Stanford University, and companies manufacturing electrical products. These employers plus Ames are the major components of the economic base in the north end of the County."*

In July 1975, total employment for the San Jose SMSA** was 531,900 with unemployment at 49,900.*** Santa Clara County has the highest median family income in the state, $17,815 in 1975.

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*Association of Bay Area Governments, Projections of the Region's Future, Population, Employment and Land-Use Alternatives in the San Francisco Bay Region: 1970-2000, Series 2, September 1974, p. 45.

**The San Jose Standard Metropolitan Statistical Area includes all of Santa Clara County.

***Security Pacific Bank Monthly Summary of Business Conditions in the Northern Coastal Counties of California, "Selected Business Statistics," September 1975, p. 6.

4.0

RELATIONSHIP OF THE FACILITY TO LAND-USE PLANS, POLICIES, AND CONTROLS

4.0

RELATIONSHIP OF THE FACILITY TO LAND-USE PLANS, POLICIES, AND CONTROLS

4.1 EXISTING LAND USE

Ames occupies 421.4 acres of the north Santa Clara Valley at the southern end of the San Francisco Bay. San Francisco Bay is about 1 mile north of Ames lands, and the Santa Cruz Mountains are several miles to the south (Figure 1). The Center's lands are of low elevation, contiguous to salt ponds of the Bay. The City of Mountain View is immediately adjacent to Ames to the west and south and is adjacent to the City of Sunnyvale. Bayshore Freeway separates the Ames/Moffett Field complex from the urbanized areas of Mountain View and Sunnyvale.

The pattern of development in the Bay Area is characterized by a narrow plain of urban land encircling the Bay. Generally, linear pockets of industrial activity are located along the Bay front between somewhat parallel transportation corridors. Commercial and high-density industrial development is concentrated along major arterials, declining in density with distance from the Bay.[1] In the past several decades, this pattern has been altered somewhat as residential development has spread into the larger valleys beyond the encircling ridges.

Mountain View is typical of development around the Bay. Once an agricultural suburban town, the city is experiencing rapid urbanization. The 1975 population of Mountain View was 59,900. The city is bounded by Palo Alto to the west, Los Altos to the south and west, and Sunnyvale to the east. Dramatic increases in the number of multi-family residential units in the city over the past 20 years are indicative of the shift from suburb to city. To the east of Ames are the aircraft runways, taxiways and approach zones of Moffett Field.

Land uses south of Bayshore Freeway in the vicinity of Ames are described in the General Plan for Mountain View as high-density residential and limited industrial.[2] The limited industrial classification refers to industries that do not produce noise, smoke, vibration, and odor, and that present a pleasing aesthetic appearance.[3]

Stevens Creek separates, with minor exceptions, the city of Mountain View and unincorporated Santa Clara County lands from land owned by the federal government. In the area bounded by Stevens Creek on the east, Bayshore Freeway on the south, Charleston Slough on the west, and San Francisco Bay on the north (Figure 18) the northern portion is utilized for salt evaporation. These salt ponds are owned by Leslie Salt Company. Before the dikes were built which created the 1,075 acres of salt ponds, this northern area of Mountain View was comprised of marsh, sloughs, and tidal flats. Only small areas of these natural features remain around the perimeter of the diked ponds. The largest of these marshlands is Charleston Slough, which constitutes 170 acres of tidal slough and low salt marsh, currently held under Williamson Act contracts.[4]

At the southern edge of the salt ponds is the 544-acre Shoreline Park. Formerly, this area was used for indiscriminate dumping, junk yards, and marginal industrial purposes. The park will provide in the near future "a means of access to the Bay, a vista of the entire valley, and presently provides valuable conservation services such as flood control, a habitat for migratory birds, and (on an interim basis) a valuable area for solid waste disposal."[4]

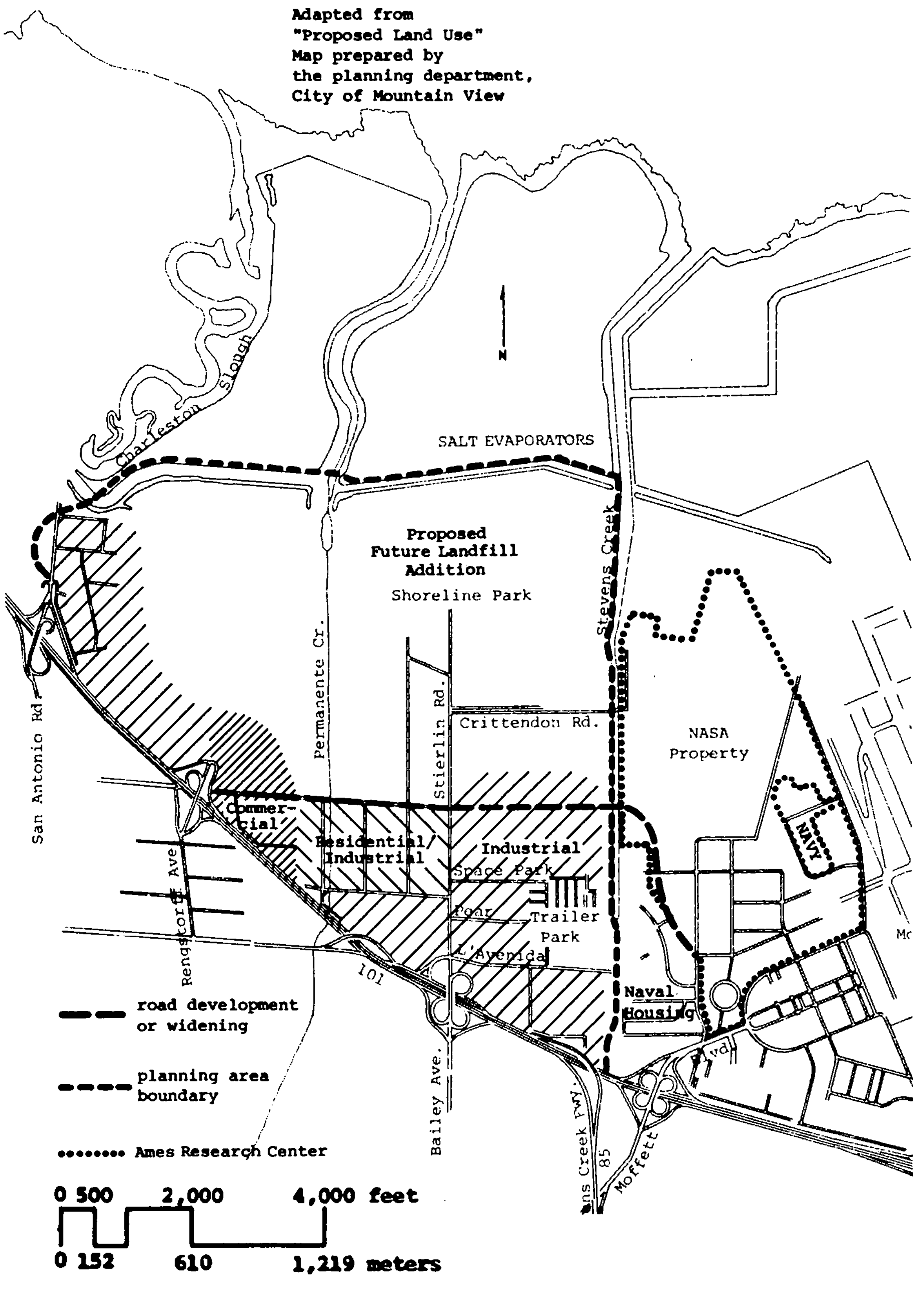

Figure 18. PROPOSED LAND-USE PLAN FOR THE CITY OF MOUNTAIN VIEW'S NORTH BAYSHORE AREA

The 300 acres of land south of Shoreline Park, and approximately north of the 10-foot elevation line, are primarily in agricultural use, with scattered residences and light industry along Stierlin and Charleston Roads. The land south of the 10-foot contour, adjacent to Bayshore Freeway, is in urban use. Directly across Stevens Creek from the Ames/ Moffett Complex are Kaiser Sand and Gravel, the 360-unit Santiago Mobile Home Park, and a nursery/Christmas tree farm. PG&E transmission lines run parallel and adjacent to Stevens Creek. Stevens Creek, between and including the parallel dikes, is subject to easement by the Santa Clara Valley Water District.

Except for lands used by PG&E and scattered private parcels, the land east of Stevens Creek is under the auspices of the U.S. Government. Naval housing, including Moffett Homes, officers' housing, and Orion Park, is located between Ames and Stevens Creek. Land north of this Naval housing and Ames is leased for agricultural use, with a vacant parcel to its north. Private property owned by Leslie Salt Company lies to the north of the undeveloped Ames land. Currently a 54-acre portion of these lands is being acquired from Leslie by the Mid-Peninsula Regional Park District. This parcel (the Stevens Creek Shoreline Acquisition) is immediately north of Ames and is abutted by Stevens Creek on the east and the evaporator ponds on the north. Its intended use is as regional open space dedicated to nature study activities; docent tours for school children are currently being conducted.

The Ames facility, except for a few scattered small facilities (Figure 2), is concentrated in the south-central portion of the Ames/Moffett complex. The facility is characterized by a dense pattern of structures of varied shapes and sizes, and paved areas connected with small landscaped spaces. Access to the Ames plant is controlled by fencing and guarded gates.

4.2 LAND-USE PLANS, POLICIES, AND CONTROLS

The Ames/Moffett complex is located on federal lands subject only to the planning and regulatory control of the federal government. In addition, Ames has been located at the present site since 1940 and thus has been included in the planning of local and regional agencies for some time. The local Mountain View plan does, however, reflect the effect of Ames on the surrounding jurisdictions and is, for this reason, worthy of discussion.

The area of Mountain View north of Highway 101 is referred to in the City's planning documents as the North Bayshore Area. Forty percent (544 acres) of this area is in public ownership and devoted to the City's Shoreline Park. Policy for the use of the remaining 850 acres between the Park and Bayshore Freeway is dictated by environmental constraints and constraints posed by major development on the area's perimeter. The Bayshore Area is of low elevation, with poor drainage, subject to subsidence, and prone to liquefaction in the event of an earthquake.[5] Provision of utilities and a secure residential environment is made difficult by these conditions.

Noise emanating from the freeway, Moffett Field aircraft, and the Ames installations (wind tunnels) is also a major factor[5] influencing plan formulation. Furthermore, the isolation imposed upon the area as a result of the barriers of the freeway, government lands and the Bay significantly affect access. These constraints, together with a number of social, economic, and physical characteristics of the area, preclude intensive development south of Shoreline Park. Residential use particularly was judged to be unsuitable for most of the area.

The Proposed Land Use Plan (Figure 18) anticipates an extension of Charleston Road across Stevens Creek to connect with the realigned spur of Moffett Boulevard adjacent to the Naval housing. While Mountain View planners expressed some concern initially at providing additional access/egress to the Ames/Moffett complex, further study revealed that undue congestion would not occur as a result of the extension, while there would be some alleviation of tie-ups at the Moffett Boulevard interchange at US Route 101.

With the exception of the mobile home park, which is expected to continue in its present location for the foreseeable future, the lands west of Stevens Creek are to be devoted to industrial or open space uses.

In the entire planning area, residential uses are to be confined to the mobile home park and the area on the proposed plan map identified as residential/industrial. Thus residences outside these designated zones will be phased out gradually.

The proposed plan diagram discussed herein reflects the adopted policies of the City. The precise plan which will specify the spatial interpretation of these policies, however, is presently undergoing review.

The General Plan identifies a Stevens Creek Park Chain which would link Shoreline Park with open space areas in the rest of the city. As yet, no implementation scheme has been developed, primarily because of the number of jurisdictions involved. The recent 54-acre Stevens Creek Shoreline Acquisition by the Mid-Peninsula Regional Park District represents an expansion of open space directly across from Shoreline Park. However, both PG&E and the Santa Clara Valley Water District hold easements over the land adjacent to and including Stevens Creek, while Ames lands abut the creek. In addition, the Navy has constructed housing and fenced off yard space up to the creek banks, all but precluding the open space corridor on the east side of the creek.

While not a public planning body, the Navy controls planning for lands contiguous to Ames to the southwest. This land is utilized for housing 441 Naval families. Residents of Orion Park, the housing group closest to the 40 X 80-Foot wind tunnel, have complained of noise and vibration. Orion Park was constructed in 1968, presumably with awareness of these conditions. According to the Commanding Officer, Naval Air Station, Moffett Field, the Navy intends to maintain the housing for the foreseeable future and may even expand in that area in the future should there be a shortage of housing in the local community.

4.3 AIR QUALITY MAINTENANCE PLAN (AQMP)

The San Francisco Bay Area has been designated an Air Quality Maintenance Area by the Environmental Protection Agency. The Air Quality Maintenance Plan is being formulated by the Environmental Management Task Force operating under the auspices of the Association of Bay Area Governments with support from the Air Resource Board, EPA, and the Bay Area Air Pollution Control District (BAAPCD). The goal of the AQMP is to develop a program which will result in the attainment and maintenance of all applicable air quality standards in the San Francisco Bay Area. The Task Force finished its work design to complete the AQMP, but it is still in its formative stages. It will take approximately two years for the Plan to be completed.

Future Ames projects will be reviewed in light of the completed AQMP in order to assure consistency with the State Implementation Plan. The balance between the degree of pollution allowed and health effects on susceptible population and its relation to ARC growth is of concern to Ames personnel. It will become a policy of Ames personnel to closely monitor the AQMP process and to plan future projects accordingly.

4.4 IMPACTS

According to Mr. Ken Alsman, Principal Planner of Mountain View, Ames is generally compatible with the present and planned city and has not been an overriding element in determining land uses in the city's North Bayshore Area. The Stevens Creek corridor is the only area for which plans remain uncertain, contingent upon the cooperation of several public and quasi-public jurisdictions, including Ames. It is the City's hope that these groups will take an interest in effecting the corridor park plan.

5.0

ENVIRONMENTAL IMPACTS OF THE EXISTING FACILITIES

5.0

ENVIRONMENTAL IMPACTS OF THE EXISTING FACILITIES

5.1 SOILS AND GEOLOGY

Operation of the existing facilities at Ames has very little impact on the geologic environment, as no operations involve any significant movement of soil. Maintenance and repair of facilities do involve some soil disturbance, but this is expected to be very minimal. Some soil erosion from these activities could occur, but unless those construction activities occur during the rainy season and excavated material is piled near a storm drain inlet without any protection, the amount of eroded material should be minimal.

Most of the potential geologic hazards at Ames are common to all areas of northern Santa Clara Valley including the area around south San Francisco Bay. As with other sites located on deep, unconsolidated alluvial deposits in the seismically active Bay Area, Ames will be subjected to strong groundshaking during a large magnitude earthquake. However, as was stated in the discussion of geologic hazards earlier, what impact earthquake-shaking will have on Ames is primarily determined by building design. In general, all structures within Ames have been built with the necessary structural integrity to resist the effects of seismic events, in particular those associated with groundshaking (i.e., liquefaction and expansion of soils). As a result, such events have not caused in the past nor are expected to cause in the future any serious limitations with regard to the operation of Ames. The structures most subject to damage during seismic activity are the various pipelines, especially water and sewer mains, that traverse Ames.

Although damage to both existing and proposed structures due to geologic hazards could have a serious financial impact on Ames, it would not in most cases create any additional environmental problems. The only foreseeable problems would arise from the possible rupture of on-site service mains during major seismic events and the loss of their contents (e.g., the spillage of untreated sewage waste). This loss can be effectively minimized through prompt pipeline shutdown and subsequent cleanup and repair.

5.2 ARCHAEOLOGIC AND HISTORIC FEATURES

The operations at Ames generally will have little or no effect upon the historic and archaeologic resources within the Center area. Completion of the security fence around most of the lands along Stevens Creek will, in fact, secure not only the Center but also the areas of highest archaeologic potential.

Continued cultivation of the croplands along Stevens Creek may create some adverse effects upon the archaeologic remains within the surface layer of the soil (upper 1 to 2 feet). However, this activity has existed for about 100 years and most of the damage has already been done.

Within the Center, no operation or maintenance activity requires the excavation of large areas or deep holes, and therefore these Ames activities will not endanger archaeologic remains. However, construction which involves extensive excavation and grading of new facilities certainly has the potential to disturb archaeologic remains. Before further construction and maintenance or operations activities adversely affect remains, a survey by a professional archaeologist should be conducted to determine the historic significance of the sites and designate those of importance. However, a survey to identify these sites will not be conducted until the activities which might disturb these sites are more clearly defined (i.e., an explicit definition of the location and type of construction proposed), thus making it possible to design a cost-effective and highly productive study. As an exception to the above, however, a detailed survey of the Indian kitchen midden now presently designated as Santa Clara 23 was made by a professional archaeologist. The results of this survey (on file at ARC) indicate artifacts will be found only on the surface of the site.

5.3 WATER

a. Hydrological Impacts

The operation of Ames has very little effect on either surface or groundwater hydrology. The existence of the perimeter road/dike and the improvements to the flood protection of Building N-217 impede tidal action to only an extremely limited extent as the existing Leslie Salt evaporator pond dikes, and the SCVWD flood control dikes on Stevens Creek provide the greatest resistance to tidal action. The existence of buildings, roads, parking lots, and other impervious areas has increased the amount of storm runoff during rainfall events. As mentioned earlier (see Sec. 3.3, a.1), some of the storm runoff is combined with that of Moffett Field, but most of it ponds at the northern part of Ames. Because these waters do not naturally discharge into any public waterways, their potential for impact is essentially nil. This fact is particularly important relative to concerns raised about the potential of soil erosion and sedimentation due to future Ames construction. In actuality, the flat topography of the Ames area reduces substantially the probability of soil erosion and the subsequent ponding of runoff waters in the northern portion of the Ames property removes (through settling) most of the solids' loading that does occur. In addition, the use of normal construction procedures would also serve to further minimize the likelihood of soil erosion. Future plans do call for the pumping of stormwaters from a storm drainage pond on the site's northwest corner into Stevens Creek. However, except in extreme flooding events, these waters will be relatively clear and free of suspended sediments due to the expected removal efficiencies of the proposed storm drainage pond. Moreover, considering the limited flushing capacity of the South Bay, such pumpage and the higher flows in Stevens Creek that will result may even have a beneficial effect.

Operation of the Center has little effect on groundwater resources, as the Center withdraws very little groundwater and only prevents surface water infiltration into the upper aquifer, which is not used in this area anyway. Because the aquifers are separated by an impermeable clay layer, the quantity of recharge into the lower, more useful aquifer is not affected by any recharge loss suffered by the upper aquifer.

b. Water Quality Impacts

Ames has little effect on either surface or groundwater quality. Stevens Creek receives no discharges from the facility. South San Francisco Bay receives only minor discharges. As mentioned later, in the sewage section, the wastes from Ames contribute about one-half of 1 percent of the flow into either the Palo Alto or Sunnyvale sewage treatment plants and hence have only an incremental, essentially unnoticeable, effect on south Bay water quality. This impact will be further reduced when planned upgradings at these plants are completed and their discharges are moved northward of Dumbarton Bridge.

The small portions of stormwater and dry-weather runoffs which flow to the storm drains of the U.S. Navy contribute small amounts of pollutants to the Bay. The quality of stormwater runoff from the Center would be similar to that presented in Table 4. The quality of this runoff is poor, containing water quality pollutants released by automobiles, and operation and maintenance activities (such as airplane cleaning) at Ames. Because the magnitude of stormwater runoff loadings is primarily related to the amount of impervious area, the contribution from Ames is small compared with that of the surrounding communities. Ames contributes less than 1 percent of the stormwater pollutant loading discharged into the south Bay by the communities of Palo Alto, Los Altos, Mountain View, and Sunnyvale.

As mentioned in the hydrology section, both winter and summer runoff from Ames are mixed with similar discharges from Moffett Field before being discharged into the Bay. Table 14 lists the quality of summer drainage before and after Moffett Field runoff has been added. This tabulation would seem to indicate that the quality of Ames runoff is considerably higher than the Moffett Field drainage. However, due to the location of the sampling station for the combined runoffs (i.e., the Navy pumping station on the east side of the Moffett Field runway) it is likely that the higher values found in the combined runoffs are primarily a result of saltwater intrusion and not poor quality Moffett Field drainage. In particular, the very high chloride levels present are a good indicator that this second sampling station is contaminated by saltwater. Thus, while it might be expected that the quality of Moffett drainage waters are lower than Ames, it is more likely that the quality difference is not nearly as great as is indicated by the above data. However, even with the probable saltwater intrusion, the waters of this second sampling station, while reasonably poor in quality, have not proved to be even marginally toxic to test fish. For this reason and the fact that Guadalupe Slough water quality is similar, the EPA has determined that the discharge is not significant and requires no regulation.

The sewage and stormwater collection and disposal systems appear to be providing protection for the upper aquifer. An analysis of the quality of nearby wells does not indicate any degradation. Even if an accidental

Table 14

QUALITY OF SUMMER DRAINAGE FROM AMES AND MOFFETT FIELD

Constituent, mg/ℓ unless otherwise indicated	Ames	Moffett Field Plus Ames
Temperature, °C	18	19
pH, pH units	8.6	8.1
Total Dissolved Solids	240	11,108
Suspended Solids	4	10
Grease	3	1.0
BOD	6.2	3.0
COD	22	282[a]
Dissolved Oxygen	10	8
Sulfide	≦ 0.15	≦ 0.15
Total Phosphorus	2.3	0.4
Sulfate	61	738
Chloride	20	5,550
Phenols	≦ 0.02	≦ 0.02
Zinc	≦ 0.5	≦ 0.5
Chromium	≦ 0.05	≦ 0.05
Mercury, μg/ℓ	≦11	≦11

Source: Teledyne Isotopes Quarterly Collection of Storm Drain Samples, arithmetic average of June 26 and October 9, 1975, sampling efforts.

[a] The accuracy of this value is questionable since COD cannot in general be measured accurately in samples containing more than 2000 mg/ℓ chloride.

spill occurred, the impermeable clay layer separating the upper and lower aquifers should provide adequate protection for the more important lower aquifer.

5.4 AIR QUALITY

Ames has a variety of sources which contribute pollutants of various forms and quantities to the atmosphere. There are four major sources of pollutants present: (1) ground traffic; (2) air traffic operations; (3) combustion of fossil fuels for space heating; and (4) other miscellaneous sources, i.e., wind tunnels, arc-jets, and laboratories.

a. Traffic

Traffic impacts associated with Ames are most acute during the morning and evening rush hours. The traffic data used to assess the Center's effect can be found in Sections 3.7 and 5.7. Where peak hourly volumes were unobtainable estimates were made based upon hourly and daily counts on nearby streets.

The methodology employed in air quality analysis of traffic is based upon a recent Information Bulletin published by the Bay Area Air Pollution Control District (BAAPCD) for completing air quality impact analyses.* For traffic-induced impacts, only concentrations of carbon monoxide were calculated, as this pollutant is the primary one associated with vehicular-induced pollutants. Photochemical oxidants, which are secondary pollutants related to automobile traffic, are addressed later.

The roads chosen for analysis were sections of Moffett Boulevard, U.S. 101, and State Route 85 (Figure 19). These are the major routes

* "Guidelines for Air Quality Impact Analysis of Projects," Technical Services Division, BAAPCD, June 1, 1975.

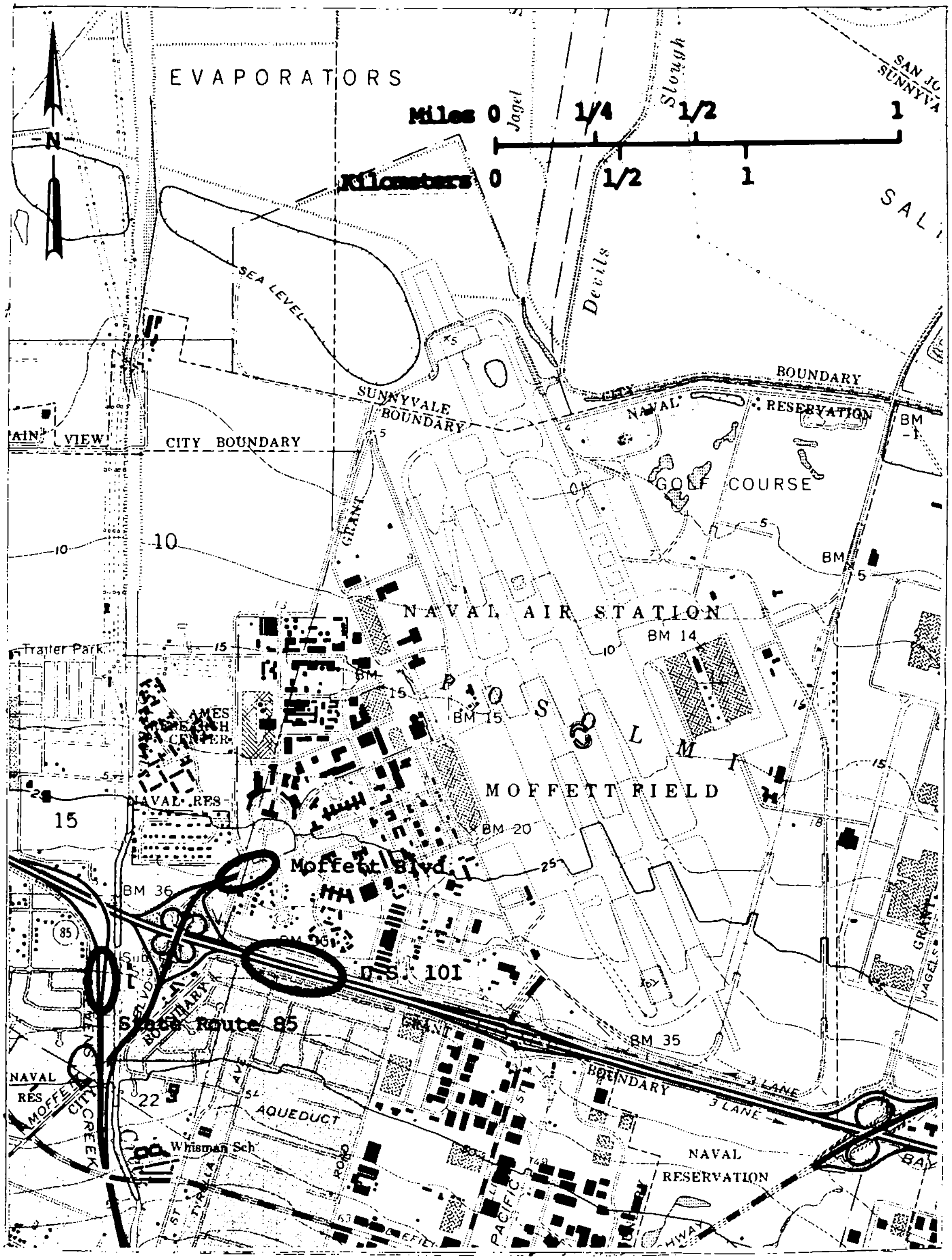

Figure 19. LOCATION OF AIR QUALITY ANALYSES FOR CARBON MONOXIDE

serving Ames and therefore the analysis was limited to these roads. Concentrations were predicted for both 1- and 8-hour periods in order to compare them to State and National Ambient Air Quality Standards. Meteorological conditions associated with each averaging time were a 1-meter per second wind speed and Class E (stable) stability for the 1-hour case and a 2-meter per second wind speed and a Class D (neutral) stability for the 8-hour case.

Because carbon monoxide is a very localized problem with respect to vehicular traffic, concentrations expected to be found within the mixing cell of the road were calculated. The mixing cell is basically an area of intense mixing and turbulence over the surface of the road caused by the motion of vehicles. Concentrations were also calculated at a distance of 50 meters normal to the road to illustrate impacts on any receptors at that distance.

The year 1975 was used as the base year for evaluation. Vehicle emission factors used (shown in Table 15) were those derived by the BAAPCD for the assumed model year mix in the San Francisco Bay and the 7-mode California Driving Cycle. Adjustments for vehicle speed at the appropriate averaging times have also been made. An average vehicle speed of 10 miles per hour (mph) is assumed to occur during peak-hour conditions and 55 mph during average-hour traffic for both U.S. 101 and State Route 85. For Moffett Boulevard, the average speed was assumed to be 25 mph; the peak-hour average speed was assumed to be 10 mph.

The results of the traffic analysis are shown in Table 16. As is clearly indicated, Ames contributes up to 15 percent of the maximum expected concentrations along the specified routes. The largest proportionate contribution is, as expected, along Moffett Boulevard. The only location where air quality standards for carbon monoxide are exceeded is along U.S. 101 where Ames contributes about 10 percent to the maximum.

The 1-hour standard is exceeded here during rush-hour traffic. This was determined assuming "worst-case" meteorological conditions of a one meter per second wind speed, class E (stable) stability and a 10 mph average traffic speed. The most sensitive receptors to the effects of the traffic generated by Ames are residences along Highway 101 just west of Highway 85 and south of 101. The prevailing winds (NW, NNW) make this area the most susceptible during the conditions described. At the other locations modeled, no standards were exceeded for either the 1- or 8-hour averaging times.

Table 15

VEHICLE EMISSION FACTORS APPLICABLE IN THE BAY AREA, 1975

AVERAGE VEHICLE SPEED (mph)	POLLUTANT (grams/mile)				
	CO	HC	NO_x	SO_x	PARTICULATES
55	15.5	2.6	5.7	0.18	0.42
25	28.9	4.3	4.3	0.18	0.42
10	54.2	7.7	3.7	0.18	0.42

Source: Bay Area Air Pollution Control District, "Guidelines For Air Quality Impact Analysis of Projects," June 1975.

Table 16

CARBON MONOXIDE CONCENTRATION (PPM) DUE TO
TRAFFIC FOR SELECTED ROUTES

ROUTE	1-HOUR MAXIMUM M.C.***	1-HOUR MAXIMUM 50 METERS	8-HOUR MAXIMUM M.C.	8-HOUR MAXIMUM 50 METERS
Moffett Boulevard				
Existing Traffic*	22	9	1	< 1
NASA-ARC	4	2	1	< 1
	26	11	2	< 1
U.S. 101				
Existing Traffic*	45	19	5	2
NASA-ARC	4	2	< 1	< 1
	49**	21	5	2
State Route 85				
Existing Traffic*	13	5	2	1
NASA-ARC	2	1	< 1	< 1
	15	6	2	1

* Exclusive of that from NASA-ARC

** 1-hour standard (40 ppm) exceeded

*** Mixing cell

Source: URS Research Company

A number of measures have been instituted at Ames to reduce traffic-induced pollution. These include computerized carpools, instituting bus lines, providing for flexible and staggered working hours, and aiding in the formation of a bicycle club.

In February, 1974, a computerized carpool system was organized areawide as part of the Bay Area Commuters Program in which ARC participates. Employees were given information about and encouraged to participate in the carpool system. Ames personnel are participating in the development of the new program which is currently still in progress. Plans are to have it expanded and improved in Santa Clara County.

The Santa Clara County Transit District currently operates two bus lines to Ames (see the Transportation Section). One line starts from the Westgate Shopping Center and proceeds through Cupertino to ARC. Another line begins in the East Bay at Milpitas and serves ARC. Both lines are run by subscription.

Staggered working hours are currently in effect and have been so for some time. They were instituted in order to alleviate traffic congestion at the Moffett Boulevard intersection with U.S. 101. Supervisors have been instructed by management to allow employees flexibility in their work schedules in order to accommodate carpools and facilitate ingress to and egress from the facility.

A bicycle club has been formed which included participation by Ames management. However, the employees worked directly with the City of Mountain View in planning and completing a bike system for employee use. An alternative bikeway plan is also being developed with Mountain View which would allow crossing of the Bayshore Freeway at the Stierlin overpass. In order to utilize this alternative solely, Ames is negotiating for the construction of a pedestrian/bike bridge across Stevens Creek prior to the construction of the proposed Charleston vehicular bridge.

The bussing of employees from nearby Southern Pacific railroad stations to ARC has also been considered but the proposal was dropped due to federal restrictions on transportation of employees. A similar bus pool was cancelled for the same reason.

b. Area Sources

The impact of all area sources was determined using the methodology outlined in the BAAPCD document referenced earlier. Basically, the emissions from aircraft operations, space heating, and other miscellaneous sources were determined from data supplied by Ames personnel and emission factors obtained from EPA Document AP-42.* Emissions were distributed evenly throughout the averaging periods. No point source evaluation was completed.

The model used in the BAAPCD document for area sources combines pollutants generated by traffic, and all other ground level sources. Estimates of an annual concentration are averaged over a one-square-kilometer grid. From the spatially averaged values, an annual maximum concentration is calculated based upon the standard geometric deviation of historic monitoring data in the Bay Area. Additionally, a regional impact estimation is produced which represents the pollutants once they have become thoroughly mixed, both vertically and horizontally, after traveling a considerable distance downwind (an estimate of background contributions). The downwind distance is assumed to be 10 kilometers

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* "Compilation of Air Pollutant Emission Factors," Environmental Protection Agency, Document AP-42, Supplements 1-5.

under meteorological conditions consisting of a 300 meter mixing height and a 2 meter per second wind speed. The calculation assumes a one-hour averaging time.

1. Aircraft Operations

Aircraft operations at Moffett Field attributable to Ames include those of research, support, and visiting aircraft. Records indicate that there are about 1,700 flights per year associated with Ames activities. As this number is relatively small, the impacts associated with the aircraft activities are included in an area source analysis. Burning of aircraft fuels produces varying quantities of all primary pollutants depending on engine size and design. Ames is responsible for about 6.5 percent of all aircraft operations at Moffett Field. Most flights at Ames are made by Lear jets and U-2 aircraft.

2. Space Heating

Space heating and process steam generation consumed about 360 million cubic feet of natural gas in 1974. As there are 44 boilers of relatively small magnitude, this source was also included in the area source analysis. The primary pollutant that is released during combustion is NO_x (primarily NO which is rapidly oxidized to NO_2). Because natural gas is such a clean-burning gas, only very small quantities of other pollutants are released to the atmosphere.

3. Other Sources

There are a variety of other small sources of air pollutants at Ames. These include the wind tunnels, arc-jets, pebble-bed heaters, and incinerator, and chemical vapors vented through hoods located over laboratory work benches.

The present 40 X 80-Ft Wind Tunnel contributes small amounts of various pollutants to the air from the testing of models with their jet engines running. Because a variety of engines are tested, the emission rates vary considerably from test to test.

Jet fuel usage at the tunnel is currently 40,000 gallons annually. This quantity (40,000 gallons) is relatively insignificant when compared to the 79,000 gallon per day usage of Moffett Field.

The arc-jets emit primarily oxides of nitrogen (NO_x) during operation. The Space Shuttle Program has caused the operating schedule of the jets to be increased and consequently has increased the emission of NO_x. However, controls in the form of large vacuum-holding spheres and a liquid-gas scrubbing tower have been instituted. Therefore, this source is no longer considered to be significant.

The incinerator at the Center has a rated capacity of 4.8 million BTU/hr and handles approximately 500 pounds of biomedical wastes every 2 weeks. The incinerator is equipped with an emission control device for particulates.

Anticipated annual maximum concentrations of NO_x, HC, CO, SO_2 and particulates are shown in Table 17 using the BAAPCD Guidelines described earlier. These values represent the effects of all emission sources at the Center, including related auto traffic. Data regarding fuel usage by aircraft, space heating, and other sources have been presented above. Emission factors were derived from EPA Document AP-42. The maximum location for emissions from these sources is just outside of one square kilometer grid embracing the Ames Research Center. The area most potentially affected would be those residences adjacent to Highway 101 or south-east of the ARC. Table 17 also includes the average background

Table 17

ANNUAL MAXIMUM CONCENTRATION (μg/m³) OF EMISSION FACTORS AT THE FACILITY BOUNDARY

POLLUTANT SOURCE	EMISSION FACTORS: CARBON MONOXIDE		HYDROCARBONS	NITROGEN OXIDES		SULFUL OXIDES			PARTICULATES	
	1-HR	8-HR	3-HR	1-HR	ANN. AVG.	3-HR	24-HR	ANN. AVG.	24-HR	ANN. AVG.
Ames	1,370	840	150	600	55	13	8	3	17	5
Background	1,600	1,600	—[a]	37	37	10	10	10	35	35
Total	2,973	2,440	150	637[b]	92	23	18	13	52	40

Source: URS Research Company

[a] No monitoring data available to determine background.

[b] Exceeds Standard.

levels as determined from Redwood City monitoring data. The annual average background on regional impact of ARC is shown in Table 18. As the table illustrates, once the pollutants become completely mixed, the effect of the ARC on air quality is not very significant.

The one-hour NO_2 concentration is calculated to currently exceed the standard near the site boundary. However, NO_2 is a relatively reactive species which takes part in the formation of photochemical smog, and its concentration is therefore difficult to predict with accuracy. Additionally, most oxides of nitrogen (NO_x) are emitted in the nitrous oxide form (NO) and then converted to NO_2. Therefore, the one-hour NO_2 value shown (Table 16) is a very conservative estimate based upon its mixing characteristics and the fact that no standard exceedances were recorded at Redwood City or Sunnyvale during 1975.

In contrast, the carbon monoxide exceedances predicted along Highway 101 are fairly accurate since CO is quite unreactive. Drivers on the freeway and the people residing in the buildings adjacent to the freeway are the most sensitive receptors and are affected most acutely during rush hour traffic and when meteorological conditions are stagnant.

In addition to the primary pollutant analysis, an analysis of the relative contribution of Ames to photochemical oxidant formation in the Bay Area was made. This was done by comparing the amount of reactive hydrocarbon emissions from Santa Clara County. This comparison is made by assuming there is a proportionate correlation between reactive hydrocarbon emissions and photochemical oxidant levels. Using this assumption, Ames contributes about 0.02 percent to the photochemical oxidant concentration in Santa Clara County.

Table 19 presents total annual emissions of pollutants from Ames using the assumptions and methodology described above. In summary, Ames is a contributor to current oxidant and carbon monoxide standard exceedances

Table 18

REGIONAL AIR QUALITY IMPACT OF AMES RESEARCH CENTER

POLLUTANT SOURCE	AIR QUALITY PARAMETERS ($\mu g/m^3$)			
	CARBON MONOXIDE	NITROGEN OXIDES (as NO_2)	SULFUR OXIDES (as SO_2)	PARTICULATES
Ames	190	54	2	5
Other Background Sources	1,600	37	10	35
	1,790	91	12	40

Source: URS Research Company

Table 19

ANNUAL POLLUTANT EMISSIONS FROM AMES AND SANTA CLARA COUNTY (TONS/YEAR)

AIR POLLUTANT	AMES[1]	SANTA CLARA COUNTY[2]
Carbon Monoxide	132	361,350
Nitrogen Oxides	38	62,050
Sulfur Oxides	2	3,285
Particulates	4	9,490
Total Hydrocarbons	19	102,200

1 - URS Research Company

2 - BAAPCD Emission Source Inventory, 1975

in the vicinity of the facility. The approximate contribution to the peak oxidant concentration is .02 percent and to maximum CO concentration along Highway 101 it is 10 percent. The one-hour nitrogen dioxide standard is calculated as being exceeded at the boundary of the Ames facility due mainly to the high temperature combustion of fossil fuels. However, oxides of nitrogen are quite reactive and the predicted maximum is overly conservative. No NO_2 standard exceedances have been recorded at the closest monitoring stations.

5.5 BIOTIC RESOURCES

The operation of Ames has had the same general adverse impact upon the biota as any other structured or intensive land use has. The resulting and future biotic resources will generally consist of those species which are tolerant of or are encouraged by urban activity. However, the large, low-intensity land uses in the western and northern areas of the Center should continue to support a large and diverse biota of native and introduced plants and animals. In general, existing operations will be continued, although future plans include a new security and perimeter road system.

The adverse effects of continuing operations at Ames are caused primarily by cultivation and weed control in the area of the cultivated fields, disturbances from runway activity, the noise from wind tunnel and aircraft operations, and the occasional filling of the marsh area as a means of disposal of debris and dirt. It should be noted, however, that this filling of the marsh, which occurs adjacent to the soil moisture test area and in and around buildings, N-217 and N-217A, will in the future not be expanded outside its present boundaries. The majority of this fill material originates from basement and foundation excavations in other portions of Ames. As attested by the discussion of existing biotic resources, the area still retains a significant biota. However, without the weed and grass control in the non-ornamental lawn and garden areas, they would rapidly return to an oldfield habitat with substantial increases in the number of plants and wildlife.

Existing and projected noise and activity may disturb the more sensitive birds, although the continuous, constant-pitch sounds from wind tunnel operations are not disturbing (in the absence of other disturbances, mainly people) to many birds. The total effect of long-term exposure is not completely known, but the disturbing effects of noise from the continuing operations at Ames have probably reduced the diversity and productivity among birds from 1 to 10 percent. Other animals have been protected by their habitat or low-ground dwelling habits.

The biota in the northwestern sector of the Center should incur long-term beneficial effects from the operation of the security fencing along the western and northern perimeter of Ames. Such fencing will restrict dogs and inhibit cats from foraging in the oldfield habitat and the small pickleweed marsh at the northern end of the cultivated fields. This will also reduce the illegal hunting for pheasant and other animals which occurs in the northwestern sector of Ames. Hawks and falcons will use the fence posts as vantage points to view the oldfield area while hunting. This will benefit the hawks to the detriment of rodents and small birds.

In summary, the existing and newly authorized additions to Ames will actually improve the biotic resources.

5.6 NOISE

The effects of the noise environment derived from activities at the Ames Research Center result from both on-site and off-site noise sources. The latter category of noise sources will be addressed first in the following discussion and on-site sources discussed subsequently.

a. Off-Site Sources

These sources consist of aircraft operations and vehicular traffic. Ames has nine research aircraft which utilize Moffett Field Naval Air Station (MFNAS); a variety of support and transient aircraft associated with Ames also use MFNAS.

MFNAS has approximately 50,000 flight operations a year, about 98 percent of which occur during daylight hours. Less than 7 percent of the annual operations, approximately 3,500 flights, is attributable to Ames aircraft (some of which are the nosiest on the field). Although aircraft operations at MFNAS are a significant source of community complaints,[19] the airfield probably has a lower number of complaints than similar airports in other metropolitan areas due to the type of aircraft operating from the base. The overall contribution of Ames aircraft to community irritation, however, is very low.

Vehicular traffic consists of employees, contractor personnel, vendors, and visitors traveling to and from Ames.* The vast majority of these trips go through Gate 18 on Moffett Boulevard. Aside from Moffett Boulevard, the major arterials which carry this traffic are U.S. 101 and State Route 85.

Roadside noise levels are a logarithmic function of traffic volume and speed. Consequently a 25 percent change in traffic volume results in a 1-dB change in roadside noise levels. The number of trips generated by ARC is about 8,000 per day. The daily volume on Bayshore Freeway varies from 83,000 (south of SR 85) to 120,000 (north of SR 85). The daily volume on SR 85 is 36,000-45,000 and the daily volume on Moffett Boulevard west of SR 85 (where impacts may occur) is 15,000 vehicles per day. That portion

*See Transportation Section for a comprehensive discussion of transportation system, and traffic patterns and volumes.

of total traffic on each of these three roadways originating or going to ARC is less than 10 percent. Therefore, ARC traffic does not significantly contribute to the roadside noise environments.

b. On-Site Noise Sources

Historically, the wind tunnels at Ames have occasioned complaints from residential communities. From what information and data are available, these complaints generally occur during the relatively quiet, early and late evening hours when some of the more powerful tunnels are operated to take advantage of off-peak electrical power rates available after 10:00 p.m.* During evening hours, with low winds, a clear sky, and a positive temperature gradient (temperature inversion), the sound waves generated by some of the wind tunnels may be refracted toward the ground over relatively long distances. The determination of these noise levels and their possible effects on evening noise levels in distant residential communities cannot be determined.

The City of Mountain View, in its Sound Element of the General Plan, sets no absolute standards but recommends guidelines for environmental review.[27] The Sound Element suggests that an area is severely impacted by noise when it sustains levels beyond 65 dBA. The only areas which can be clearly identified as being so affected by the activities in and around ARC and Moffett Field Naval Air Station are the Naval dependant housing area and other isolated residences west of ARC and north of U.S. 101. However, these residential uses were established after ARC had established itself as a source of noise-related activity. Further, the proximity of Moffett Field and U.S. 101 make it hard to distinguish a specific source.

*The number of noise complaints due to ARC operations, received when the tunnels are operating, have averaged about six per year from 1971 to 1977. Additional complaints have been received, especially more recently since ARC has been actively encouraging public response; however, these have been non-specific as to either the location of the caller or the source of noise generating the complaint.

Existing literature was reviewed, and NASA and Navy personnel were interviewed to identify those ARC facilities which may be sources of noise and may cause noise impacts outside of ARC boundaries.[17,18,20-22] Facilities so identified are listed in Table 20. An indication of the extent of available noise data for each facility is given. Very extensive data and analysis are available for the 40 X 80-Foot Wind Tunnel, but data are minimal or very limited on most others. Thus, in the ensuing discussion of noise impact, the 40 X 80 facility is the only one for which noise contours can be drawn. The 2 X 2-Foot Transonic Wind Tunnel was eliminated from consideration because of low power level, and because it is surrounded by the 40 X 80-Foot Wind Tunnel structure which provides effective acoustic shielding.

Using Leq/Ldn noise descriptor parameters approved by the Environmental Protection Agency, Table 21 shows the approximate levels associated with major ARC facilities. Leq (noise level equivalent) is a decibel (dBA) measure which averages emissions over a 24-hour period. Ldn (noise level equivalent-day/night) averages emissions over a 24-hour period but weighs those night emissions more heavily than those occurring during the day.

The relative significance of different Ldn levels for residential, hospital, and educational activity is shown in Appendix A-4.

Table 20

IDENTIFICATION AND DELINEATION OF ARC FACILITIES

WITH POTENTIAL OFF-SITE IMPACTS

NAME	I.D. NO.[1]	NOISE INFORMATION	POTENTIAL FOR OFF-SITE IMPACTS
12 Foot Pressure Wind Tunnel	N-206	Minimal	Possible
7 X 10-Foot Wind Tunnel No. 1	N-215	None	No
7 X 10-Foot Wind Tunnel No. 2	N-216	None	No
14 Foot Transonic Wind Tunnel	N-218	None	Possible
40 X 80-Foot Wind Tunnel	N-221	Extensive	Yes
2 X 2-Foot Transonic Wind Tunnel	N-222	None	No
6 X 6-Foot Supersonic Wind Tunnel	N-226	Minimal	Possible
11 Foot Transonic Wind Tunnel[2]	N-227A	Appreciable	Possible
9 X 7-Foot Supersonic Wind Tunnel[2]	N-227B	Appreciable	Possible
8 X 7-Foot Supersonic Wind Tunnel[2]	N-227C	Minimal	Possible
3.5 Foot Hypersonic Wind Tunnel	N-229	None	Possible
Static Test Stand (Rotary and Fixed Wing)	N-249	Limited	Yes

1 - Facility Identification Number. See Figure 2 for location.

2 - These three facilities are part of the Unitary System. Four motors drive either a 3-stage compressor for the 11 Foot Transonic Wind Tunnel or an 11-stage compressor for the 8 X 7- or 9 X 7-Foot Supersonic Wind Tunnels.

Table 21

APPROXIMATE NOISE LEVELS FROM VARIOUS WIND TUNNELS AT THE AMES RESEARCH CENTER

WIND TUNNEL	AVERAGE DAYTIME OPERATING HOURS	AVERAGE NIGHT-TIME OPERATING	APPROXIMATE NOISE LEVELS* dBA	
			Leq(24)	(Ldn)
6 x 6 Foot	0.58	0.50	60	61
8 x 7 Foot	0.10	0.08	58	58
9 x 7 Foot	0.17	0.25	59	59
11 Foot	2.97	1.25	66	67
12 Foot	1.63	0.50	63	63
14 Foot	0.70	0.95	62	63
40 x 80 Foot	2.00	2.00	61	63
2 Foot	-	-	Insignificant	
3.5 Foot	0.05	0.05	Insignificant	

* Assuminq a baseline noise level of 56 dBA and 100 foot distance from wind tunnel

Each of the remaining facilities listed in Table 20 is discussed individually below. When data are limited or non-existent, noise levels are inferred from other tunnel data, and attenuation with distance is expected to follow the relationship:

$$\text{Attenuation (dB)} - 20 \log \left(\frac{\text{Distance of interest}}{\text{Distance at which Noise Level is known}} \right)$$

Allowance is made when appropriate for shielding provided by intervening buildings and structures (10-15 dB excess attenuation), and atmospheric absorption (2 dB per 1,000 feet for distances greater than 1,000 feet).

1. <u>12-Foot Pressure Wind Tunnel</u>

Airflow in this tunnel is produced by a 2-stage, axial-flow variable-speed fan. Operation of the tunnel results in pressurization which is relieved at the end of the test cycle through a blow-off valve. A peak noise level of 113 dBA was recorded at the northwest corner of the facility during a special and very atypical test series conducted many years ago. This facility operates during afternoon hours. More typical noise levels of about 100 dBA are anticipated. A 100-dBA peak noise level has been measured during blow-off. The noise level from blow-off is transient, lasting a few minutes until pressure is relieved in the tunnel. The blow-off has been equipped with a muffler.

The closest off-site noise-sensitive areas are Naval housing to the west, southwest, and south of the 12-Foot Wind Tunnel. Distances vary from 1,300 to 1,700 feet with intervening structures. Noise levels in these areas from the 12-Foot Wind Tunnel are therefore likely to range from 60 to 65 dBA which is sufficient to cause disturbance and annoyance.*

Noise levels at greater distances such as the residential areas south of Bayshore Freeway are extremely difficult to predict. The sound spectrum of the 12-Foot Wind Tunnel is dominated by frequencies in the 1,000 to 2,000 Hz bands. These frequencies are significantly higher than the 500 Hz frequency-dominated background or ambient noise environments produced primarily by vehicular traffic in typical urban settings. Therefore, it is possible that when the 12-Foot Wind Tunnel is operating at maximum power, the noise may be audible in residential areas south of Bayshore Freeway. Meteorological conditions, e.g., wind conditions and thermal gradients, could occasionally magnify this effect.

2. 14-Foot Transonic Wind Tunnel

Airflow in this tunnel is produced by a 3-stage, axial-flow compressor. No noise data have been obtained during operation of this facility. The facility for which noise data are available that comes closest to the operating characteristics of the 14-Foot Transonic Wind Tunnel is the 11-Foot Transonic Wind Tunnel of the Unitary system of wind tunnels. Only noise data obtained prior to the placement of an acoustical enclosure around the 11-Foot Transonic Wind Tunnel are applicable. Noise data from a range of operating conditions taken about 100 feet from the facility indicate noise levels of from 95 to 105 dBA would be an appropriate assumption for the 14-Foot Transonic Wind Tunnel. This facility is located such that Naval housing to the west is effectively shielded by the 40 X 80-Foot Wind Tunnel, but the 14-Foot Transonic Wind Tunnel is probably audible during quiet evening hours. For the remainder of the Naval housing generally south and southwest of the 14-Foot Transonic Wind Tunnel, the closest residences may experience noise levels of 55 to 65 dBA which is sufficiently high to dominate ambient evening noise levels in the area. Some annoyance and a few complaints are possible but not probable.

Under infrequent meteorological conditions, noise from the 14-Foot Transonic Wind Tunnel may be audible during evening hours in residential areas south of Bayshore Freeway.

3. <u>40 X 80-Foot Wind Tunnel</u>

Airflow in this facility is produced by six 1-stage variable-speed fans.

The somewhat infrequent complaints attributed to the 40 X 80-Foot Wind Tunnel are primarily associated with noise from nighttime testing and vibration (the tunnel operates with two 8-hour shifts ending at midnight). Most of these complaints come from the Naval housing residents. The noise generated by this tunnel is predominately low frequency centered at 31.5 Hz and 63 Hz.

The facility operates about 208 days a year. This is based upon 52 5-day work weeks less allowance for holidays, with an average test cycle of 12 work days, two of which are downtime. From Table 22, the facility operates 1,394.22 hours per year,[23] or an average of 6.63 hours per test day. On an annual basis, 11 percent of the operational time the facility is operating with maximum speed in the test section and generates the noise levels shown in Figure 20.[16, 22] The noise levels in the Naval housing to the west and southwest of the tunnel vary from 60 to 80 dBA when the tunnel is operating at maximum speed. Compared to the 56 dBA annual ambient attributable to all other noise sources, the tunnel noise levels are from 4 to 24 dBA higher and clearly dominate the noise environment when the tunnel is operating at top speed (11 percent of the operating time). When the full range of tunnel speeds is considered, tunnel noise equals or exceeds the normal ambient in the southernmost portions of the Naval housing area about 30 percent of the time the tunnel is operating. The percentage is about 60 percent for that portion of the Naval housing closest to the tunnel. A similar result is obtained for Ames facilities north and south

Table 22

UTILIZATION OF 40 X 80-FOOT WIND TUNNEL

TEST SECTION SPEED RANGES KNOTS	RUNNING TIMES IN 40 X 80 TEST SECTION HOURS/YEAR
0-30	77.45
30-40	77.45
40-50	77.45
50-60	77.45
60-70	77.45
70-80	77.45
80-90	77.45
90-100	77.45
100-110	77.45
110-120	77.45
120-140	154.93
140-160	154.93
160-180	154.93
180-200	154.93
TOTAL	1,394.22

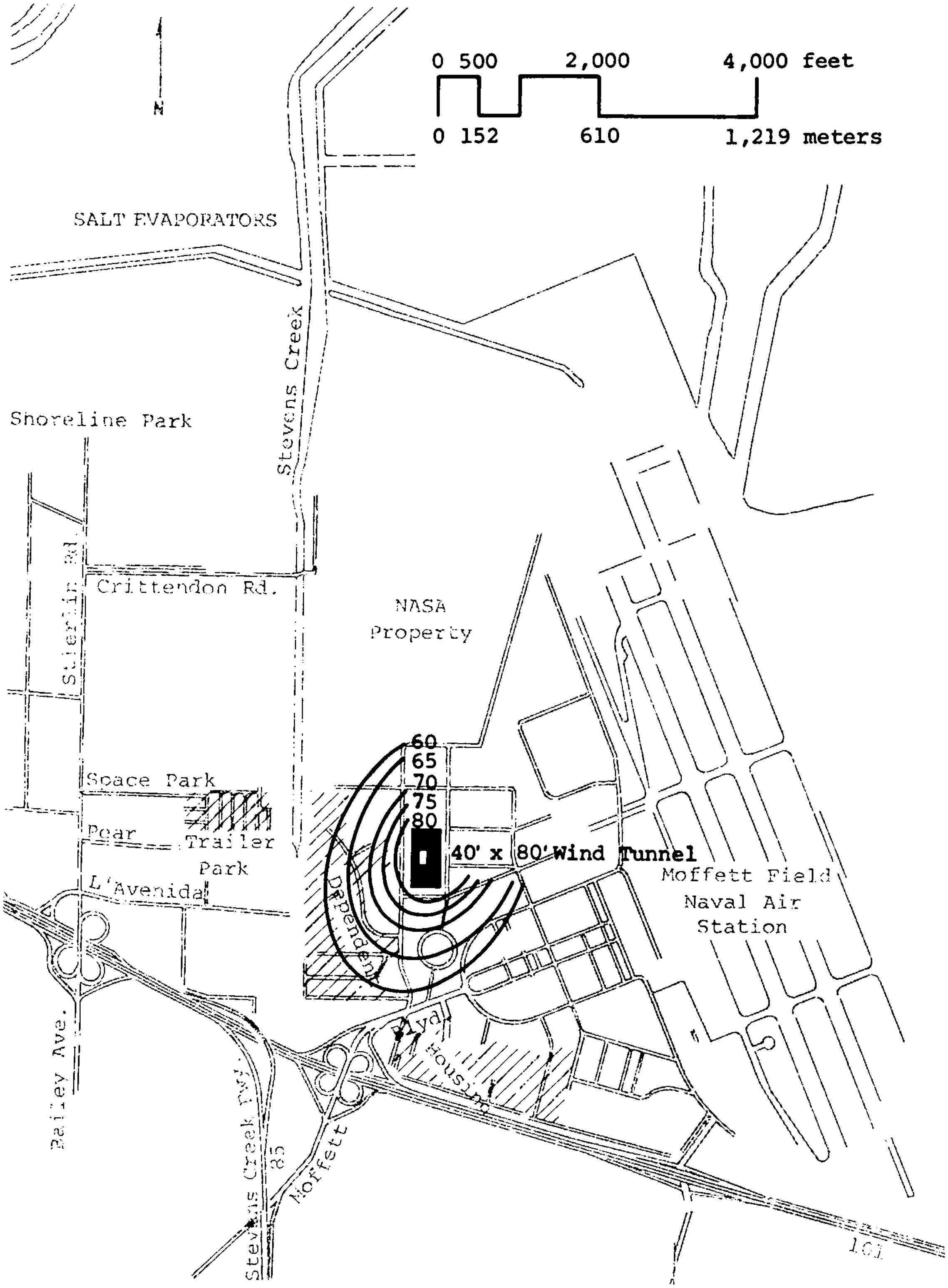

Figure 20. PEAK NOISE LEVELS FOR 40 x 80-FOOT WIND TUNNEL, dBA

of the tunnel. ARC facilities to the east have noise levels equal to or greater than the ambient about 40 percent of the time the tunnel is operating because the ambient in this area is somewhat higher.

Full-scale aircraft models with engines running are occasionally tested in the 40 X 80-Foot Wind Tunnel. In some cases these models generate more noise than the tunnel itself and thus cause higher noise levels than shown in Figure 20. An estimate of model noise levels frequency of occurrence is given in Reference 24. These estimates indicate noise levels from models would be as much as 10 dBA higher than shown in Figure 20. Model noise will exceed the levels shown in Figure 20 by 10 dBA, 15 to 20 percent of total tunnel running time during the year. These higher noise levels, plus recognition that aircraft engine noise has higher dominant frequencies, would magnify the impacts previously discussed. In addition, the ambient noise level in the Trailer Park would be dominated by tunnel noise, and portions of Naval housing south of ARC would experience a similar effect.

The second factor that causes complaints from residents close to the 40 X 80-Foot Wind Tunnel is low frequency vibrations. Of particular concern, reported by some Moffett Field officials,* are wooden and metal sash windows and sliding glass doors which vibrate loose. These, in turn, generate their own noise within the dwellings.

The average total running time of the 40 X 80-Foot Wind Tunnel is slightly in excess of 6-1/2 hours per test day; 2-1/2 hours of this time occur during the startup and shut-down operations. During this time, the

*Separate reports were received in telephone conversations with the base public works and housing office.

wind tunnel noise level is changing gradually, which tends to minimize the startle reaction created by sudden noisy events.

In other areas not previously discussed, tunnel noise does not dominate the noise environment, but does contribute and is occasionally audible. Tunnel noise should not be audible south of Bayshore Freeway except at night and when unusual meteorological conditions promote the transmission of sound waves, and/or on those occasions when powered aircraft models are tested. Under those conditions, occasional annoyance is possible.

4. 6 X 6-Foot Supersonic Wind Tunnel

Airflow in this facility is produced by an 8-stage, axial-flow compressor. The only noise data available were obtained during an ambient noise level survey of off-site locations when the 6 X 6-Foot Supersonic Wind Tunnel was operating.* The data were obtained about 10:00 p.m. on Crittenden Lane (approximately 4,000 feet northwest of the 6 X 6-Foot Tunnel), and on Space Park Way (approximately 3,000 feet west). No change in the ambient noise levels at these locations is discernible from the limited data available. This would imply a noise level 100 feet from the source of 90 to 95 dBA which is reasonable for this facility. Naval housing is located within approximately 2,000 feet of the 6 X 6-Foot Supersonic Wind Tunnel which would indicate that evening ambient noise levels may be somewhat elevated but not sufficiently to cause significant disturbance. Noise from this facility would not be audible in residential areas south of Bayshore Freeway.

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* The 3.5-Foot Hypersonic Wind Tunnel was also operating, but at much lower power levels.

5. 11-Foot Transonic Wind Tunnel

Airflow in this facility is produced by a 3-stage, axial-flow compressor. This facility operates on the average of 35 hours a week between noon and midnight. If maximum power is required for a particular test requirement, that test will be conducted after 10:00 p.m. to minimize electricity costs. This facility has in the past generated complaints from as far as 4 miles away, depending on weather conditions. Both frequency of noise generated (500 Hz tone) and intensity (about 105 to 110 dBA at the source depending on tunnel operating conditions) were significant factors in the complaints.*[25] To reduce the noise, Ames has installed an acoustic enclosure around the tunnel. This barrier has reduced the noise output in the community. Analysis of data obtained before and after enclosure in an acoustical shield, and reported in Reference 21, indicates the following:

- The effectiveness of the acoustical barrier appears to depend on tunnel operating conditions. At low power settings and low air velocities in the test section, a 10-dBA reduction occurs.** At nearly maximum power levels and air velocities, about an 18-dBA reduction occurs.
- At distances of 2,500 feet, and nearly maximum operating conditions, tunnel-generated noise levels are about equal to normal ambient noise levels.

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* Generally, people are more annoyed by high frequencies than low frequencies; however, in this case the 500-Hz frequency dominates the noise spectrum and is attenuated less than higher frequencies over large distances.

** For the sound frequency spectrum of this facility, the dBA noise level is nearly equal to the Sound Power Level in decibels of the 500-Hz frequency band.

Blowdown on the 11-Foot Transonic Tunnel was equipped with a muffler at the same time the acoustic enclosure was constructed. Measurements indicate that about a 27-dBA reduction to a peak of 92 dBA was accomplished.[26] This peak noise level diminishes to ambient on the order of five minutes or less as pressure is relieved.

The noise levels from the 11-Foot Transonic Wind Tunnel are expected to make an audible contribution to the evening ambients of the Naval housing areas, but are not expected to be audible in residential areas of south Bayshore Freeway except under very extreme meteorological conditions.

6. 9 X 7-Foot Supersonic Wind Tunnel

Airflow in this facility is produced by an 11-stage, axial-flow compressor. This facility operates infrequently, but fairly extensive data are available.[18] Data obtained at various close-in locations on the perimeter of the facility range from a low of 85 dBA to a high of 122 dBA with an average of 110 dBA. The sound spectrum peaks in the 500-Hz frequency band. No noise measurements were obtained during blowdown, but a peak noise level of 115 to 120 dBA seems appropriate.

Noise measurements were also made off-site at distances ranging from 2,300 feet to 11,000 feet from the operating facility. Analysis of these data indicates:

- At 2,300 feet southwest (Naval housing area) a noise level of 71.5 dBA was measured and the frequency spectrum clearly indicates dominance by sound from the 9 X 7-Foot Supersonic Wind Tunnel.
- Sound spectrum data from measurements 4,000 feet southeast indicate a tunnel contributing to the 56-dBA noise level, but data from measurements 4,500 feet west show no such contribution to a 49-dBA noise level.
- Data from measurements at greater distances show no clear evidence of tunnel noise.

From the foregoing, it is apparent that the Naval housing to the southwest of the 9 X 7-Foot Supersonic Wind Tunnel experiences some disturbance and annoyance when the tunnel is operating. However, the Naval housing to the south, while receiving an audible contribution to the normal ambient, would not likely be disturbed. These differences in impact are explained partly by the greater distance to the southern Naval housing area, and partly by the greater number of intervening structures which interrupt sound propagating in that direction. There is a significant probability that noise from the 9 X 7-Foot Supersonic Wind Tunnel would be audible in residential areas to the south of Bayshore Freeway under adverse meteorological conditions.

7. 8 X 7-Foot Supersonic Wind Tunnel

Airflow in this facility is produced by an 11-stage, axial-flow compressor. Noise measurements taken in the immediate vicinity of this facility have recorded noise levels of from 99 to 117 dBA (average is 110 dBA) with sound power levels in the 250-Hz and 500-Hz frequency bands dominating. This facility uses the same motors and compressor used by the 9 X 7-Foot Supersonic Wind Tunnel. This facility operates infrequently.

No off-site noise measurements have been made, therefore the assumption is made that impacts would be essentially the same as those resulting from the 9 X 7-Foot Supersonic Wind Tunnel.

8. 3.5-Foot Hypersonic Wind Tunnel

Airflow in this facility is produced by heating compressed gases in a sphere, then releasing through the test section. Test runs have a 1/2- to 3-minute duration. Noise sources are the compressors used to pressurize the air storage system, and airflow when testing is performed. No noise data are available.

The closest residential area is Naval housing 1,500 feet southwest of this facility. Because of the short duration of test runs, only minimal disturbance is expected primarily due to startle reactions when pressure release occurs. No other effects are anticipated.

9. Static Test Stand

This facility is used to static test fixed and rotary wing aircraft. See Figure 2 for location. The only data currently available were obtained during static test of prototype thrust reversers on a jet aircraft mock-up equipped with two jet engines. A series of microphones were placed at intervals along a semicircle 90 feet from the simulated aircraft. Noise levels were dependent upon orientation to the longitudinal axis of the aircraft, and the power setting of the engines. The noise level measured under least favorable conditions of engine power and orientation was 111 dBA. Under most favorable conditions, it was 80 dBA. The Naval housing area south-southwest of the Static Test Stand is approximately 3,500 feet away. A noise level of 95 dBA at the Static Test Stand would cause a detectable change in the ambient noise levels; a noise level of 110 dBA or higher would be sufficient to cause significant disturbance and annoyance.

The park and open space proposed by the City of Mountain View Figure 13) borders Stevens Creek, which is approximately 2,200 feet west of the Static Test Stand. Test Stand noise levels of 100 dBA would mean noise levels of 60 to 65 dBA at the eastern margin of the proposed park. This constitutes a potential impact when and if the park is developed.

The Mid-Peninsula Regional Park District is currently acquiring land for use as a nature study area which is 1,500 feet from the Static Test Stand. Noise levels of 70 to 75 dBA can be expected at its southern boundary. The Static Test Stand is in operation about 18 weeks of the year. However, the aircraft mock-up is only operated from 1 to 2 hours in the early morning; thus, the Static Test Stand represents limited potential impact for this area due to its operating schedule.

No other impacts are anticipated.

5.7 TRANSPORTATION

The impacts identified here will be those of Ames current operations against the background activity identified in Section 4.7. Evaluation criteria for traffic impacts will once again be based on the concept of "level of service," which is defined in Appendix A-2.

The amount of travel generated by any facility is dependent on the type and level of activity. On any one day there are approximately 4,000 persons involved in activities at Ames. Of these, about 1,700 are Ames civil service personnel. It is estimated that there are about 700 visitors to the base each day. The remaining 1,500 persons traveling into Ames would be contractors' personnel and miscellaneous part-time and temporary Ames employees. It is estimated that these 4,000 persons generate about 8,000 trips per day.* This estimate compares well with the traffic-generation figures for industrial facilities and certain office buildings.

Geographic distribution of the Ames civil service personnel has been determined through a ZIP-code survey for an earlier carpooling program. The distribution of most of the 1,700 Ames civil service employees is illustrated in Figure 21. The majority of these Ames employees (68 percent) live in Santa Clara County south of Ames. The next largest group (21 percent) lives in Santa Clara County north of Ames. San Francisco and

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* Personal communication with G. Holdaway, NASA Ames Research Center, November 10, 1975.

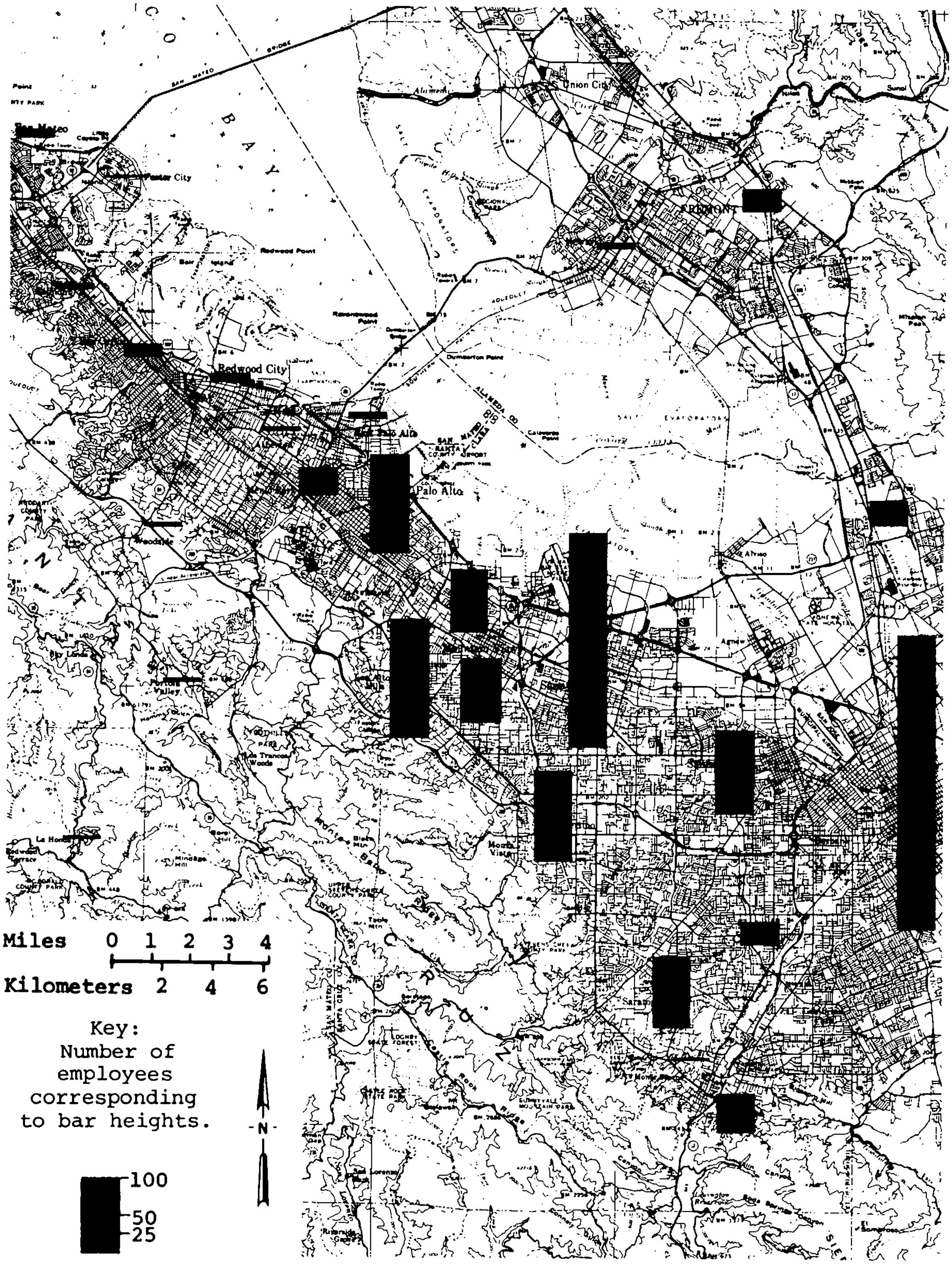


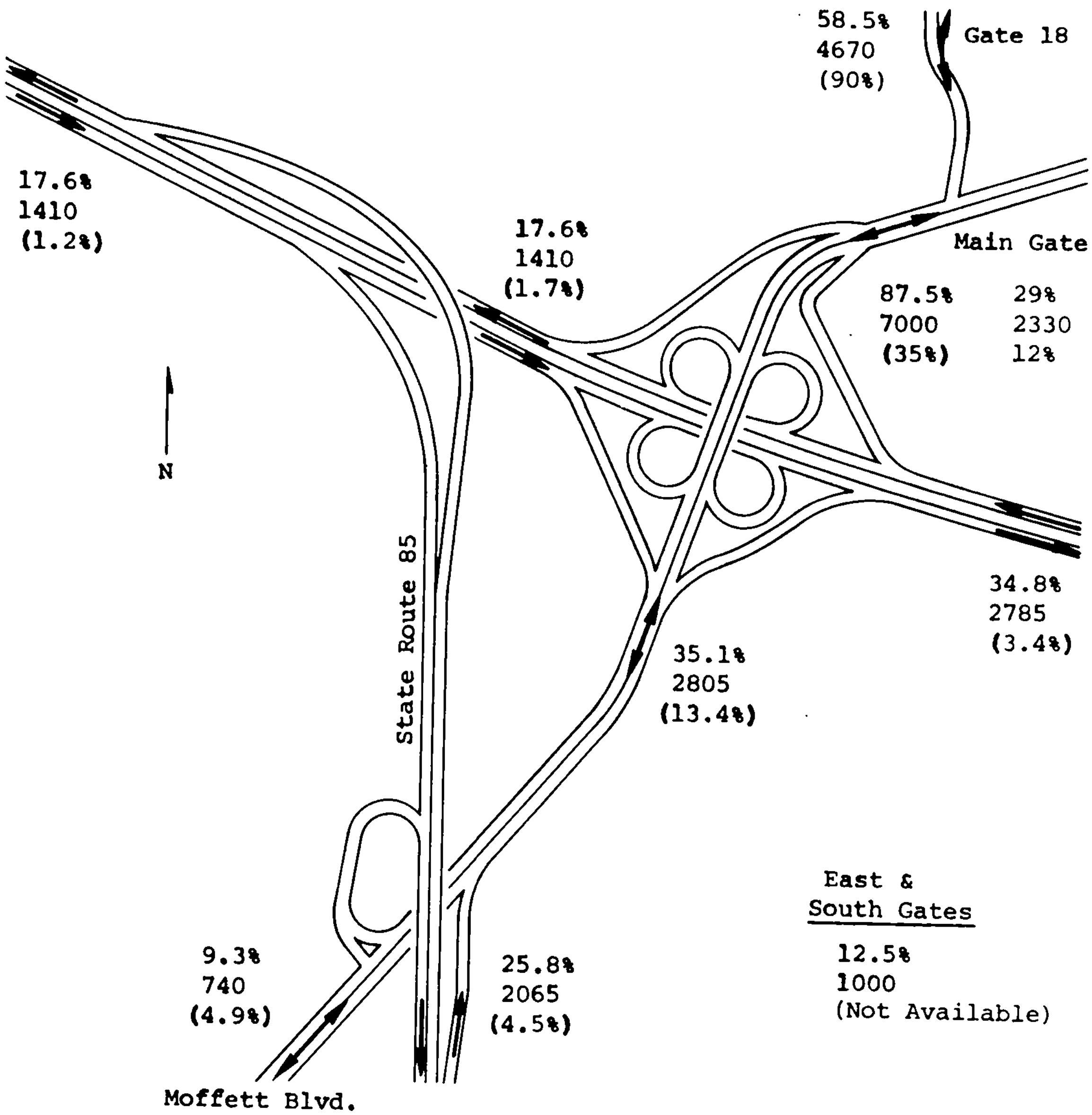
Figure 21. GEOGRAPHIC DISTRIBUTION OF AMES EMPLOYEES' PLACES OF RESIDENCE

San Mateo Counties together account for approximately 7 percent of Ames employees. It will be assumed for the purposes of this analysis that the remainder of the 4,000 persons engaged at Ames are arriving from similarly distributed locations.

From the above geographic distribution, the daily trips arriving and departing Ames have been assigned to the various approaches. The majority, 7,000 trips daily, arrive at the Moffett Boulevard interchange. The remaining 1,000 are assumed to enter primarily through MFNAS via Ellis Street, and some from Highway 237 at the south gate. The corresponding impacts on the Moffett Boulevard interchange and the interchange of Moffett Boulevard with State Route 85 are shown in Figure 22.

Ames traffic is not creating unacceptable levels of service on these local facilities (as noted in Section 3.7, all of these traffic facilities are maintaining acceptable levels of service when carrying the existing traffic, which included Ames traffic). North of U.S. 101, the percentage of Ames traffic is substantial, as Ames and MFNAS are the only activities present. South of U.S. 101, Ames traffic represents, at the maximum, only 13.4 percent of the traffic stream. The traffic at that point operates at about level of service B, clearly acceptable.

The impact of Ames on public transportation facilities is very low due to the low service level provided to Ames. Although no passenger counts are available, it is assumed that only local Mountain View residents would find transit access to be feasible. Increased transit patronage by Ames personnel would probably bring increasing returns to the Transit District under current operating conditions. The extension of Line 52 beyond central Mountain View to Ames is likely to be more costly on a net basis than the average segment of transit service.



NOTE: The Above Description is Based on a Highway Route Assignment of Ames Average Daily Traffic (ADT) Based on Civil Service Personnel Place of Residence

KEY

Percent of Total Ames ADT using indicated roadway
Ames vehicle trips on identified roadway
Percent that Ames ADT contributes to Baseline ADT (see Figs. 18-20)

Not Drawn To Scale

Figure 22. IMPACT OF AMES RESEARCH CENTER'S TRAFFIC OF LOCAL ACCESS FACILITIES

The greatest impact on pedestrian and cycle facilities is likely occurring in the planning and implementation stages at this time. An active group of cyclists employed at Ames has been making inputs to the Mountain View Citizens Transportation Committee.*

Future access to Ames via the North Bayshore area would be expected to divert about 1,000 trips daily (12 percent) away from the Moffett Boulevard interchange onto Stierlin and Charleston Roads.** This figure compares well with the estimated 1,410 persons employed at Ames who reside northward and would find some advantage to divert from the congested Moffett main gate entrance to the alternate access. An analysis of these intersections has shown that this increment of Ames traffic would not create unacceptable levels of traffic. However, full development of the North Bayshore area would demand roadway improvements in order to maintain acceptable levels.***

The current project to improve roads on the Ames site for flood control and security is not expected to have any impact on local traffic operations.

5.8 UTILITIES AND PUBLIC SERVICES

a. Sewage

In 1974, Ames discharged, on an average daily basis, about 80,000 gallons to the Palo Alto plant and about 27,000 gallons to the City of Sunnyvale plant. The flow to these plants represents less than one-half

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*Personal communication with Mr. Robert Lawrence, City of Mountain View Planning Director, November 18, 1975.

**Estimated by Mr. G. Holdaway, NASA-Ames, November 10, 1975.

***City of Mountain View, "North Bayshore Area Traffic Study, Barton-Aschman & Associates, November 2, 1975.

of 1 percent of their respective design capacities and average daily flows. Neither treatment facility has reported any problems with Ames wastewater, although a recent reduction in flow volume to the Palo Alto plant to about 20,000 gallons per day has been noticed by the City of Mountain View. Measurements of the level of radioactivity in the sewage indicate the levels are not significantly above background. Considering the present rate and quality of Ames sewage discharge, the lack of pretreatment requirements seems justified.

b. Water Supply

The average daily consumption rate of Ames is 0.79 MGD. This compares with the 2.0 MGD consumption of MFNAS and represents about 5 percent, 11 percent and 7 percent of the consumption rates of the surrounding communities of Palo Alto, Mountain View, and Sunnyvale for SFWD water. Ames demand represents less than one-half of 1 percent of the total SFWD system demand.

c. Natural Gas

Ames consumes annually about 360 million cubic feet of gas. This represents less than 0.1 percent of the total 1974 PG&E system demand and about 5 to 10 percent of that consumed by the neighboring communities of Palo Alto, Mountain View, and Sunnyvale.

d. Electricity

The Ames facility presently uses about 315 million kwh per year, of which 200 million represent base power purchased from the Bureau of Reclamation. This annual consumption rate represents less than one-half of 1 percent of the total system load produced by both PG&E and the Bureau of Reclamation in 1974. Because the Bureau generates all its power from hydroelectric facilities and PG&E produces about half its power from such facilities, the consumption of power by Ames has little effect on the consumption of fossil fuels and its attendant increase in air pollution. With regard to community consumption, the Ames demands represent about 60 percent, 44 percent, and 42 percent of the demands of the communities of Mountain View, Palo Alto, and Sunnyvale during 1974.

The other concern with regard to Ames energy consumption is its high peak power demand. To mitigate this effect, technical loads of the Center are scheduled to keep peak power demands as low and steady as possible. Contractual limits for the Center are 175,000 kw during the day and 260,000 kw for nighttime. To avoid exceeding these limits, it is necessary to schedule around those facilities, such as the Unitary Wind Tunnel, which have extraordinarily high power consumption. Ames' peak power demand under contractual limits represents about 2 percent of PG&E's generating capacity. In no case has Ames been required to cancel or halt scheduled tests because of system shortages or brownouts. During 1975, the average on-peak demand was 134,784 kw, while the average off-peak demand was 150,656 kw.

Ames, like all federal facilities, has an energy-savings program in effect which results in reduced consumption of power. As an example, Ames is currently in the process of procuring the Ames Power Scheduling System (APSS) which will provide all the information and management tools required to maintain the demand level and energy usage at a minimum commensurate with the chosen level of facility operation. In addition, Ames is currently adding centralized remote control of the environmental systems in a majority of the buildings. This control permits reducing the energy consumption to only that which is required to provide a level of comfort that conforms with the recommendations of current energy conservation directives and to tailor the hours of system operation to the individual occupancy. In addition, as noted above, technical loads utilize off-peak power which lowers costs and mitigates the requirement for additional generating capacity on the part of the utility.

e. Solid Wastes

The Ames facility produces about 12 tons/day of municipal-type solid wastes which are collected for final disposal in the Sunnyvale landfill by a private contractor. This represents less than 1 percent of the production of solid wastes by the neighboring communities and probably is one reason why the draft solid waste management plan does not include them in their transfer station concept. Ames also practices resource recovery by collecting and selling metal scrap and oil waste (which is reclaimed by a processor for resale). The methods of disposal for radioactive and biological wastes are covered elsewhere. It should be noted that the Environmental Protection Agency has recently (January 15, 1976) proposed guidelines to require federal agencies to establish facilities to recover resources from residential, commercial and institutional solid waste (41 F.R. 2359).

The proposed guidelines require federal facilities which generate, collect, or dispose of at least 100 tons of solid waste per day to establish or utilize resource recovery systems (the utilization of a local system is recommended). Furthermore, the guidelines state that federal operations in a Standard Metropolitan Statistical Area must establish or use a single facility if any one facility generates 50 tons or more of solid waste per day and if the total generation of wastes by facilities in the area is 100 tons or more. Within one year of the final promulgation of the guidelines, federal agencies must determine what actions are necessary for compliance with the rules and submit the findings to EPA. Agencies electing not to comply with the requirements must submit data to EPA detailing their analysis and rationale.

In the light of the small amount of solid waste produced by Ames, these proposed guidelines will have little effect on Ames disposal of solid waste. They may though, have an effect on neighboring federal facilities if their solid waste production is near 100 tons per day or is greater than 50 tons per day and the total production by federal facilities within the San Jose SMSA is greater than 100 tons per day.

f. Public Services

Ames has very little demand on the public services offered by the community as security, fire protection, and health services are all provided on-site by either Ames or MFNAS personnel. Because the Health Unit is only open during regular business hours, Monday through Friday, emergency service during other times of the weekday or weekend is available from doctors and hospitals in the community. The need for such emergency service has been rare.

5.9 VISUAL QUALITY

On the Peninsula, of all the development east and north of Bayshore Freeway, the hangars of Moffett Field and the Ames 40 X 80-Foot Wind Tunnel are among the largest and bulkiest. Despite their size, even these very large structures are for the most part not visible to the communities west and south of the freeway.

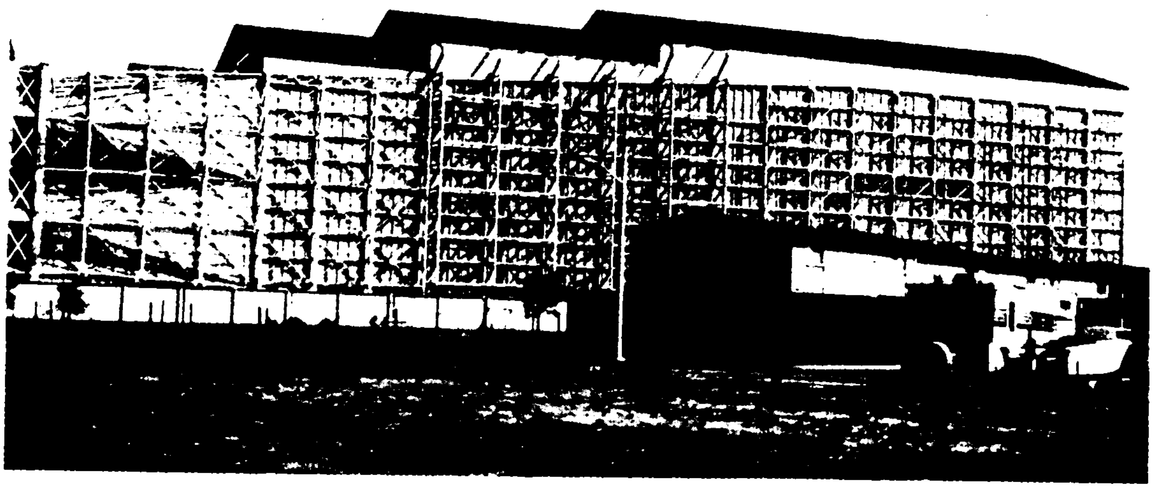
To the freeway viewer the Ames complex appears indistinguishable from the office/industrial/residential development of Moffett Field. Of the Ames structures, the 40 X 80-Foot Wind Tunnel is most prominent. Landscaping appears to be at a minimum and structures seem strictly utilitarian. The features of the complex could be felt by some to be visually stimulating and by others to be a dense obstruction of natural views. In either case, Ames is not visually incongruous with its immediate environment of freeway structures and the industrial facilities of Moffett.

To the viewer in the Bayshore area of Mountain View the 40 X 80-Foot Wind Tunnel is the only major Ames facility viewable (Figure 23). Viewed from Naval housing on the east side of Stevens Creek immediately southwest of the wind tunnel structure and the mobile home community on the west side of Stevens Creek, the structure looms massively, exposing shiny metal structural parts. Both these housing groups, however, were located subsequent to construction of the wind tunnel.

While the view from Mountain View's Shoreline Park (Figure 23) toward the southeast is dominated by the Ames Wind Tunnel, according to Ken Alsman, Principal Planner of Mountain View, the park is not adversely affected by the structure. This is primarily a result of land contouring in the park, landscaping buffers in the park, and the number of other, more attractive vistas for the park user.

The City of Mountain View's Stevens Creek Park corridor remains an area to be visually resolved. The creek corridor now appears as a kind of no-man's-land between Mountain View and federal lands, but is actually owned by the Santa Clara Valley Water District. The District does not object to the park concept, but their plans to increase the size of the dikes, limitation of funds, and higher priority projects have delayed their landscaping of the corridor or the development of a park. The potential of the park as a visual resource will be realized after public hearings and with the cooperation of Ames, private homeowners, and all other cognizant jurisdictions.

Long-range view of Ames Research Center
(especially 40 X 80-Foot Wind Tunnel) from the southwest



Short-range view of the 40 X 80-Foot Wind Tunnel
from the northwest, adjacent to the Naval Housing

Figure 23. VIEWS OF AMES RESEARCH CENTER
FROM DIFFERENT PERSPECTIVES

5.10 PUBLIC HEALTH CONSIDERATIONS

Two studies were recently completed regarding the use of radioisotopes at Ames. An environmental survey completed in January 1975 evaluated radioisotope usage and disposal as well as concentrations in soil, vegetation, and water effluents.[1,2] The study found that radioactivity levels of soil and vegetation samples showed no unusual increases above previous samplings and that the results fell entirely within expected limits of normal fluctuation. Some radioactivity was found in a number of sink drains in the radiological laboratories; most of the amounts were, however, insignificant. One sample, containing .58 times the allowable for release to a controlled area, was considered significant. However, this laboratory has been monitored closely since April 1974, and personnel have been warned not to dispose of their liquid wastes in this manner. The discharges have not resulted in an unacceptable concentration in the sewer but, nevertheless, impact the environment unnecessarily because liquid waste containers are available in all radioisotope-using laboratories.

A radiological survey of radioisotope usage areas was completed in August 1975.[1] The survey was very extensive in that air and water effluents were tested, and that 1,537 wipes were made in 43 areas where radioisotopes are used. No violations were noticed by health physics personnel while taking this survey.

5.11 SOCIOECONOMICS

Ames employs about 1,700 full-time civil service personnel.* The Ames work force also includes a number of temporary, part-time, student, military, and research associate workers totaling approximately 330. In addition a variable number of contractor personnel are also employed at Ames.

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* NASA-Ames Research Center, "Personnel on Board Summaries," report date 10/31/75.

When these and other individuals are included, the number of personnel employed at Ames varies between 3,000 and 4,000. For purposes of describing economic effects a total of 3,500 full-time employees will be assumed to work at Ames.

Ames personnel reside all over the Bay Area, but 89 percent live in the San Jose SMSA (Standard Metropolitan Statistical Area), which includes all of Santa Clara County.* Therefore, this SMSA can serve as a reasonable locus for socioeconomic effects attributable to Ames. Using a 1975 total SMSA employment figure of 531,900, Ames personnel represent about 0.7 percent of the San Jose Metropolitan Area employment.

The total of personal income from wages and salaries in Santa Clara County in 1973 was $4,395,006,000.** Wages and salaries earned by Ames personnel total about $60,000,000 (based on an average salary of about $17,000 per year for the 3,500 people at Ames) or about 1.4 percent of the total County income. While this percentage would probably be somewhat smaller when Ames income is compared with 1975 total County figures, Ames clearly is a significant contributor to County income.

Ames provides further economic stimulus to both the local and national economic sectors through research, design, development, and manufacturing contracts with other public and private agencies and companies. The extent of this stimulus is indicated in Table 23, which shows the FY 1975 Operating Plan for Ames. These expenditures included the wages and salaries for Ames personnel mentioned above.

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* Letter from George H. Holdaway, Technical Assistant, RF&I Div., NASA-Ames, to Richard Lloyd, Planning Department, City of Mountain View, October 9, 1975.

** Security Pacific Bank, "Monthly Summary of Business Conditions in the Northern Coastal Counties of California," February 1975, p. 4.

Table 23

FY 1975 OPERATING PLAN

PLAN AREA	ALLOCATION (millions of dollars)
Research and Development	83
Research and Program Management	46
Construction	3

6.0

ALTERNATIVES TO PRESENT OPERATING CONDITIONS AND FACILITIES

ALTERNATIVES TO PRESENT OPERATING CONDITIONS AND FACILITIES

As was mentioned in the Introduction, an Institutional Environmental Impact Statement describes the effects of ongoing activities and is not a statement describing a proposed action. Therefore, the potential alternatives to be considered in this section range from the complete cessation of all activities at Ames Research Center to minor modifications in certain facilities and activities. Although cessation of all ongoing activities would result in minor local environmental gains, it would also result in major economic, technological, scientific, and environmental losses and as such cannot be considered viable.

Other less drastic changes in present operating conditions and facilities may be viable. For instance, Ames has long recognized that most of the local adverse environmental impacts created by Ames can be attributed to the production of noise by certain wind tunnels and the Static Test Stand. At least three procedures are available to reduce these noise impacts: (1) the reduction of noise at its source; (2) the control of the noise path; and (3) protection of the noise receiver. All three procedures require physical changes, but the last two only provide noise control in certain selected areas, whereas the first provides noise protection to all areas. For this reason and others, Ames has in the past chosen to reduce noise impacts by isolating the offending source and designing cost-effective source control measures. Such measures include:

- The blow-off system of the 12-Foot Pressure Wind Tunnel has been equipped with a muffler. This has reduced the noise level of this source approximately 20 dBA.

- The 11-Foot Transonic Wind Tunnel has been enclosed in an acoustical barrier structure. This has reduced noise levels 10 to 18 dBA depending on operating conditions.

- The 11-Foot Transonic Wind Tunnel blow-down system has been equipped with a muffler which has reduced noise levels from this source by about 27 dBA.

- The Static Test Stand was located in a remote area of Ames partly to mitigate noise impacts and partly to insure a safe zone from debris hazards in the event of a structural failure during aircraft testing.

Although these measures have considerably reduced the effects of noise generated by Ames activities on the surrounding community, significant sources of noise remain, the most prominent being the 40 X 80-Foot Wind Tunnel. The general consensus of noise experts indicates that a reduction in fan tip speed brought about by installing new fans and electric motors would be the most effective approach to noise control in this tunnel. Such an alternative, maintaining the current performance capability, would cost in excess of 11 million dollars. Engineering studies are currently in process which may lead to major modifications in the 40 X 80-Foot Wind Tunnel and noise control is a significant factor in these studies.

Further reductions in noise levels could come from programs which decrease the operating levels of certain facilities or which reschedule the operating times of the offending facilities to periods when the ambient noise levels in the critical receptor areas are higher. Changing the operating levels and/or schedules, though, is probably not possible because of the necessity to schedule around the contractual limits for peak power demands, the need to utilize cheaper off-peak hours and the large and continuing demand placed on these facilities to obtain important aeronautical data.

7.0

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

7.0

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Unavoidable adverse impacts are primarily caused by the noise generated by certain facilities. Production of air pollutants and the visual impact of the large Ames structures, especially the 40 X 80-Foot Subsonic Wind Tunnel, cause less significant impacts.

The noise environment of the Naval dependent housing area southwest and adjacent to the ARC is significantly and adversely affected. This is documented both by measurements of noise levels and by complaints from residents. Noise levels and vibration effects from the 40 X 80-Foot Wind Tunnel are the most important contributors to the adverse noise environment effect in the area. When the 40 X 80-Foot Wind Tunnel is operating at full speed (about 11 percent of the operational time or an average of about 45 minutes per work day), the noise levels in the Naval housing area closest to the tunnel reach as high as 80 dBA. This peak level is much higher than the average ambient level of 56 dBA. Other significant contributors are the 12-Foot Pressure Wind Tunnel and the Static Test Stand. The 9 X 7-Foot and 8 X 7-Foot Supersonic Wind Tunnels of the Unitary System have the potential to cause complaints, but operate so infrequently that their net impact is insignificant.

The Naval dependent housing area south of the ARC is adversely affected by noise levels from the 12-Foot Pressure Wind Tunnel, the 14-Foot Transonic Wind Tunnel, and the 40 X 80-Foot Wind Tunnel when testing full-scale operating aircraft engines. These effects are limited to the northernmost portions of this area as the portions bordering Bayshore Freeway have higher noise levels caused by freeway traffic and experience a noise environment normally considered not acceptable by the U.S. Department of Housing and Urban Development.

The Trailer Park to the west of the ARC is occasionally impacted by noise when the 40 X 80-Foot Wind Tunnel is testing full-scale operating aircraft engines. Residential areas south of Ames may be occasionally disturbed when uncommon meteorological conditions occur which are conducive to sound transmission.

Testing of aircraft at the Static Test Stand will generate noise levels which may conflict with the City of Mountain View's proposed park and open space located west of Stevens Creek and north of Crittenden Lane and with the park use on the Shoreline Park Acquisition of the Mid-Peninsula Park Region. The seriousness of this conflict depends upon the types of uses and activities planned for the proposed parks.

The production of NO_2 from all sources will cause the 1-hour NO_2 standard to be exceeded at Ames at least once during the year. Ames commute traffic contributes about 10 percent to the exceedance of the 1-hour carbon monoxide air quality standard on U.S. Route 101 during rush-hour traffic. Without Ames, however, the standard would still be exceeded. For more information on the above adverse impacts, the individual parts of Sections 5.1 - 5.11 should be consulted.

The existence of the facilities, especially the 40 X 80-Foot Subsonic Wind Tunnel, visually dominates short-range vistas near the site, especially from the Naval housing southwest of Ames and the area to become the City of Mountain View's Shoreline Park. However, the views from the completed park will not be affected to any significant degree because of landscape contouring and vegetation.

8.0

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT, AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

8.0

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT, AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The construction and operation of this facility has brought about a long-term commitment of the facility site for research and development activities at Ames. This commitment has not been made at the expense of any other option, though, as the site is generally not suitable for other types of development. The present land use is also recognized by all cognizant planning agencies.

Localized short-term increases in noise and air pollution are expenses incurred in increasing the level of science and technology in the fields of aeronautics, astronautics, life sciences, advanced computation and unmanned spacecraft which have and are maintaining and enhancing man's long-term productivity.

Listed below are some specific examples of Ames' research and its contributions to man's long-term productivity.

- Ames advanced computer systems are providing solutions to complex fluid mechanics problems, including 3-dimensional models of global climate dynamics which can be used to predict the fate of pollutants in the stratosphere.

- Ames wind tunnels give commercial airplane manufacturers the opportunity to optimize aircraft designs for maximum safety, economy, and reliability.

- Ames research in advanced flight systems for planetary and interplanetary flight has led to new methods in water purification, air revitalization, and waste-matter processing.

- Research at Ames in conjunction with the Federal Aviation Administration leads to increased airline safety.

- Research at Ames in VTOL and STOL aircraft is leading to technology which should revolutionize middle-distance (less than 500 miles) air transportation, both nationally and internationally.

- Earth Resources Research at Ames assists community and regional planning agencies, both nationally and internationally, in the evaluation of agricultural and forest land and the identification of probable landslide areas, etc., through the use of high-altitude infrared photography.

9.0

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

9.0

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The use of this land for a research and development facility represents an irreversible commitment of the land to this use. As mentioned in the last section though, the land is only suitable for a limited number of uses because of its proximity to MFNAS, which therefore makes its use as a relatively non-polluting research and development facility acceptable.

Water, electricity, natural gas, and aircraft fuel are consumed by the facilities and activities of the Center. As the ultimate source of the Ames water supply is the SFWD's Hetch Hetchy reservoir, which is replenished yearly by the natural hydrologic cycle, the consumption of water by Ames cannot be considered an irreversible or irretrievable consumption of natural resources. Similarly, its consumption of electricity, of which over 90 percent is generated by hydroelectric facilities replenished yearly by rainfall and snowfall, also cannot be considered an irreversible or irretrievable consumption of natural resources. Ames' consumption of natural gas, about 360×10^6 million cubic feet in FY 1975, and jet fuel does represent an irreversible and irretrievable consumption of natural resources. However, Ames' consumption of natural gas represents less than one-tenth of 1 percent of the total amount purchased by PG&E in 1974. Consumption of jet fuel is also small when compared to that used by MFNAS, or the San Francisco or San Jose airports.

10.0

OTHER CONSIDERATIONS OF FEDERAL POLICY WHICH OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE FACILITY

10.0

OTHER CONSIDERATIONS OF FEDERAL POLICY WHICH OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE FACILITY

Ames, as a field laboratory of NASA, contributes significantly to the national research and development programs in the fields of aeronautics, astronautics, life sciences, advanced computation, and unmanned spacecraft. The following qualitative discussion lists some of the continuing benefits of the programs and operations of Ames facilities.

Wind tunnels at Ames are providing a variety of benefits. The testing of scale models of aircraft and spacecraft allows the builder to collect valuable information on new designs without having to spend the time and money to build full-scale models. For example, almost all of the commercial airline models have been tested here. This application takes on national economic significance when one considers that 80 percent of the civil airplanes flying throughout the world are of U.S. manufacture.

Ames' studies of interactions between crew members, between crew and air traffic controllers, and between crew and the instruments and control systems of the aircraft itself have been partly responsible for the admirable safety record of commercial airlines transportation. In particular, methods have been developed to relieve the stress-inducing workload associated with the brief but "busy" periods of take-offs and landings of complex modern aircraft at a heavily trafficked airport. In order to improve the reliability of crew-control system interactions, Ames scientists developed a computer-operated device which decodes a pilot's instructions and displays them for his approval before obeying the verbal command. Airline safety has also been improved through the in-flight study of commercial aircraft accidents.

The development of advanced life support systems to allow survival in unnatural environments and to resist the stresses imposed by manned aircraft and spacecraft has fostered improvements in such basic Earth applications as water purification, air revitalization and waste-matter processing.

With regard to the origins of life, Ames researchers have synthesized the building blocks of living things from chemicals, discovered that meteorites that fall to Earth from space contain these building blocks and that some Earth life thrives under environmental conditions at one time thought impossible for life even to survive, let alone flourish. These studies have allowed Ames' scientists to more accurately predict where life outside our planet would be and to design instruments able to detect life on other planets.

Ames' large and complex computing systems, featuring the Illiac IV, have made possible the solution of highly complex problems impossible to attack economically by other means. Theoretical analysis of complicated aerodynamic problems of wings and wing-body combinations and how air flows past them in three-dimensional patterns has reduced aircraft design costs and improved reliability and safety. The use of these computers to model global climate dynamics and to determine the effects of pollutants and natural disturbances such as volcanos is of both national and international significance considering the importance of climate and weather to agricultural production and human survival.

Ames VTOL and STOL aircraft are providing information on probably the next major breakthrough in civilian air transportation, i.e., the economical use of air transportation for distances less than 500 miles and the use of small airports not designed to land today's larger aircraft. Evaluation of the Earth's agricultural production potential at a fraction of the cost of ground inspection is a key benefit of U-2 surveys. Other Ames aircraft are providing useful information on other planets in the Solar System through infrared astronomy, studying the distribution of marine animals, investigating the fundamentals of the Arctic Sea ice, evaluating the way in which Earth's weather is generated in the tropics and providing data in support of the computer models of interactions among atmospheric layers, and natural and man-made pollutants.

In summary then, research at Ames directed toward increasing the level of science and technology in the fields of aeronautics, astronautics, life sciences, advanced computation, and unmanned spacecraft is providing significant economic, scientific, technological, and environmental benefits to the local as well as the national and international sectors. In order to achieve these benefits, slight, short-term increases in noise and air pollution are being produced. However, it is clear that the many benefits produced overwhelm the minor environmental problems incurred.

11.0

COMMENTS RECEIVED ON THE DRAFT STATEMENT AND RESPONSES

11.0

COMMENTS RECEIVED ON THE DRAFT STATEMENT AND RESPONSES

11.1 REQUEST FOR COMMENTS

The Draft Institutional Environmental Impact Statement was submitted to the Council of Environmental Quality in July, 1976. Notice of the availability of the draft statement was filed in the Federal Register at that time. Copies of the draft statement were sent to the following parties along with a solicitation of their comments:

Regional Administrator IX
U.S. Environmental Protection Agency

Office of Federal Activities
U.S. Environmental Protection Agency

Moffett Field Naval Air Station

Department of the Navy

Environmental Project Review
Department of the Interior

Office of Architectural and Environmental Preservation
Advisory Council on Historic Preservation

Advisory Council on Historic Preservation

Office of Environmental Affairs
Department of Health, Education and Welfare

Office of Environmental Quality
Department of Housing and Urban Development

Office of Environmental Quality
Department of Transportation

California State Water Resources Control Board

California State Department of Fish and Game, Region III

California State Lands Commission

California State Department of Public Health

California State Air Resources Board

California State Historic Preservation Office
Resource Management and Protection Division
Department of Parks and Recreation

California State Department of Transportation

California State Office of Planning and Research

California Regional Water Quality Control Board
San Francisco Bay Region

San Francisco Bay Conservation and Development Commission

Association of Bay Area Governments

Bay Area Air Pollution Control Board

Santa Clara Valley Water District

Santa Clara County Board of Supervisors

Santa Clara County Planning Commission

City of Palo Alto

City of Mountain View

City of Sunnyvale

City of Menlo Park

11.2 COMMENTS RECEIVED AND RESPONSES

Comments on the draft statement were received by the parties listed below. A copy of each party's comments followed by the respective response is presented on the pages shown.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

D-NAS-K12002-CA

SEP 21 1976

Dr. Lewis Hughes, Chief
Health and Safety Office
Research Center
Moffett Field, CA 94035

Dear Dr. Hughes:

The Environmental Protection Agency has received and reviewed the Draft Environmental Impact Statement for AMES Research Center, Moffett Field, Santa Clara, California.

EPA's comments on the Draft Environmental Impact Statement have been classified as LO-2. The classification and date of EPA's comments will be published in the Federal Register, in accordance with our responsibility to inform the public of our views of the proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the consequences of the proposed action and the adequacy of the environmental statement.

EPA appreciates the opportunity to comment on this Draft Environmental Impact Statement, and requests two copies of the final statement when available.

If you have any questions about our comments, please contact Patricia Sanderson Port, EIS Coordinator, at (415)556-3232.

Sincerely,

Paul De Falco, Jr.
Regional Administrator

cc: Council on Environmental Quality

Comments on the Draft Institutional Environmental Impact Statement, Ames Research Center Moffett Field, Santa Clara County California

AIR

1. Baseline air quality data is not adequately described in the DEIS. Actual maximum values should be presented for each National Ambient Air Quality Standard (NAAQS), rather than monthly averages, since monthly averages cannot be related to the health effect mentioned on pages 51 - 53. Actual maximum hourly NO_2 values for 1974 should also be presented in the impact statement.

2. In order to determine the adequacy of the pollutant emission summaries for Ames on page 109, the final statement should describe or reference the methodology used. For example, the point source emission factors and percent of peak emission rate assumed should be referenced in the EIS. THe EIS should also reference the dispersion model inputs, outputs, and assumptions for those key locations where the CO standard is predicted to be exceeded. Further, the EIS should clearly show the location, for example a park or residence, where the CO impact on the public is the highest.

3. In order to evaluate the Center's NO_2 impact relative to the NAAQS, the following additional information is needed: NO_2 background concentration, location of the predicted annual maximum concentration, and a detailed description of the model and assumptions used by the URS Research Company.

4. The conclusion on page 107 that the Ames Center has very little impact on air quality is not consistent with the facility's stated contribution to violations of the CO and O_x NAAQS and the California NO_2 one hour standard. EPA suggests that the Ames Center should consider all reasonable control measures to reduce its contribution to violations of the air quality standards. The EIS should contain a detailed discussion of the options available to reduce air emissions including a carpool and bicycle system (which was briefly noted in the DEIS as having employee interest), flexible/staggered work hours, on and off-base bus/van service, auto disincentives and transit/carpool incentives.

5. Section 4 of the DEIS should discuss the designation of the San Francisco Bay Area as an Air Quality Maintenance Area and the status of Air Quality Maintenance planning to date. It is quite likely that future projects at the Moffett Field facility will be evaluated against the Air Quality Maintenance Plan (AQMP) by many reviewing agencies such as ABAG, BAAPCD, ARB, and EPA in order to ascertain consistency with the State Implementation Plan. Therefore, NASA/Ames should consider becoming an observer if not an active participant in the AQMP process (the AQMP is being formulated by the Environmental Management Task Force operating under the Association of Bay Area Governments with the direct support of the Air Resources Board and EPA).

NOISE

The final EIS should show noise contour maps for the various wind tunnels. California law requires owners of transportation facilities to provide this information to local planners for use in preparing the noise element of the general development plan. Compatible future land use can best be assured by making noise contours available as public information. NASA/Ames being a major stationary noise source should provide as much information as possible with regard to the nature of the facility. Variation in contours as a function of temperature inversions or other sensitive atmospheric factors should be discussed in more detail.

Some statistics about hours of operation and complaint levels should be quantified and examined in light of historic perspective. What local noise ordinances are in effect (or likely) and do any violations occur in this facility?

EPA recommends that the environmental noise impact analysis for this action employ the Leq/Ldn noise descriptor methodology. EPA has approved the Leq/Ldn methodology as the uniform environmental noise descriptor for Federal agency actions.

WATER

1. The FEIS should provide assurance that appropriate measures will be taken to minimize the impact of future construction on soil erosion/sedimentation.

2. The FEIS should discuss in greater detail "the occasional filling of the marsh area as a means of disposal of debris and dirt" as referenced throughout the DEIS, and specifically on page 110.

3. The FEIS should address the secondary impacts of seismic activity on water supply/transport structures.

U.S. Environmental Protection Agency
Region IX, San Francisco

Comment: It was suggested that maximum values be presented for each National Ambient Air Quality Standard (NAAQS), including that for NO_2.

Response: The text has been modified so that the description of air quality baseline is in terms of maximum values (pp. 54 and 56).

Comment: It was suggested that the statement present a description of the methodology used to derive the pollution emissions summaries presented in Table 19.

Response: The methodology used in consistent with that outlined by both the Bay Area Pollution Control District and EPA. A description of the methods used in deriving the pollution emission summaries of the impact section has been inserted into the text (p. 107). Also, the text has been expanded to incorporate references for the point source emission factors and percentage peak emission rates which were assumed in the analysis (p. 110).

Comment: It was suggested that areas in which it is expected that the CO standard will be exceeded be specified in the analysis.

Response: The area along U.S. 101 has already been specified in the report as the only location in which CO standards are occasionally exceeded. This discussion has been expanded to a discussion of the most sensitive receptors (i.e., adjacent residential areas) of these high emissions and the conditions under which they are in effect (p. 103).

Comment: It was suggested that additional information be included that would aid in the detailed evaluation of ARC's NO_2 emissions relative to the NAAQS.

Response: The text was modified to address NO_2 background concentrations and the location of predicted annual maximum concentrations. Due to the reactive nature of NO_2 and the indirect manner in which it is generated, its concentration and location is difficult to predict with accuracy. As noted in the text, no standard exceedences were recorded at Redwood City in 1975, and, the analysis assumed conservative estimates based on average one-hour values (p. 109).

Comment: Further discussion of the finding of "very little impact" on air quality was suggested in light of the fact that CO and Ox NAAQS and the California one-hour NO_2 standard are occasionally exceeded in the areas surrounding ARC.

Response: The findings of the specific effect of ARC upon the air quality of the region are substantiated by reference to Tables 17, 18, and 19 which show the background levels to dominate any typification of emission factors in the area. Significant contributions are shown for Ox and CO. However, the estimates for NO_2, being based on a "worst-case" average emission factor, are heavily qualified. These estimates are extremely conservative and since no standard exceedances have been recorded at the nearest monitoring station, they are to be interpreted cautiously (pp. 109-114).

Comment: It was suggested that the statement discuss the options available to ARC that might mitigate air emissions due to traffic volume, e.g., carpooling, bicycle systems, flexible work hours, and bus/van service.

Response: The text was modified to include a more thorough discussion of these options. A number of measures have been instituted at ARC to reduce traffic-induced pollution including computerized carpools, instituting bus lines, providing for flexible or staggered work hours, and aiding in the formation of bicycle clubs. These are discussed in the text (pp. 106-107).

Comment: It was suggested that San Francisco Bay Area Air Quality Maintenance planning be described with respect to regional plans, policies, and controls that relate to Ames Research Center.

Response: The Bay Area Air Quality Maintenance Plan is still in the process of being formulated. An appropriate description has been included in the text (p 93).

Comment: It was suggested that the statement show noise contour maps for all of the various wind tunnels and that variations in these countours due to variations in climatic conditions be discussed.

Response: Accurate noise data, and thus representative noise contours, are only available for the 40 X 80-foot wind tunnel. The potential for off-site impacts, therefore, was determined by a review of available data and a consideration of the location of facilities as discussed in the text (p 118).

Comment: It was suggested that the noise analysis deal more specifically with the hours of operation for the various wind tunnels and that Leq/Ldn noise descriptors be used in the analysis of impact.

Response: The quality of available noise data only permits approximate estimates of Leq/Ldn descriptors which, along with average daily operating times, have been incorporated into the analysis and shown in Table 21. However, because of the high background noise levels for these facilities and weak data upon which the Leq/Ldn estimates are based, the analysis of noise effects must still rely on the other quantitative and qualitative measures originally presented (pp. 118-120).

Comment: It was suggested that complaint levels be quantified, also that local noise ordinances currently in effect be specified in order to determine if any violations occur at this facility.

Response: Ames Center's complaint records dating from 1971 were reviewed and the average annual number of complaints (six per year) are footnoted in the text. Recently, there has been a renewed public awareness of the current noise environment in and around ARC. Thus, although the level of wind-tunnel test activity has not appreciably increased, ARC has initiated a comprehensive study of community noise complaints in order to better determine the source of any offending noise and the community areas which are most often affected.

The City of Mountain View, in its Sound Element of the General Plan, sets no absolute standards but recommends guidelines for environmental review.[27] The Sound Element suggests that an area is severely impacted by noise when it sustains levels beyond 65 dBA. The only areas which can be clearly identified as being so affected by the activities in and around ARC and Moffett Field Air Station are the Naval dependant housing area and other isolated residences west of ARC and north of U.S. 101. However, these residential uses were established after ARC had established itself as a source of noise-related activity. In any case, the proximity of Moffett Field and U.S. 101 make it hard to distinguish a specific source. The text has been expanded to incorporate this response (p. 117).

Comment: Assurance was sought that appropriate measures will be taken to minimize the impact of future construction on soil erosion/ sedimentation.

Response: Normal construction procedures on any future construction will adequately serve to minimize the likelihood of soil erosion. Further, the flat topography of the Ames area substantially reduces the probability of soil erosion, and the subsequent ponding of runoff waters in the northern portion of the Ames property removes (through settling) most of the solid's loading that does occur. The text has been modified to discuss this point (pp. 97-98).

Comment: Greater detail concerning the references to "occasional filling of the marsh area" were requested.

Response: This filling of the marsh, which occurs adjacent to the soil moisture test area and in and around buildings N-217 and N-217A, will not be expanded outside its present boundaries. The majority of this fill material originates from basement and foundation excavations in other portions of Ames. The text reference has been appropriately qualified (p. 114).

Comment: It was suggested that the statement discuss the secondary effects of seismic activity on water supply/transport structures.

Response: Generally, all structures within Ames have been built with the necessary structural integrity to resist effects of seismic events. During major seismic events, the only effect of environmental consequence that would occur due to possible rupture of on-site service mains would be the spillage of untreated sewage waste. This loss can be effectively minimized through prompt pipeline shutdown and subsequent cleanup and repair. The text has been expanded to discuss this point (pp. 95-96).

DEPARTMENT OF THE NAVY
NAVAL AIR STATION
MOFFETT FIELD, CALIFORNIA 94035

IN REPLY REFER TO:
18:HLD:jss
24 Aug 76

Mr. Duward L. Crow
Associate Deputy Administrator
National Aeronauticsand Space Administration
Washington, D.C. 20546

Dear Mr. Crow:

This Command was forwarded for review and comment a copy of the April 1976 revision to the Draft Institutional Environmental Impact Statement for the Ames Research Center, Moffett Field, California by your letter of July 8, 1976.

The draft Environmental Impact Statement is acceptable to this Command with a few minor exceptions; specific comments are as follows:

"Page 101, Table 13. The data presented in the column entitled "Moffett Field plus Ames" are questioned. The data on dissolved solids, sulfate, and chloride suggest the presence of seawater in the storm drainage. The stated figure for chemical oxygen demand (COD) is suspect in that a high chloride level would interfer with most measurements of COD. The COD level indicated could be fully attributable to the presence of seawater and not to pollutants in the Moffett Field storm sewage."

"Page 111, paragraph 5.6a. The reference to community noise complaints is inaccurate. The level of community complaints at Moffett Field is low by most airfield standards. It should also be noted that some NASA aircraft are among the noisiest operating at the field."

Sincerely,

H. L. DOZIER, JR. P.E.
Com[illegible] CEC, USN
Public Wo[illegible]
by direction [illegible] Commanding Officer

U.S. Department of The Navy

Comment: It was suggested that the interpretation of water quality data regarding summer drainage from Ames and Moffett Field (Table 14, especially the COD estimates) be qualified by the consideration of possible seawater intrusion.

Response: While it might be expected that the quality of Moffett Field drainage waters are lower than Ames, it is more likely that the quality difference is not nearly as great as indicated by the sampling data (Table 14) due to sample contamination by seawater. These qualifications are explained more fully in the text (pp. 98-99).

Comment: It was suggested that references to community noise complaints be more accurately qualified by noting that (1) community complaints at Moffett Field are low by most airfield standards and (2) NASA aircraft are among the noisiest operating at the airfield.

Response: The text has been modified to incorporate these qualifications (p. 116).

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

SEP 16 1976

In Reply Refer To:
EGS-ER-76/702-MS760

Dear Mr. Crow:

This is in response to a request for the Department of the Interior's review of the draft environmental statement for the Ames Research Center.

In general, we consider the draft statement to be an excellent document that is noteworthy for its treatment of potential geologic hazards, particularly seismic activity, and for its candid evaluation of the noise element.

The draft report should prove to be a valuable tool in planning the development of adjacent parklands. A further acquisition for park development, not mentioned in the report, is the 53.9 acre site located on the east side of Stevens Creek immediately north of the Ames Center. The Mid-Peninsula Park Region, through a grant from the Land and Water Conservation Fund (Stevens Creek Shoreline Acquisition, Land and Water Conservation Fund Number 06-00467), will acquire the site for a regional park and nature study area. We are concerned about the potential conflict between noise generation at the static test stand and future use of the new parkland. The draft statement indicates that operation of the static test stand under least favorable conditions would generate noise levels that constitute a potential impact to the eastern margin of Shoreline Park when and if the park is developed. The new acquisition is nearer the test stand than the area of Shoreline Park referred to above. Information on the frequency and duration of use of the test stand would assist in defining this conflict. If any increase in use of the stand is expected, it should also be noted.

We recognize that Moffett air traffic may be the dominant noise source at the northern end of the Ames property. If your noise data permits a comparison between the air traffic and test stand at the northern boundary of the Ames Center, we would appreciate seeing this information in the environmental statement.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

The statement indicates on page 98 that an archeological survey will be conducted when the location and type of construction is specified. We recommend that a professional archeologist perform an on-the-ground survey in the early planning stages of each project. The survey results should be of sufficient detail to identify and describe the resources and to determine their eligibility for inclusion in the National Register. Procedures for evaluating cultural resources for their National Register potential are outlined in Title 36 CFR 60. After surveys are complete and this evaluation has been conducted, informed decisions can be made concerning location of facilities and development of necessary impact mitigating measures.

Copies of any comments received from the State Historic Preservation Officer should be included in the final statement. We request that copies of any archeological reports be sent to the Western Archeological Center, National Park Service, P.O. Box 49008, Tucson, Arizona 85717, so that a more comprehensive review of future project statements will be possible.

Thank you for the opportunity to review the environmental statement.

Sincerely yours,

Stanley D. Doremus

Deputy Assistant Secretary of the Interior

Mr. Duward L. Crow
Associate Deputy Administrator
National Aeronautics and Space Administration
Washington, D.C. 20546

U.S. Department of The Interior
Office of the Secretary

Comment: It was suggested that a recent acquisition for park development by the Mid-Peninsula Park Region (The Stevens Creek Shoreline Acquisition) be referenced in the statement.

Response: These 54 acres located on the east side of Stevens Creek, immediately north of the Ames Research Center, are still in the process of being acquired by the Mid-Peninsula Park Region. Its open-space use as a wildlife education area has already commenced; docent tours are being conducted for school children. The text has been expanded to include description of this adjoining land use (pp. 90 and 92).

Comment: It was suggested that information on the frequency and duration of use of the static test stand -- the closest Ames facility to the Stevens Creek Shoreline Acquisition -- be incorporated into the noise analysis.

Response: The text has been modified to show a static test stand operating schedule of one to two hours a day during early morning for approximately 18 days per year. Noise data does not permit a comparison between air traffic effects and those of the test stand at the northern boundary of the Ames Center (pp. 131-132).

Comment: It was recommended that a professional archaeologist perform an on-the-ground survey in the early planning stages of future Ames construction projects.

Response: These recommendations have been anticipated by the text (pp. 96-97).

Advisory Council
On Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

July 21, 1976

Mr. Duward L. Crow
Associate Deputy Administrator
Office of the Administrator
National Aeronautics and Space
Administration
Washington, D. C. 20546

Dear Mr. Crow:

This is in response to your request of July 8, 1976 for comments on the draft institutional environmental impact statement (DIEIS) for the National Aeronautics and Space Administration (NASA) Ames Research Center, Moffett Field, California. The Advisory Council notes from its review of the DIEIS that while NASA has determined the proposed undertaking will result in no effect to properties included in or known to be eligible for inclusion in the National Register of Historic Places, additional cultural studies will be made with respect to possible effects on archeological site number Santa Clara-23. Accordingly, NASA is reminded that should those additional studies determine that site, or others subsequently identified, will be affected, it should obtain the Council's comments in accordance with the "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800) as appropriate prior to proceeding with project implementation.

Should you have questions or require additional information, please contact Michael H. Bureman of the Council staff at P. O. Box 25085, Denver, Colorado 80225, telephone number (303) 234-4946.

Sincerely yours,

Michael H. Bureman

for Louis S. Wall
Assistant Director, Office
of Review and Compliance

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

Advisory Council on Historic Preservation

Response: No response is required.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION NINE
Two Embarcadero Center, Suite 530
San Francisco, California 94111

ARIZONA
CALIFORNIA
NEVADA
HAWAII
GUAM
AMERICAN SAMOA

IN REPLY REFER TO
9ED

August 17, 1976

Dr. Lewis Hughes
Chief, Health and Safety Office
Ames Research Center
Moffett Field, California 94035

Dear Dr. Hughes:

We have reviewed the Draft Environmental Impact Statement for Ames Research Center, Moffett Field, Santa Clara County, California.

It is noted that the traffic volume counts in Section 3.7 were taken in 1973 and 1974. It is recommended that the District 4 Office of the California Department of Transportation be contacted for an update of the traffic data. The CALTRANS District 4 address is:

Mr. T. R. Lammers, District Director
P. O. Box 3366, Rincon Annex
San Francisco, California 94119

We appreciate this opportunity to comment on the Draft EIS and would like to receive a copy of the Final Statement when it becomes available.

Sincerely yours,

F. E. Hawley
Regional Administrator

cc: Nathaniel B. Cohen, NASA Hqs., Code ADA-1
Bob Magers, 213-4

U.S. Department of Transportation
Federal Highway Administration
Region IX, San Francisco

Comment: It was recommended that more recent traffic volume counts be used in the analysis.

Response: According to the California Department of Transportation, the traffic counts cited in the report (1973 and 1974) are the most recent available.

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814
(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Navigation and
Ocean Development
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

Air Resources Board
Colorado River Board
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Lands Commission
State Reclamation Board
State Water Resources Control Board
Regional Water Quality Control Boards
Energy Resources Conservation and Development Commission

THE RESOURCES AGENCY OF CALIFORNIA

SACRAMENTO, CALIFORNIA

SEP 30 1976

Mr. Duward L. Crow
Office of the Administrator
National Aeronautics and Space
Administration
Washington, D. C. 20546

Dear Mr. Crow:

The State of California has reviewed your "Draft Institutional Environmental Impact Statement, Ames Research Center, Moffett Field, California", transmitted by Notice of Intent (SCH 76080308) dated August 8, 1976, and submitted to the Office of Planning and Research (State Clearinghouse) in the Governor's Office. This review fulfills the requirements under Part II of the U. S. Office of Management and Budget Circular A-95 and the National Environmental Policy Act of 1969.

Your Draft Statement has been reviewed by the Departments of Conservation, Fish and Game, Parks and Recreation, Water Resources, Food and Agriculture, Health, and Transportation; the Air Resources Board; the Solid Waste Management Board; the State Water Resources Control Board; the Association of Bay Area Governments; the Energy Commission; the Public Utilities Commission; and the State Lands Commission.

The Ames Research Center has done a thorough job in assessing the environmental impacts from its activities. It has objectively concluded that its activities do have an impact on the environment, particularly in the noise regime, primarily as a result of the operation of its wind tunnels.

Further, it has been and is continuing to address the noise problems to mitigate, as far as technically and economically feasible, the noise impact.

As a draft "Institutional Environmental Impact Statement", the document does not address a specific action falling in the category of a "major federal action having a significant effect upon the human environment" and, as such, is not used in the program and project decision-making process.

Most NASA Centers are located on facilities that house other activities. These other activities also could contribute to the degradation of the environment. Thus, while a NASA Center activity or project may contribute negligibly to adverse environmental impacts, the cumulative contribution of the activities of both the NASA Center and the facility on which it is housed could have a significant adverse effect. These cumulative effects should be addressed in any environmental documentation prepared for use in the decision-making process.

We concur in the conclusions of the statement that, in view of the mitigation measures already instituted and proposed, the benefits to the Nation accruing through the research efforts at this Center may outweigh the insignificant adverse impacts on the environment.

Thank you for the opportunity to review and comment.

Sincerely,

CLAIRE T. DEDRICK
Secretary for Resources

By [signature]
L. FRANK GOODSON
Assistant to the Secretary
Projects Coordinator

cc: Director of Management Systems
State Clearinghouse
Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814

Dr. Lewis Hughes, Chief
Health and Safety Office
Ames Research Center
Moffett Field, CA 94035

The Resources Agency of California

Comment: It was suggested that the statement assess the cumulative effects of on-going activities at both the Ames Research Center and the "facility on which it is housed."

Response: The only area of consequence where the cumulative effect of on-going Naval Air Station and NASA activities can be assessed is in the area of noise, and that is addressed in Section 3.6 (p. 62) and Section 5.6 (p. 115).

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
POST OFFICE BOX 2390
SACRAMENTO, CALIFORNIA 95811
(916) 445-8006

November 17, 1976

Mr. Duward Crow
Associate Deputy Administrator
National Aeronautics and Space
Administration
Office of the Administrator
Washington, D. C. 20546

Dear Mr. Crow:

The Office of Historic Preservation, California State Department of Parks and Recreation, has reviewed the Draft Institutional Environmental Impact Statement and the Draft Environmental Impact Statement (Amendment No. 1) for the proposed modification of the Subsonic Wind Tunnel located at the Ames Research Center, Moffet Field, California.

The Draft Environmental Impact Statement fails to adequately assess possible historical and architectural significance of the farm buildings, Building N-224, and Building N-223 scheduled for demolition. Compliance with the National Historic Preservation Act of 1966, as amended by 90 Stat. 1320, requires that significant cultural resources be identified for possible inclusion in the National Register of Historic Places.

The Draft Environmental Impact Statement did not address the lighter than air ship hangers located at Moffet Field. The hangers are potentially eligible for listing on the National Register. In addition, the Thererkauf House, a recently destroyed property, had been determined to be eligible for the National Register by the Secretary of the Department of the Interior.

In time, the Subsonic Wind Tunnel may also be eligible for the National Register for its engineering and architectural values. Measured drawings and photographic documentation should be provided to record the original appearance of this structure previous to the implementation of the modification proposal.

Please do not hesitate to contact Eugene Itogawa of my staff should you require further assistance in this matter.

Sincerely,

Dr. Knox Mellon
Historic Preservation Coordinator

G-3/416

California State Office of Historic Preservation
Department of Parks and Recreation

Comment: It was suggested that farm buildings, Building N-223, and Building N-224 might be historically significant.

Response: All of these buildings are less than 50 years old and do not meet the National Register criteria for properties less than 50 years old as specified in the regulations of the Advisory Committee for Historic Preservation ("Procedures for the Protection of Historical and Cultural Properties," 36 CFR Part 800).

Comment: It was suggested that the statement call out the lighter-than-air ship hangers located at Moffett Field as being potentially eligible for listing on the National Register of Historic Places.

Response: The hangers do not belong to NASA but are the property of the Navy and completely under their control and use. Thus, their status is outside the scope of this statement.

Comment: It was suggested that, in the event that the Subsonic Wind Tunnel becomes eligible for inclusion in the National Register of Historic Places, drawings and photographs describing the facility should be provided as a record of the original appearance.

Response: Such measured drawings and photographs do exist and are on file at Ames Research Center.

STATE OF CALIFORNIA—BUSINESS AND TRANSPORTATION AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF TRANSPORTATION
P. O. BOX 3366 RINCON ANNEX
SAN FRANCISCO 94119
(415) 557-1840

August 9, 1976

4-SC1-85,101,237

Mr. Duward L. Crow
Associate Deputy Administrator
National Aeronautics and
Space Administration
Washington, D. C. 20546

Dear Mr. Crow:

This is in response to your referral of Draft Institutional Environmental Impact Statement - Ames Research Center, Moffett Field, California 94035.

We have reviewed the Draft Statement and consider it to be adequate insofar as functions and responsibilities of the California Department of Transportation are concerned.

Sincerely yours,

T. R. LAMMERS
District Director

By
M. E. HARDIN
Deputy District Director

California State Department of Transportation

Response: No response is required.

City of Mountain View
City Hall
540 Castro Street
Post Office Box 10
Mountain View, CA 94042
(415) 967-7211
Department: Planning

DESIGNATED AS A
BI-CENTENNIAL CITY

January 14, 1977

Dr. Lewis Hughes
Chief Health and Safety Officer
Ames Research Center
Moffett Field, CA 94035

Dear Dr. Hughes:

Comments on Draft Institutional Environmental Impact Statement (EIS)

This is a follow-up to our recent phone conversation wherein you invited comments on the subject document. Let me say first that the idea of doing an EIS to cover existing operations is commendable and should provide the base line reference needed to make future changes (and EIS's) more meaningful. Given the importance of having such a complete document, I would offer several comments. Some comments are obviously minor and deal with apparent accuracy while others may be more substantive. In any event, they are:

a) To be truly meaningful in soliciting diverse comments, it might be desirable to have a broader local distribution of such a document such as to citizens and organizations of known interest.

b) Page 4 seems to indicate Ames as being located in Sunnyvale, whereas it is actually in Mountain View.

c) The specific solid waste transfer sites referred to on page 82 were apparently taken from the original draft County Solid Waste Management Plan. The subsequent amendment of that plan eliminated reference to such precise sites.

d) To be precise, page 95 would indicate Mr. Alsman's title as Principal Planner.

e) Page 116 states that most noise complaints come from naval housing residents. While this is no doubt the case, it is my understanding that there may be a fair number of other complaints (e.g., from the residential area south of Route 101). I would presume that your office maintains records of such complaints, perhaps by address, which could give a more accurate picture of the actual impact of the existing operation on the surrounding community. I believe that the credibility of the EIS would benefit from such an objective accounting and response.

f) With respect to Figure 23, are the peak noise figures based upon measurements with test aircraft running? I would also suggest that the document include a similar map showing noise levels in various parts of the surrounding community as they occur under the "infrequent meteorological conditions" referred to in several places.

While I feel that the subject document is generally fairly complete, I feel that it would benefit from a more thorough, objective and deliberate approach to the noise question.

Thank you for the opportunity to comment on this matter. We look forward to continued good relations between Ames Research Center and the City of Mountain View.

Very truly yours,

Glen Gentry
Director of Planning

GG/z
F/A2-3

City of Mountain View
Planning Department

Comment: It was recommended that the statement be given a broad distribution to local citizen's organizations and others of known interest.

Response: The Final Statement will be made available on request from Dr. Lewis Hughes, Chief, Health and Safety Office, Ames Research Center, Moffett Field, CA 94035, Phone: (415) 965-5107.

Comment: It was noted that the specific solid waste transfer sites, referenced in the discussion of public utilities, are no longer precisely identified in the latest County Solid Waste Management Plan.

Response: References to precise sites have been eliminated from the text (p. 80).

Comment: It was suggested that the statement include an accounting of complaints received by ARC due to noise and that such an account specify the address from which the complaint originated.

Response: As discussed in the response to a previous comment, a comprehensive study of community complaints and noise generation is currently underway. If the results of that study are deemed to be of significance, ARC will continue to work toward a reduction of the noise impact.

Comment: An explanation of the measurement of peak noise levels (depicted in Figure 20 for the 40 x 80-foot wind tunnel) was requested.

Response: The measurements represented in this figure were described in the text which answers the above question and provides further explanation (pp. 123 and 126).

Comment: It was suggested that the text include a contour map showing noise levels from ARC activities for various parts of the surrounding community under infrequent meteorological conditions.

Response: As discussed in the response to previous comments, there does not exist sufficient data to provide noise contour plots throughout the community (p. 117).

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5. National Aeronautics and Space Administration, Environmental Statement for Ames Research Center, Moffett Field, California, July 1971. Cited on p. 2.

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7. Rockrise, Odermatt, Mountjoy, Amis, "Master Plan, Ames Research Center, Moffett Field, California, 19751985," for National Aeronautics and Space Administration, September 7, 1973. Cited on p. 11.

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3. Ruth and Going, Norton S. Curtiss, Inc., "Environmental Impact Appraisal on Addition to Roads for Security and Flood Control, F.Y. 1975," June, 1975.

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APPENDICES

APPENDIX A-1

ARCHAEOLOGIC AND HISTORIC FEATURES

The history of the northern Santa Clara Valley involves four phases: the Indian Era (early and recent) from several thousand years ago up to 1848 (1769),* the Spanish-Hispanic Period from 1542 (1769) to 1822 (1836), the brief Mexican-Hispanic period from 1822 (1836) to 1848, and the American period from 1848 to present. Although some remains from each period exist within the northern Santa Clara Valley, remains have been destroyed over large areas. Some Indian and early American period remains still exist within the boundaries of Ames (Fig. 7). Some physical remains of the three early periods had existed on the Research Center grounds, but have been unintentionally disturbed by farming, and subsequent filling, excavation, and construction during the past 100 years. This study of the archaeologic and historic remains indicates that many areas have been adversely affected by prior activities, but that some remains may yet be preserved, either below existing facilities or in the relatively less disturbed areas of the northwest quadrant of the facility area.

This study has been based entirely upon the review of existing documents, maps, and historic accounts, and upon interviews with individuals familiar with the resources of the area. Surveys of exposed lands were not conducted, and no evaluations of existing structures were made for their historic interests.

---

*Dates in parentheses are important to California history, while those without are taken from the California History Plan (California State Department of Parks and Recreation, 1973).

Historic documents and earlier archaeologic surveys of the Moffett Field area generally indicate that large groups of Indians occupied the local area. At least nine areas of archaeologic remains have been recorded (Treganza Museum, San Francisco State University) within the Moffett Field and Ames area (Fig. 7). These occupation sites include the "Costanoan" village called Posolmi (Kroeber, 1925 and 1953). Several environmental features indicate a high probability of archaeologic remains within the area. Joint occurrence of the freshwater Stevens Creek, of Bay mudflats for shellfish and marshes for waterfowl, and land above mean higher tidel level would provide excellent supportive conditions for early occupation of the area. This has been confirmed by the presence of occupation sites.

The Indian refuse disposal sites ("kitchen" or shell middens) in the general Moffett Field area may be equivalent to that referenced by DeAnza in 1776 (Indian village north along the trail to San Francisco from several villages on Guadalupe River). The Santa Clara Mission records in 1777 refer to a tribelet of "Xa de los Yamloquis" along the old road to San Francisco (the lower or summer road) and near Stevens Creek (ESA and ARS, 1974). A field reconnaissance and maps of the Treganza Museum have located a site designated as Santa Clara 23 in the cultivated field within the western portion of Ames.

No physical evidence of the Spanish and Mexican periods can be accurately attributed to the facility area. However, some deductions are possible from the general history of the area. During the 1830s and 1840s, the Santa Clara Valley had a thriving hides/tallow industry. In order to transport these materials to San Francisco, small boats were brought into the channels which passed through the mudflats and marshes and reached the creeks. The landings for these boats and the access roads probably formed the initial core for future development in the low-lying areas. In the general vicinity of Stevens Creek, two landings have been located. The landing at the northern end of the Moffett runways has been variously called the Whisman Landing (1858), the

Bernard Landing (1876), and the Jagel Landing (1899 to 1944). The landing west of Stevens Creek was called both the Rengstorff (1876) and Guth Landing (1899 to 1944). The old roads to the landings are now called Whisman Road and Stierlin Road. These landings and roads have been covered and disturbed by recent construction and filling, although remains may still exist below the surface. In 1844, Governor Micheltorena granted the Rancho Posolmi or "Ynigo Reservation" to Lope Ynigo. The grant boundaries are still apparent on maps. The reservation accommodated many of the mission Indians displaced from the Santa Clara Mission during and following the "secularization" of the missions of California. Unfortunately, no records of structures or other physical evidence on the Ynigo Reservation were found. The 1859 location of the Ynigo residence at the southeast corner of the reservation may indicate that most physical remains of this period would be found in that area and away from the Ames area. Furthermore, the access road to Whisman Landing and the landing itself lie to the east of the Ames area, and any remains would have been covered during the early construction of Moffett Field.

The first factual evidence of historic structures near ARC is recorded in the map of the Rancho Posolmi prepared by Charles T. Healy for the U.S. Surveyor General in 1859, ten years after the separation of California from Mexico. On this map, five structures, the Whisman Landing, the landing road, and the old San Francisco and Alviso roads are located, but all are beyond the present boundaries of the Ames area. One residence is attributed to Ynigo and may have been near the area of his grave (marked by members of the Sunnyvale Historic Society). The Ames area did not include any structures, but such structures may not have been recorded beyond the limits of the Rancho Posolmi. Areas between the Rancho and the present Stevens Creek are called "Public Land," and the historic position of the creek is not indicated.

Although the Healy Map of Rancho Posolmi in 1859 and the California Geological Survey Map of 1873 did not indicate any structures or roads on the public lands west of the Rancho, Thompson and West's map of 1876 and the U.S. Geological Survey's maps of the Palo Alto Quadrangle (15-minute) for 1899 and 1944 indicate that land ownership and structures did exist in the Ames area. During the early American period in Santa Clara Valley, large tracts of the old grants and remaining public lands were subdivided into small farms. The construction of the Southern Pacific main line established the dominant area of urban development along the El Camino Real (the San Jose-San Francisco Road). The old alignments of the Whisman and Stierlin roads formed the secondary corridors of development. Most farm buildings were located along these two major roads, although by 1876 four farms had been subdivided on the public lands between Stevens Creek and the Rancho Posolmi. Two of these farms and their structures did lie within the Ames boundaries. The others were located between Ames and Bayshore Freeway.

The U.S. Geologic Survey map of 1899 (reprinted 1944) displays the location of many structures within Rancho Posolmi and along Stevens Creek. Although the 1876 map indicated only one structure per parcel, the USGS map of 1899 more accurately indicates several buildings at the approximate locations of the early map. The 1899 map indicates three or four buildings at the same location as the Crittenden structure of 1876. The Whelan structure is not located at the site indicated on the 1876 map, although three buildings were located at the northwest corner of the old Whelan property, along the east bank of Stevens Creek. The bridging of Stevens Creek to the Crittenden farm and the old Whelan farm also occurred between 1876 and 1899, and clearly established the importance of these two parcels and their use. The structures on the Richardson and Snyder farms south along Stevens Creek from the Crittenden farm (and Ames) were not recorded on the map of 1899, and they are assumed to have been destroyed.

The 1899 map also indicates five buildings and a couple of piers at "Jagel's Landing." The USGS map of 1944 (a new map based on aerial photos and new surveys) includes the first locations of Moffett Field facilities and runways. Four or five buildings were located at the Crittenden farm site in the 1876 and 1899 maps, while three buildings were located at the northwest Whelan site. Unfortunately, the precise locations of buildings on the 1944 and 1899 maps do not agree. However, the accuracy of the 15-minute quadrangle cannot be considered as sufficient to determine when buildings were moved, destroyed or replaced. No other historic building site is located within the Ames area.

A local historic marker has been erected near the site of the Whisman building site to commemorate its historic importance. However, no federal or state landmark of historic significance is located within ARC. Recent discussions were held with the U.S. Navy regarding the historic significance of the Therekauf farmhouse, which was located west of ARC near existing naval residences. The structure was considered for registration as a federal historic landmark, but burned down July 7, 1976.

In summary, the known and potential occurrence of archaeologic artifacts and other remains of the Indian Era generally exists throughout the Ames area and specifically in the old farm areas along Stevens Creek. One recorded site exists in the northwest sector of the area. Three historic building sites (no structures presently exist) occur within the present boundaries of Ames. The building sites are about in the same areas with known archaeologic sites. The building sites are about 100 years old and were part of the farming development of the Santa Clara Valley following the Civil War. No building is known to be more than 50 years old within the Ames area, and most structures are 30 years old or less.

APPENDIX A-2

BIOTIC SPECIES FOUND OR EXPECTED AT AMES

LATIN NAME	COMMON NAME
	PLANT SPECIES
Allium sp.	Wild onion
Amsinckia sp.	Fiddleneck
Anthemis cotolua	Mayweed
Artemisia sp.	Sagebrush (N)
Athysanus pusillus	Athysanus
Avena barbata	Slender wild oat
Avena fatua	Wild oat
Baccharis viminea	Mulefat (N)
Brassica geniculata	Summer mustard
Brodiaea pulchella	Wild hyacinth
Bromus tectorum	Cheat grass
Calandrinia ciliata	Red maids
Capsella bursa-pastoris	Shepard's purse
Centaurea melitensis	Tocalote (N)
Chenopodium album	Lamb's quarters
Cotula coronopifolia	Brass buttons
Cynodon dactylon	Bermuda grass
Cyperus sp.	Cyperus (N)

Source: Scientific and common names from Munz (1970), A California Flora.

KEY: (N) = Native Plant

LATIN NAME	COMMON NAME
	PLANT SPECIES continued
Erodium sp.	Filaree
Helcocharis palustris	Spike rush (N)
Hemizonia ramosissima	Tarweed (N)
Lactuca serriola	Prickly lettuce
Lepidium nitidum	Peppergrass
Lolium multiflorum	Italian ryegrass
Lotus purshianus	Bird's-foot trefoil (N)
Lupinus sp.	Lupine
Malva parviflora	Cheeseweed
Medicago hispida	Bur clover
Melilotus spp.	Sweetclovers
Nemophila menziesii	Baby blue eyes
Pelargonium spp.	Cultivated geranium
Orthocarpus erlanthus	Butter and eggs
Picris echioides	Ox tongue
Plagiobothrys	
Polygonum aviculare	Common knotweed
Polypogon monspeliensis	Rabbitfoot grass
Prunus persica	Peach
Pyracantha sp.	Pyracantha
Raphanus sativa	Wild radish
Rumex crispus	Curly dock
Salsola kali	Russian thistle
Sanicula sp.	Sanide
Sysmbrium sp.	Mustard
Veronica persica	Veronica
Zanthium strumarium	Cocklebur

LATIN NAME	COMMON NAME
PLANT SPECIES continued	
Artiplex sp.	Salt bushes
Distichlis spicata	Salt grass
Grindelia humitis	Gum plant
Frankenia grandifolia	Alkali heath
Limonium californica	Sea lavender
Jaumea carnosa	Jaumec
Salicornia pacifica	Pickle weed
Spartina sp.	Cordgrass
Lepidium oxycarpum	Pepper-grass
Stellaria sp.	Check weed
Spergularia marina	Sand Spurrey
Montia perfoliata	Miner's lettuce
Anagallis arvensis	Scarlet pimpernel
Lathyrus sp.	Pea
Conium maculatum	Poison hemlock
Foeniculum vulgare	Fennel
Baccharis pilularis	Coyote bush
Senecio sp.	Groundsel
Silvbum marianum	Milk thistle
Circium lanceolatum	Bull thistle
Sonchus asper	Prickly sow-thistle
Hordeum sp.	Foxtail
Lolium multiflorum	Italian ryegrass
Avena sp.	Wild oat
VERTEBRATE SPECIES	
Rana catesbeiana	Bullfrog
Clemmys marmorata	Western pond turtle
Eumeces skiltonianus	Western skink
Diadophis punctatus	Ringneck snake

LATIN NAME	COMMON NAME
	VERTEBRATE SPECIES continued
Contia tenuis	Sharp-tailed snake
Coluber constrictor	Racer
Lampropeltis getulus	Common kingsnake
Thamnophis elegans	Western terrestrial garter snake
Thamnophis sirtalis	Common garter snake
	TERRESTRIAL BIRDS
Catharties aura	Turkey vulture
Elanus leucurus	White-tailed kite
Buteo jamaicensis	Red-tailed hawk
Buteo lagopus	Rough-legged hawk
Aquila chrysaetos	Golden eagle
Circus cyaneus	Marsh hawk
Falco mexicanus	Prairie falcon
Falco sparverius	Sparrow hawk
Phasianus colchicus	Ring-necked pheasant
Columba livia	Rock dove (domestic pigeon)
Zenaidura macroura	Mourning dove
Tyto alba	Barn own
Speotyto cunicularia	Burrowing owl
Asio flammeus	Short-eared owl
Aeronautes saxatalis	White-throated Swift
Calypte anna	Anna's hummingbird
Colaptes cafer	Red-shafted flicker
Tyrannus verticalis	Western kingbird
Myiarchus cinerascens	Ash-throated fly-catcher
Sayornis nigricans	Black phoebe

LATIN NAME	COMMON NAME
	TERRESTRIAL BIRDS continued
Sayornis saya	Say's phoebe
Eremophila alpestris	Horned lark
Tachycineta thalassina	Violet-green swallow
Iridoprocne bicolor	Tree swallow
Stelgidopteryx rufucollis	Rough-winged swallow
Hirundo restica	Barn swallow
Petrochelidon pyrrhonota	Cliff swallow
Aphelocoma coerulescens	Scrub jay
Corvus corax	Common raven
Corvus brachyrhynchos	Crow
Telmatodytes palustrus	Long-billed marsh wren
Mimus polyglottos	Mockingbird
Turdus migratorius	Robin
Ixoreus naevius	Varied thrush
Sialia mexicana	Western bluebird
Anthus spinoletta	Water pippit
Bombycilla cedrorum	Cedar waxwing
Lanius ludovicianus	Loggerhead shrike
Sturnus vulgaris	Starling
Dendrocia auduboni	Audubon's warbler
Geothylpis trichas	Yellowthroat
Passer domesticus	House sparrow
Sturnella neglecta	Western meadowlark
Agelaius phoeniceus	Red-winged blackbird
Euphagus cyanocephalus	Brewer's blackbird
Melothrus ater	Brown-headed cowbird
Carpodacus cassinii	Cassin's finch
Carpodacus mexicanus	House finch
Spinus pinus	Pine siskin

LATIN NAME	COMMON NAME
TERRESTRIAL BIRDS continued	
Spinus tristis	American goldfinch
Spinus psaltria	Lesser goldfinch (green-backed)
Passerculus sandwichensis	Savannah sparrow
Zonotrichia leucophrys	White-crowned sparrow
Zonotrichia atricapilla	Golden-crowned sparrow
Passerella iliaca	Fox sparrow
Melospiza melodia	Song sparrow
AQUATIC BIRDS	
Podiceps caspicus	Eared grebe
Aechmophorus occidentalis	Western grebe
Pelecanus erythrorhynchos	White pelican
Ardea herodias	Great blue heron
Casmerodius albus	Common egret
Anas platyrhynchos	Mallard
Anas acuta	Pintail
Anas cyanoptera	Cinnamon teal
Spatula clypeata	Shoveler
Aythya marila	Greater scaup
Aythya affinis	Lesser scaup
Melanitta perspicillata	Surf scoter
Fulica americana	American coot
Charadrius vociferus	Killdeer
Catoptrophorus semipalmatus	Willet
Limosa fedoa	Marbled Godwit
Recurvirostra americana	American avocet
Himantopus mexicanus	Black-necked stilt
Larus occidentalis	Western gull
Larus argentatus	Herring gull
Sterna forsteri	Forster's tern
Hydroprogne caspia	Caspian tern

LATIN NAME	COMMON NAME
	TERRESTRIAL MAMMALS
Didelphis marsupialis	Opossum
Scapanus latimanus	Broad-handed mole
Sorex trowbridgei	Trowbridge shrew
Eptesicus fuscus	Big brown bat
Antrozous pallidus	Pallid bat
Tadarida brasiliensis	Mexican free-tailed bat
Procyon lotor	Raccoon
Mustela frenata	Long-tailed weasel
Mephitis mephitis	Striped skunk
Citellus beecheyi	Beechey ground squirrel
Thomomys bottae	Botta pocket gopher
Perognathus californicus	California pocket mouse
Reithrodontomys megalotis	Western harvest mouse
Reithrodontomys raviventris	Salt marsh harvest mouse
Peromyscus maniculatus	Deer mouse
Microtus californicus	California meadow mouse
Ondatra zibethica	Muskrat
Rattus norvegicus	Norway rat
Rattus rattus	Black rat
Mus musculus	House mouse
Lepus californicus	Black-tailed hare (Jackrabbit)
Sylvilagus audubonii	Audubon cottontail
Sulvilagus bachmani	Brush rabbit

Source: Ruth, 1969

APPENDIX A-3

LEVELS OF SERVICE

DEFINITIONS

This is a concept employed by highway and traffic engineers to describe traffic operating conditions on any type of road facility. The following descriptions of operating conditions are broadly generalized. Level of service A represents the best conditions; level F is the worst. Level C is an acceptable condition for which most highway agencies have designed in the past. Level D is becoming more acceptable as congestion increases and highway funds diminish. Levels E and F would constitute an adverse impact.

Level of service A describes a condition of free flow, with low volumes and high speeds. Traffic density is low, with speeds controlled by driver desires, speed limits, and physical roadway conditions. There is little or no restriction in maneuverability due to the presence of other vehicles, and drivers can maintain their desired speeds with little or no delay.

Level of service B is in the zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane of operation. Reductions in speed are not unreasonable, with a low probability of traffic flow being restricted. The lower limit (lowest speed, highest volume) of this level of service has been associated with service volumes used in the design of rural highways.

Level of service C is still in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. Most of the drivers are restricted in their freedom to select their own speed, change lanes, or pass. A relatively satisfactory operating speed is still obtained, with service volumes perhaps suitable for urban design practice.

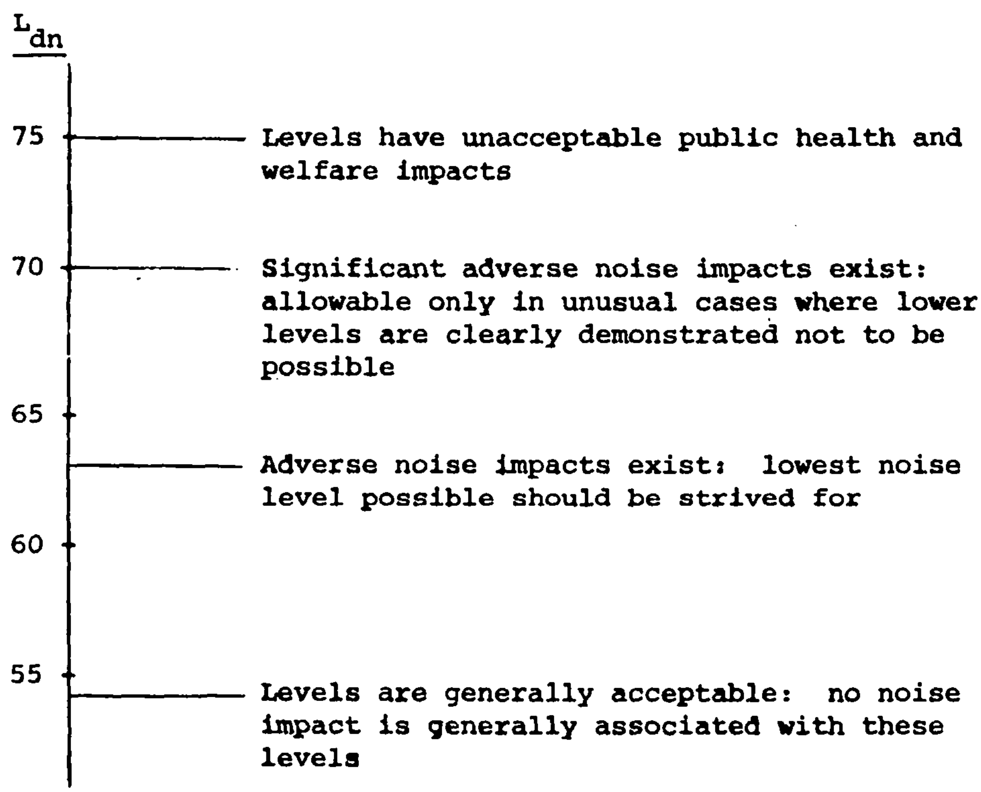
Level of service D approaches unstable flow, with tolerable operating speeds being maintained though considerably affected by changes in operating conditions. Fluctuations in volume and temporary restrictions to flow may cause substantial drops in operating speeds. Drivers have little freedom to maneuver, and comfort and convenience are low, but conditions can be tolerated for short periods of time.

Level of service E cannot be described by speed alone, but represents operations at even lower operating speeds than in level D, with volumes at or near the capacity of the highway. At capacity, speeds are typically, but not always, in the neighborhood of 30 mph. Flow is unstable, and there may be stoppages of momentary duration.

Level of service F describes forced flow operation at low speeds, where volumes are below capacity. These conditions usually result from queues of vehicles backing up from a restriction downstream. The section under study will be serving as a storage area during parts or all of the peak hour. Speeds are reduced substantially and stoppages may occur for short or long periods of time because of the downstream congestion. In the extreme, both speed and volume can drop to zero.

APPENDIX A-4

QUALITATIVE CONSIDERATIONS ASSOCIATED WITH VARIOUS L_{dn} NOISE LEVELS*



* U.S. Environmental Protection Agency, Region IX.