AMXTH-AS-IA-82341

INSTALLATION ASSESSMENT OF THE HEADQUARTERS, 1ST INFANTRY DIVISION (MECHANIZED) AND FORT RILEY, KANS.
REPORT NO. 341

B.N. McMaster, C.D. Hendry, J.D. Bonds, S.A. Denahan, C.F. Jones, D. F. McNeill, C.R. Neff, and K.A. Civitarese

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
P.O. Box ESE
Gainesville, Fla. 36202

December 1984

Prepared for:

COMMANDER
Headquarters, 1st Infantry Division (Mechanized) and Fort Riley, Fort Riley, Kansas.
66442

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
Assessments Division
Aberdeen Proving Ground, MD 21010-5401

INSTALLATION ASSESSMENT

OF

FORT RILEY, KS

Report No. 341

ACKNOWLEDGED: [signature]

JOHN A. SEITZ III
Colonel, FA
Deputy Post Commander

APPROVED: [signature]

PETER D. HIDALGO
Colonel, CmlC, Commanding
US Army Toxic and Hazardous
Materials Agency

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER AMXTH-AS-IA-82341	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Installation Assessment of the Headquarters, 1st Infantry Division (Mechanized) and Fort Riley, Kans.		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER ESE-341
7. AUTHOR(s) B.N. McMaster, C.D. Hendry, J.D. Bonds, S.A. Denahan, C.F. Jones, D.F. McNeill, C.R. Neff, and K.A. Civitarese		8. CONTRACT OR GRANT NUMBER(s) DAAK11-81-C-0093
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Science and Engineering, Inc. P.O. Box ESE Gainesville, Fla. 32602		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS N/A
11. CONTROLLING OFFICE NAME AND ADDRESS Commander, Headquarters, 1st Infantry Division and Fort Riley Fort Riley, Kans. 66442		12. REPORT DATE December 1984 13. NUMBER OF PAGES 233
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) U.S. Army Toxic and Hazardous Materials Agency Assessments Division Aberdeen Proving Ground, Md. 21010-5401		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

Distribution limited to U.S. Government Agencies only for protection of privileged information evaluating another command: December 1984. Requests for this document must be referred to: Commander, Headquarters, 1st Infantry Division (Mechanized) and Fort Riley, Fort Riley, Kans. 66442.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

N/A

18. SUPPLEMENTARY NOTES

N/A

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

An onsite installation assessment was conducted Dec. 12-16, 1983, at the Headquarters, 1st Infantry Division (Mechanized) and Fort Riley (FR), Kans., to determine the presence of any toxic or hazardous materials and to assess the potential for offpost migration. In addition, limited onsite sampling was conducted Apr. 26-28, and subsequent analyses indicated that significant migration was not occurring. Based on the findings of this assessment, a field survey was not recommended.

SUMMARY

An onsite installation assessment was conducted Dec. 12-16, 1983, at the Headquarters, 1st Infantry Division (Mechanized) and Fort Riley (FR), Kans., to assess past and current use of toxic and hazardous materials, as well as the potential for these substances to migrate off the installation.

The Initial Installation Assessment (IIA) determined that toxic/hazardous wastes (primarily waste oils and degreasing solvents) were formerly (mid-1950s to 1970) disposed of in the landfill southwest of Camp Funston. This landfill, which was closed in 1981, is located in very permeable alluvial deposits adjacent to the Kansas River, which forms the installation boundary. Therefore, a limited sampling and analysis program was performed by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) involving the sampling of ground water monitor wells that had been installed around this landfill, as required by the state of Kansas closure plan. Limited geohydrological and water quality data do not indicate that contaminants are migrating at significant levels from the landfill.

Additionally, the IIA identified the following problem areas:

1. Caustic sodium hydroxide cleaning solution generated by engine parts cleaning operations at the Directorate of Industrial Operations maintenance facility and the Directorate of Personnel and Community Activities Automotive Self-Help Shop is disposed of to the sanitary sewer system. This solution may be classified as a hazardous waste due to corrosivity. Subsequent to the site visit, the following actions were reported by the installation: The decision to discharge caustic solution to the sanitary sewer will be based on the

results of laboratory analyses for corrosivity and trace metals content. The discharge of caustic cleaning solution to the sewer system is prohibited without prior consultation with the facilities engineer.

2. Nonhazardous waste degreasing solvents generated by the Directorate of Industrial Operations aircraft maintenance shop are disposed of by dumping into a wash rack drain that is connected to the sanitary sewer system. This disposal of waste petroleum, oils, and lubricants is not in accordance with Army regulations. Subsequent to the site visit, the following actions were reported by the installation: Aircraft maintenance activities have been advised to dispose of waste degreasing solvents by transfer to the Defense Property Disposal Office.
3. Tetrachloroethylene is used as a solvent to clean paint spray equipment in the Directorate of Industrial Operations furniture shop. Wastes (residues, rags, containers) from this operation are disposed of in the post sanitary landfill, contrary to Federal Resource Conservation and Recovery Act regulations. Subsequent to the site visit, the following actions were reported by the installation: The furniture shop has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.
4. Tetrachloroethylene is used to clean printing equipment at the Adjutant General print plant. Wastes (residues, rags, containers) are disposed of in the sanitary landfill. This disposal practice is not in accordance with Federal Resource Conservation and Recovery Act regulations. Subsequent to the site visit, the following actions were reported by the installation: The print plant has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.

5. Still bottoms from distillation of tetrachloroethylene drycleaning solvent at the Directorate of Industrial Operations drycleaning plant have been periodically disposed of on the ground behind Bldg. 109. Tetrachloroethylene still bottoms are a designated Resource Conservation and Recovery Act hazardous waste. Subsequent to the site visit, the following actions were reported by the installation: The soil in the vicinity of Bldg. 109 will be sampled and analyzed for tetrachloroethylene. Based on the results of these analyses, soil decontamination will be conducted, as necessary.
6. Trichloroethane and trichlorotrifluoroethane (Freon®) solvents used in the Directorate of Industrial Operations oil analysis laboratory are disposed of by comingling with nonhazardous waste motor oils that are contract sold to recycling companies through the Defense Property Disposal Office. This disposal practice is not in accordance with Federal Resource Conservation and Recovery Act regulations. Subsequent to the site visit, the following actions were reported by the installation: The oil analysis laboratory has been advised to dispose of waste solvents by transfer to the Defense Property Disposal Office.
7. Waste mercury generated from breakage of laboratory instruments has been disposed of in the post sanitary landfill. Since 1982, the waste mercury has been accumulated for disposal by hazardous waste contract. It may be possible to recycle/reclaim this waste mercury through supply channels. Subsequent to the site visit, the following actions were reported by the installation: The feasibility of recycling mercury wastes from breakage of laboratory instruments is being investigated.
8. Pesticides in the soil and stream sediments behind Bldg. 292 present a potential environmental hazard due to pesticide contamination. Subsequent to the site visit, the following actions were reported by the installation: The soil and stream

sediments in the drainageway behind Bldg. 292 will be resampled and analyzed for pesticides. Based on the results of these analyses, soil decontamination will be conducted, as necessary.

9. The Directorate of Personnel and Community Activites golf course pesticide storage facility is not weatherproof, the storage area is not curbed, and potable water sources used for obtaining mixing water are not equipped with backflow-prevention devices, contrary to U.S. Environmental Protection Agency regulations. Subsequent to the site visit, the following actions were reported by the installation: Actions are being taken to provide the storage building with expedient weatherproofing and a backflow-prevention device. The feasibility of constructing a more satisfactory storage facility is being investigated.

10. The installation is conducting sampling and analysis of out-of-service transformers prior to turn-in to the Defense Property Disposal Office. Subsequent to the site visit, the following actions were reported by the installation: The transfer of accountability (for disposal) of four polychlorinated biphenyl items to the Defense Property Disposal Office was accomplished in August 1984. No sampling was performed due to a waiver of the requirement by the Defense Property Disposal Office. The installation intends to sample and transfer all future waste polychlorinated biphenyl items, as needed. The installation intends to temporarily store selected waste polychlorinated biphenyl items, as needed.

11. A continuous, 0.6-meter (m) soil cover is not being maintained on the former sanitary landfill, as required by the state of Kansas closure plan. Subsequent to the site visit, the following actions were reported by the installation: A sign which prohibits the disturbance of surface soils at the closed landfill has been posted. The installation intends to place soil cover in the eroded areas of the landfill.

12. The installation is in the process of abandoning three former water supply wells located near the former Camp Funston landfill. This abandonment will be conducted in accordance with state of Kansas procedures. Subsequent to the site visit, the following actions were reported by the installation: The landfill monitor wells were sampled by a private contractor, and the samples were sent to the U.S. Army Environmental Hygiene Agency for analysis in September 1984. The installation plans to comply with the state of Kansas request for biennial reporting of landfill ground water quality data.
13. The installation is in the process of developing and implementing a sampling and analysis plan for the former Camp Funston landfill in accordance with the state of Kansas closure plan for the landfill. Subsequent to the site visit, the following actions were reported by the installation: The installation plans to decommission the three former water supply wells in the vicinity of the Camp Funston landfill in Fiscal Year 1985 or 1986.
14. The installation is using a number of listed hazardous solvents for industrial operations for which there may be acceptable nonhazardous substitutes. Subsequent to the site visit, the following actions were reported by the installation: The installation has taken action to substitute nonhazardous solvents for hazardous solvents, where feasible.

Based on the results of limited sampling and analysis, which do not indicate that contaminants from the landfill are migrating at significant levels from the landfill, a survey by USATHAMA is not recommended at this time. However, the following actions by FR are recommended:

1. Perform a pH test of the caustic cleaning solution to determine if the waste meets the Resource Conservation and Recovery Act corrosivity characteristic and take appropriate action. Subsequent to the site visit, the following actions were

reported by the installation: The decision to discharge caustic solution to the sanitary sewer will be based on the results of laboratory analyses for corrosivity and trace metals content. The discharge of caustic cleaning solution to the sewer system is prohibited without prior consultation with the facilities engineer.

2. Properly dispose of waste degreasing solvents generated by the Directorate of Industrial Operations aircraft maintenance operation. Subsequent to the site visit, the following actions were reported by the installation: Aircraft maintenance activities have been advised to dispose of waste degreasing solvents by transfer to the Defense Property Disposal Office.
3. Properly dispose of tetrachloroethylene-contaminated wastes generated by cleaning paint spray equipment at the Directorate of Industrial Operations furniture shop. Subsequent to the site visit, the following actions were reported by the installation: The furniture shop has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.
4. Properly dispose of tetrachloroethylene-contaminated wastes generated by cleaning operations at the Adjutant General print plant. Subsequent to the site visit, the following actions were reported by the installation: The print plant has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.
5. Conduct sampling and analysis of tetrachloroethylene-contaminated soil behind Bldg. 109 and take appropriate action, including removal and proper disposal of contaminated materials. Institute procedures to ensure proper disposal of the tetrachloroethylene still bottoms in the future. Subsequent to the site visit, the following actions were reported by the installation: The soil in the vicinity of Bldg. 109 will be sampled and analyzed for tetrachloroethylene.

Based on the results of these analyses, soil decontamination will be conducted, as necessary.

6. Properly dispose of waste trichloroethane and trichlorotrifluoroethane solvents generated by the Directorate of Industrial Operations oil analysis laboratory. Subsequent to the site visit, the following actions were reported by the installation: The oil analysis laboratory has been advised to dispose of waste solvents by transfer to the Defense Property Disposal Office.
7. Investigate the feasibility of recycling/reclaiming waste mercury through supply channels. Subsequent to the site visit, the following actions were reported by the installation: The feasibility of recycling mercury wastes from breakage of laboratory instruments is being investigated.
8. Perform sampling and analysis of soils and sediments in the stream behind Bldg. 292 to determine the extent of pesticide contamination and take appropriate action. Subsequent to the site visit, the following actions were reported by the installation: The soil and stream sediments in the drainageway behind Bldg. 292 will be resampled and analyzed for pesticides. Based on the results of these analyses, soil decontamination will be conducted, as necessary.
9. Bring the Directorate of Personnel and Community Activities golf course pesticide storage facility into compliance with U.S. Environmental Protection Agency regulations. Use backflow-prevention devices on potable water sources that are used for pesticide mixing or equipment rinsing. Subsequent to the site visit, the following actions were reported by the installation: Actions are being taken to provide the storage building with expedient weatherproofing and a backflow-prevention device. The feasibility of constructing a more satisfactory storage facility is being investigated.
10. Continue with the program to sample and analyze transformer fluids and turn these items in to the Defense Property Disposal

Office. Subsequent to the site visit, the following actions were reported by the installation: The transfer of accountability (for disposal) of four polychlorinated biphenyl items to the Defense Property Disposal Office was accomplished in August 1984. No sampling was performed due to a waiver of the requirement by the Defense Property Disposal Office. The installation intends to sample and transfer all future waste polychlorinated biphenyl items, as needed. The installation intends to temporarily store selected waste polychlorinated biphenyl items, as needed.

11. Maintain proper soil cover on the former sanitary landfill. Subsequent to the site visit, the following actions were reported by the installation: A sign which prohibits the disturbance of surface soils at the closed landfill has been posted. The installation intends to place soil cover in the eroded areas of the landfill.

12. Continue with the program to develop and implement a sampling and analysis program for the monitor wells around the Camp Funston landfill. Provide water quality data from this program to USATHAMA for review and assessment. Subsequent to the site visit, the following actions were reported by the installation: The landfill monitor wells were sampled by a private contractor, and the samples were sent to the U.S. Army Environmental Hygiene Agency for analysis in September 1984. The installation plans to comply with the state of Kansas request for biennial reporting of landfill ground water quality data.

13. Continue with the program to abandon the three former water supply wells near the former Camp Funston landfill. Subsequent to the site visit, the following actions were reported by the installation: The installation plans to decommission the three former water supply wells in the vicinity of the Camp Funston landfill in Fiscal Year 1985 or 1986.

14. Institute a program to substitute hazardous solvents with nonhazardous counterparts. Subsequent to the site visit, the following actions were reported by the installation: The installation has taken action to substitute nonhazardous solvents for hazardous solvents, where feasible.

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ACR	Armored Cavalry Regiment
A.D.	anno Domini
AG	Adjutant General
Ag	silver
AMC	U.S. Army Materiel Command
AMCCOM	U.S. Army Armament, Munitions, and Chemical Command
APG-EA	Aberdeen Proving Ground-Edgewood Area
API	American Petroleum Institute
AQCR	Air Quality Control Region
AR	Army Regulation
As	arsenic
ASP	ammunition supply point
Ba	barium
B.C.	before Christ
BOD	biochemical oxygen demand
BPT	best practical treatment
BTU/hr	British thermal units per hour
BUSH	n-butyl mercaptan
°C	degrees Celsius
C-4	composition-4
$CaCO_3$	calcium carbonate
cal	caliber
CB	chemical/biological
Cd	cadmium
CDTA	cyclohexane diamine tetraacetic acid
CE	U.S. Army Corps of Engineers
CECOM	U.S. Army Communications and Electronics Command
CG	phosgene
cm	centimeters
COD	chemical oxygen demand
Cr	chromium
CS	riot control agent (o-chlorobenzylidene malononitrile)

dBA	decibels, A-weighted
DCE	Director/Directorate of Communications and Electronics
DDD	dichlorodiphenyldichloroethane
DDE	1,1,dichloro-2,2-bis(4-chlorophenyl)-ethylene
DDESB	Department of Defense Explosives Safety Board
DDS	Director/Directorate of Dental Services
DDT	dichlorodiphenyltrichloroethane
DECON	decontamination
DHS	Director/Directorate of Health Services
DENTAC	U.S. Army Dental Department Activity
DFAE	Director/Directorate of Facilities Engineering
DIO	Director/Directorate of Industrial Operations
DMA	U.S. Defense Mapping Agency
DOD	U.S. Department of Defense
DPCA	Director/Directorate of Personnel and Community Activities
DPD	n,n-diethyl-P-phenylenediamene
DPDO	Defense Property Disposal Office
DPT	Director/Directorate of Plans and Training
DRCS	Director/Directorate of Reserve Component Support
DS-2	decontaminating solution-2
DSEC	Director/Directorate of Security
ECS	equipment concentration site
EIS	environmental impact statement
EOD	explosive ordnance disposal
EODCC	Explosive Ordnance Detachment Command Center
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ESE	Environmental Science and Engineering, Inc.
FOR	Forsyth
FORSCOM	U.S. Army Forces Command
FR	Headquarters, 1st Infantry Division (Mechanized) and Fort Riley
ft	foot/feet
FTX	field training exercise

FUN	Funston
FWS	U.S. Fish and Wildlife Service
ga	gauge
gal	gallons
GC/MS	gas chromatography/mass spectrometry
gpm	gallons per minute
H	mustard
ha	hectares
HE	high explosive
HEAT	high explosive antitank
HEP	high explosive plastic
Hg	mercury
HP	high pressure
IAH	Irwin Army Hospital
I.D.	identification
ID	inside diameter
IIA	Initial Installation Assessment
in	inches
ISSA	Inter/Intraservice Support Agreement
KDHE	State of Kansas, Department of Health and Environment
kg	kilograms
kg/yr	kilograms per year
km	kilometers
KNG	Kansas National Guard
kph	kilometers per hour
l	liters
L	lewisite
LAO	Logistics Assistance Office
LAW	light antitank weapon
lb	pounds
lb/hr	pounds per hour
l/month	liters per month
lpm	liters per minute
lpy	liters per year

m	meters
m^2	square meters
m^3	cubic meters
MAAF	Marshall Army Airfield
MATES	Mobilization and Training Equipment Site
mCi	millicuries
MCL	maximum contaminant level
MEDDAC	U.S. Army Medical Department Activity
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MICOM	U.S. Army Missile Command
ml	milliliter
MLD	million liters per day
mm	millimeters
MSL	mean sea level
N	nitrogen
NATO	North Atlantic Treaty Organization
NBC	nuclear, biological, chemical
NCO	Noncommissioned Officer
n.d.	not dated
NIPDWR	National Interim Primary Drinking Water Regulations
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSDWR	National Secondary Drinking Water Regulations
Pb	lead
PCB	polychlorinated biphenyl
pCi/l	picocuries per liter
PEG 200	polyethylene glycol
POL	petroleum, oils, and lubricants
POTWs	publically owned treatment works
ppm	parts per million
PS	chlorpicrin
PVC	polyvinyl chloride
PVNTMED	Preventive Medicine

RCRA	Resource Conservation and Recovery Act
RPO	Radiation Protection Officer
RW	raw water
SCAITS	Simulant Chemical Agent Identification Training Sets
Se	selenium
SPCC/ISCP	Spill Prevention Control and Countermeasure/Installation Spill Contingency Plan
STB	supratopical bleach
STORET	Storage and Retrieval
TACOM	U.S. Army Tank-Automotive Command
TASC	Training and Audiovisual Support Center
TDS	total dissolved solids
TEP	toxic extraction procedure
TISAB	total ionic strength adjustment buffer
TMDE	Test, Measurement, and Diagnostic Equipment
TNT	trinitrotoluene
TSCA	Toxic Substances Control Act
TW	treated water
2,4-D	dichlorophenoxyacetic acid
2,4,5-T	trichlorophenoxyacetic acid
2,4,5-TP	2,4,5-trichlorophenoxy propionic acid
ug/l	micrograms per liter
umhos/cm	micromhos per centimeter
USACC	U.S. Army Communications Command
USADWSP	U.S. Army Drinking Water Surveillance Program
USAEHA	U.S. Army Environmental Hygiene Agency
USAETL	U.S. Army Engineer Topographic Laboratories
USAF	U.S. Air Force
USARB	U.S. Army Retraining Brigade
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USDA	U.S. Department of Agriculture
USSCS	U.S. Soil Conservation Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance
WPC	water pollution control

1.0 GENERAL

1.1 PURPOSE OF THE ASSESSMENT

To determine the existence of toxic and hazardous materials and related contamination at the Headquarters, 1st Infantry Division (Mechanized) and Fort Riley (FR), Kans., emphasizing those substances posing a potential for migration off the installation.

1.2 AUTHORITY

U.S. Army Materiel Command (AMC) Regulation 10-30, Mission and Major Functions of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), July 30, 1981.

1.3 INTRODUCTION

1. In response to a letter from the Commander, USATHAMA, requesting the identification of potentially contaminated installations, the Commander, U.S. Army Forces Command (FORSCOM), recommended that FR be included in the Installation Restoration Program.
2. Presurvey instructions were forwarded to FR by letter to outline assessment scope, provide guidelines to FR personnel, and obtain advance information for review by the Initial Installation Assessment (IIA) Team.
3. FR personnel were briefed by a USATHAMA representative on the Installation Restoration Program on Dec. 12, 1983, prior to the onsite records search.
4. Various Government agencies were contacted for documents pertinent to the records search effort. Agencies contacted include:
    a. Department of Defense Explosives Safety Board (DDESB), Alexandria, Va.

b. U.S. Army Environmental Hygiene Agency (USAEHA), Aberdeen Proving Ground, Md.

c. State of Kansas, Fish and Game Commission, Pratt, Kans.

d. State of Kansas Geological Survey, University of Kansas, Lawrence, Kans.

e. U.S. Environmental Protection Agency (EPA) Environmental Photographic Interpretation Center (EPIC), Vint Hill Farms Station, Warrenton, Va.

f. EPA Storage and Retrieval (STORET) Water Quality Data Base.

g. U.S. Geological Survey (USGS), Denver, Colo.

h. Washington National Records Center, Suitland, Md.

i. U.S. Soil Conservation Service (USSCS), Salina, Kans.

j. National Archives and Records Service (Navy and Old Army Branch; Modern Military Branch), Washington, D.C.

5. The onsite phase of the records search was conducted Dec. 12-16, 1983. The information presented in this report is current, as of the date of the onsite search. The following personnel from Environmental Science and Engineering, Inc. (ESE), under Contract No. DAAK11-81-C-0093, were assigned to the onsite team:
   - Dr. Charles Hendry, Team Leader
   - Dr. John Bonds, Chemist
   - Mr. Stephen Denahan, Hydrogeologist
   - Mr. Donald McNeill, Hydrogeologist
   - Mr. C. Richard Neff, Engineer

6. In addition to the records review, interviews were conducted with former and current employees. Ground and aerial tours of the installation were made, and photographs were taken.

7. Only those directorates, tenants, and activities potentially involved in the handling, production, testing, and disposal of contaminants were investigated.

1.4 CURRENT INSTALLATION ORGANIZATION

FR is a permanent FORSCOM installation with the primary mission to provide training facilities, housing, and support to the 1st Infantry

Division (Mechanized), which headquarters onpost. The 1st Infantry Division (Mechanized) is a ground combat unit with the specific mission of supporting the North Atlantic Treaty Organization (NATO) in Europe. Prior to deployment, division troops are trained at FR in field maneuvers, tank and artillery weapons fire, and aircraft flights. The Commander of the 1st Infantry Division (Mechanized) also serves as Post Commander, and several division elements have been integrated with those of the post. Fig. 1.4-1 is a simplified organizational diagram of FR; dashed lines indicate elements onpost which belong exclusively to the 1st Infantry Division (Mechanized), while solid lines indicate integrated elements.

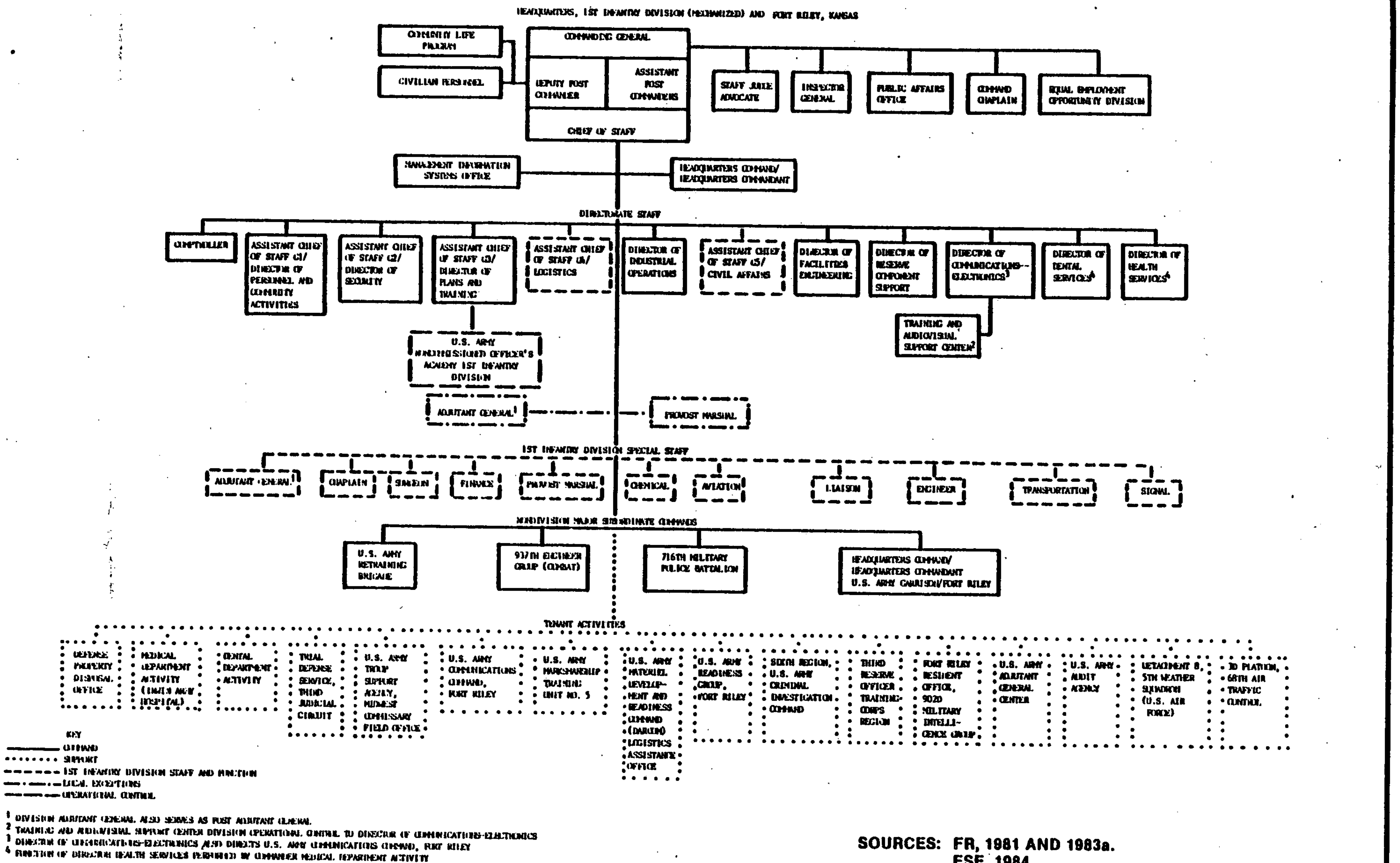
As shown in Fig. 1.4-1, FR also supports several nondivisional units, the principal ones being the 937th Engineer Group and the U.S. Army Retraining Brigade (USARB). The 937th Engineer Group provides training to engineer and other support units associated with division-level combat operations, and the USARB trains soldiers returning to duty following confinement. Other nondivisional units onpost include U.S. Army Reserve and National Guard units, which train intermittently. Further details concerning specific FR organizational units are contained in FR Regulation No. 10-3 (FR, 1981).

The onpost population fluctuates during the year, particularly during the summer when Reserve and National Guard units train. Generally, however, active duty military personnel number about 17,500, with 28,000 dependents residing onpost and 3,900 civilians employed (Department of the Army, Headquarters, Forces Command, 1981).

1.4.1 DIRECTORATES

The directorate staff of FR consists of the following positions (see Fig. 1.4-1):

1. Comptroller
2. Assistant Chief of Staff G1/Director of Personnel and Community Activities (DPCA)



SOURCES: FR, 1981 AND 1983a.
ESE, 1984.

Figure 1.4-1
BASIC ORGANIZATIONAL STRUCTURE OF FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

3. Assistant Chief of Staff G2/Director of Security (DSEC)
4. Assistant Chief of Staff G3/Director of Plans and Training (DPT)
5. Director of Industrial Operations (DIO)
6. Director of Facilities Engineering (DFAE)
7. Director of Reserve Component Support (DRCS)
8. Director of Communications-Electronics (DCE)
9. Director of Dental Services (DDS)
10. Director of Health Services (DHS)

The remaining two elements of the directorate staff shown in Fig. 1.4-1, Assistant Chief of Staff G4/Logistics and Assistant Chief of Staff G5/ Civil Affairs, are exclusively 1st Infantry Division functions and are nongarrison positions.

Among the directorates listed, the following administer activities with the potential for involvement with toxic/hazardous materials (FR, 1981).

1. DPCA: advises the Commander and staff on personnel, community activities, and administrative matters; administers onpost morale, health, and welfare activities, including the operation of the Multi-Crafts Shop (painting, black-and-white photography, ceramics, etc.), a woodworking-lapidary shop (carpentry, jewelry, metal work, etc.), and the Automotive Self-Help Shop (tuneups, engine overhauls, body painting, etc.); maintains the golf course (including pesticide applications) and other onpost recreational facilities; and administers onpost drug and alcohol abuse and safety programs, including the Urinalysis Program.
2. DPT: coordinates all functions relating to plans, operations, and training of all units and activities on the installation, including nuclear, biological, and chemical (NBC) defensive operations and nuclear and chemical offensive operations; maintains operational control over the Noncommissioned Officers (NCO) Academy; and operates the U.S. Cavalry Museum.

3. DIO: exercises responsibility over all installation logistic activities, including Inter/Intra-Service Support Agreements (ISSAs), procurement, supply, maintenance and repair of equipment, transportation, facilities, housing, laundry, and the Army Food Program.
4. DFAE: supervises real property maintenance activities for FR, including utilities, maintenance and repair, minor construction, fire prevention, refuse handling, pest control, custodial care, master planning, management and engineering, wildlife management, historical preservation, and pollution control.
5. DCE: responsible for all functions related to post communications-electronics and air traffic control, including audio-visual, photographic, television, and training aids support activities; operates the Training and Audiovisual Support Center (TASC); and directs the U.S. Army Communications Command (USACC), FR.
6. DDS: advises the installation Commander and staff on matters pertaining to the delivery of dental health care services; staffed by the U.S. Army Dental Activity (DENTAC).
7. DHS: advises the installation Commander and staff on matters concerning the delivery of health care services and environmental health services; staffed by the U.S. Army Medical Department Activity (MEDDAC).

Activities involving toxic/hazardous materials conducted under the direction of these directorates are discussed in Sec. 2.0.

1.4.2 TENANT ACTIVITIES

A listing of tenant activities onpost at the time of the site visit appears on Fig. 1.4-1. These activities occupy space on FR under ISSAs, which are on file with the DIO Management Division. Tenants potentially involved with toxic/hazardous materials are listed below, followed by brief mission statements (FR, 1981 and 1983a):

1. Defense Property Disposal Office (DPDO): receives, stores, and disposes of all excess property generated onpost.
2. MEDDAC: Under the command of the U.S. Army Health Services Command, MEDDAC provides medical care for eligible military personnel and civilians through the Irwin Army Hospital (IAH); operates X-ray, laboratory, silver recovery, and incinerator facilities; and provides necessary veterinary services.
3. DENTAC: Under the command of the U.S. Army Health Services Command, DENTAC provides dental diagnosis, care, treatment, consultation, and preventive dental programs to eligible personnel.
4. DARCOM Logistics Assistance Office (LAO): provides experts for technical assistance to activities located onpost. One group of experts is the Area Test, Measurement, and Diagnostic Equipment (TMDE) Support Team No. 11 (95th Calibration Service Company), a detachment of the U.S. Army Missile Command (MICOM), Redstone Arsenal, Ala. This detachment provides testing, calibration, and repair services for measuring and diagnostic equipment, including radiological monitoring devices (see Sec. 2.1.7).

Specific activities involving toxic/hazardous materials performed by these tenants are discussed in Sec. 2.0.

1.5 INSTALLATION HISTORY

1.5.1 GENERAL HISTORY

The origins of FR can be traced to 1852, when a temporary camp was established at the confluence of the Kansas and Republican Rivers. Called Camp Center because it was believed to be located at the geographical center of the United States, this camp was garrisoned by the 6th Infantry, whose mission was to protect from raiding Indians pioneers who were moving westward on the Santa Fe Trail. In 1853, Congress appropriated funds for the construction of a new post on the site of Camp Center. The new post was to be designated FR, in honor of

Maj. Gen. Bennett Riley, Indian fighter, Colonel of the 1st Infantry, veteran of the War of 1812, and Commander in the Mexican War. In 1854, the boundaries of the post were established, and 9,677.6 hectares (ha) of land were withdrawn from the public domain.

Construction of permanent facilities began in 1855 and included barracks, officers quarters, an ordnance building, stables, a guard house, a brick magazine, and a hospital (Bldg. 30, now the Post Museum). Many of the buildings from this period are no longer standing, but those which remain are protected and maintained (see Sec. 1.5.2).

From the mid-1850s until the outbreak of the Civil War, activity at FR slowed. The Civil War, however, brought increasing numbers of militia to FR. In the summer of 1862, approximately 132 Confederate prisoners of war were interred onpost. In 1866, the Kansas Pacific Railroad was completed from Kansas City to FR. FR land totalling 1,624.5 ha was excessed at that time for railroad and highway purposes. During the period of railroad construction (1864 to 1866), Indian hostilities increased, and FR militia were required to protect railroad supplies and personnel. The most famous of the cavalry units which served during this period was the 7th Cavalry, which arrived onpost in 1866 and remained until 1876. The regiment was commanded by Col. Andrew J. Smith, a veteran of the Mexican and Civil Wars. His second in command, Col. George A. Custer, later commanded the 7th Cavalry in the ill-fated Battle of the Little Big Horn in 1876. In 1890, the 7th Cavalry was deployed to the Battle of Wounded Knee, which ended military resistence by the Sioux nation.

The FR tradition of hosting Army service schools began in 1869, with the establishment of the School of Application for Light Artillery. This school remained in operation until 1871 and provided practical instruction in battery and battalion drill and firing in conjuction with horse-drawn light artillery. Guns were practice fired from the drill field toward the rimrock at the rear of the current Camp Whitside.

The 1880s and early 1890s were characterized by renewed construction at FR. During this decade, officer's quarters, enlisted men's barracks, recreational facilities, a dispensary, stables, magazines and ordnance storehouses, a laundry, and a coal shed for the heating plant were built. In 1892, FR became the home of the Cavalry and Light Artillery School, the mission of which was to provide instruction in both cavalry and light artillery duties. During the period of the Spanish-American War (1898), school work onpost was suspended, and FR was used as a staging area for troops going to the Philippines. Following the war, however, instruction resumed and construction of support facilities continued through World War I.

In 1903, the Farrier's and Horseshoer's School was established in conjunction with the Cavalry and Light Artillery School, which was reorganized and renamed the Mounted Service School in 1907. The mission of the Cavalry and Light Artillery School, however, remained essentially unchanged, and the curriculum continued to include subjects directly related to the horse. In 1905, a school for bakers and cooks was established onpost and was, for a time, commanded by George Patton, famed World War II general.

FR experienced tremendous expansion of facilities during World War I. Camp Funston was constructed in 1917 and became the largest semi-permanent training camp in the country. Consisting of two-story buildings complete with waterworks and electrical and refrigeration systems, Camp Funston could accommodate 50,000 men. The facility was torn down after the war and its facilities sold at auction. The Mounted Service School experienced a significant change during this period. In 1919, its mission was changed to encompass the training of officers and enlisted men in the techniques and tactics of cavalry, to the exclusion of artillery instruction. To reflect this new mission, its name was changed to the Cavalry School. It became the primary training center for horse and mechanized cavalry and, during the 1920s and 1930s, most U.S. equestrian teams, including Olympic teams, trained at FR.

Marshall Army Airfield (MAAF) began in 1921, at the southeast corner of Smokey Hill Flats. It was named Marshall Field in 1925 in honor of Col. Francis C. Marshall, Assistant Chief of Cavalry, killed in a plane crash in 1922. At that time, it contained hangars, underground fuel storage tanks, and lights for night flights. Apparently, the field had been in use since 1912 by balloons, blimps, and airplanes. It is, therefore, one of the oldest continuously active air bases in the nation. From 1924 to 1940, aviation units conducted observation and photography exercises at MAAF. During World War II, units functioned primarily in support of the Cavalry School. In 1948, the field was turned over to the newly formed U.S. Air Force, but the Army regained control of the facility in 1950.

Activity increased considerably at FR during World War II. The U.S. Cavalry became mechanized and needed to be capable of taking independent action, mounted or dismounted, when engaged in offensive or defensive combat. To accomplish this mission, the Cavalry Replacement Training Center was established in 1941 at the site of the present day Camp Forsyth. Complete training facilities for 7,900 men were completed between December 1940 and March 1941. Until its disestablishment in 1946, the Cavalry Replacement Training Center trained 125,000 men. An officer training program was added to the programs offered at the Cavalry School, providing courses in mechanized warfare.

In 1941, 12,837.5 ha of land were purchased for the construction/ expansion of post cantonment areas. Camp Forsyth and Camp Whitside were constructed during this period, and Camp Funston was reconstructed, consisting of almost 900 temporary structures. In 1948, the 10th Division, one of 10 Army training divisions in the United States, occupied Camp Funston and later trained troops for the Korean Conflict.

The Cavalry School was deactivated in 1946, following the replacement of all horse units in the Army by mechanized Cavalry and Armor units. The Cavalry School was replaced by the Ground General School, which trained officers and enlisted men as intelligence officers and staff intelligence personnel. In 1950, the school underwent a final reorganization and became the Army General School. To the present, it has continued the intelligence training functions of the Ground General School and, since 1953, has been the place where the tactics and techniques of Aggressor (the mythical enemy force that opposes U.S. troops during field exercises and maneuvers) are developed.

In 1955, in Operation Gyroscope, the 1st Infantry Division in Germany and the 10th Division at FR exchanged places. From 1955 until 1965, when it was deployed to Vietnam, the 1st Infantry Division or "Big Red One" headquartered at FR. A succession of units occupied FR until 1970, when the 1st Infantry Division returned to FR, where it remains to the present. One brigade, however, remains in the Federal Republic of Germany to provide NATO support.

Construction activities at FR since 1955 have been primarily support facilities (i.e., housing) for the 1st Infantry Division. The Custer Hill area (shops, troop and family housing) was developed in the mid-1960s, partially as a result of flooding problems experienced in older cantonment areas (Camps Forsyth and Funston). Expansion of this area continues at present.

IAH was completed in 1958. Additional wings were added in the 1960s and 1970s. In 1965, 18,771.2 ha of land were purchased to expand the FR training areas (see Sec. 1.7.2) [U.S. Cavalry Museum, not dated (n.d.a) and 1981; Barr and Rowlison, 1977; Department of the Army, Headquarters, Forces Command, 1981].

1.5.2 ARCHAEOLOGICALLY AND HISTORICALLY SIGNIFICANT AREAS

The FR area has been repeatedly surveyed for cultural resources by both amateur and professional investigators since the late 1800s. Most recently, members of the Kansas State Historical Society have performed archaeological and historical surveys of the FR Main Post and range areas, the results of which were published in 1977 and 1979. Eighteen prehistoric sites have been identified in the training areas and consist of 17 habitation sites and 1 burial mound. These sites are located primarily on uplands and along streams and attest to Indian cultures of the Paleo-Indian [pre-12,000 before Christ (B.C.) to 8,000 B.C.], Archaic [8,000 B.C. to 1 anno Domini (A.D.)], early Ceramic or Woodland (1 A.D. to 1,000 A.D.), and Middle Ceramic (1,000 A.D. to 1,500 A.D.) periods. Two sites were also located on the Main Post (Department of the Army, Headquarters, Forces Command, 1981).

Surveys of the areas surrounding FR have described burial mounds and Indian villages and campsites located on the banks of the Smoky Hill, Republican, and Kansas Rivers, Wildcat Creek, and the cities of Ogden and Manhattan. Artifacts from these areas include skeletal remains, arrow points, and bone or shell beads of varying cultures. Surveys of the Tuttle Creek Reservoir area by the Smithsonian Institution resulted in the recording of 119 sites from the Paleo-Indian Period through the Central Plains Phase. According to surveys by Kansas State University and the Kansas State Historical Society, the Milford Lake area contains 95 sites. Further information concerning these surveys is available in Barr and Rowlison (1977). App. A contains a map showing the locations of archaeological sites identified onpost.

The preponderance of historical sites on FR occurs in the Main Post area. Past training activities have destroyed the 263 historical building sites within the ranges and training areas. Although these sites were of historic interest, they were not unique to the area; therefore, their loss does not indicate a serious reduction of historical data for the time period they represent.

In 1974, the U.S. Department of Interior placed a 271-ha area within the Main Post on the National Register of Historic Places. Approximately 160 buildings are contained within this district, including officer quarters, enlisted barracks, a chapel, and academic and administrative buildings. Buildings of particular historic interest include:

1. Custer House (Quarters 24)--The only remaining set of officer housing from the period, this home is on the National Register of Historic Places. It is believed that this house or one nearby (since destroyed) was the residence of General and Mrs. Custer during his stationing at FR in 1866.
2. St. Mary's Chapel--Constructed in the mid-1850s, this structure is the first stone church in Kansas. The cornerstone was laid by the first chaplain of FR. During the Civil War, the building was used as an arsenal, and later as a school. The chapel was renovated in 1938 and now serves as a Catholic chapel.
3. Quarters 123--Currently an officer's quarters, this building housed the post chaplain until the 1890s.
4. U.S. Cavalry Museum (Bldg. 30)--Originally the post hospital, this building was reconstructed in 1887 and became headquarters of the post and later the Cavalry School. In 1957, the building was designated the U.S. Cavalry Museum, an official member of the Army Museum System.
5. The First Territorial Capitol of Kansas--Although not listed on the National Register, the First Territorial Capitol of Kansas is a significant historical site within the boundaries of FR. The site has been restored and is open to the public under the auspices of the Kansas State Historical Society (U.S. Cavalry Museum, n.d.a and n.d.b).

Other sites of historical significance onpost include (Department of the Army, Headquarters, Forces Command, 1981):

1. A work/living area, known as Packer's Camp, used by teamsters hauling military cargo during settlement of the post (1850s).
2. Training and living areas for General Leonard Wood's forces during World War I (Camp Funston).
3. Historical solid waste disposal areas (1850s).
4. Farm and school structures from the 1800s.

The locations of historical sites on FR are shown in App. A.

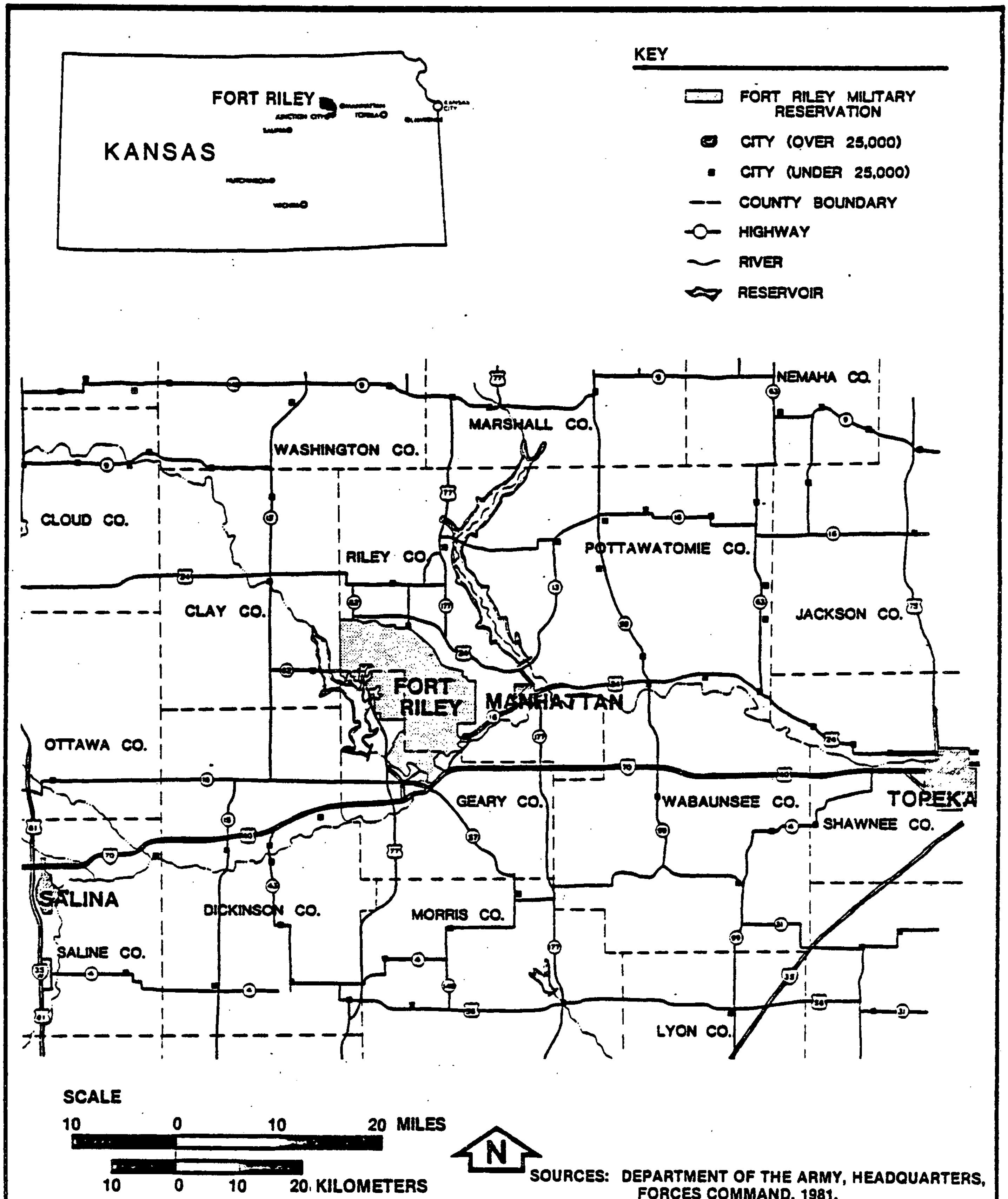
1.6 ENVIRONMENTAL SETTING

1.6.1 LOCATION

FR is located in north-central Kansas, approximately 105 kilometers (km) west of Topeka and 80 km east of Salina (see Fig. 1.6-1). Urbanized areas near the main cantonment area include Junction City (5 km), Ogden (5 km), and Manhattan (20 km). The installation is located within Geary and Riley Counties and is bordered by the Kansas and Republican Rivers on the south. The four cantonment areas at FR, Camp Whitside, Camp Forsyth, Custer Hill, and Main Post, are all located on the southern portion of the installation. MAAF is located on the south side of the Kansas River, directly across from the Main Post area.

1.6.2 METEOROLOGY

The climate of the FR area is classified as temperate (Department of the Army, Headquarters, Forces Command, 1981). Climatological data obtained from stations in the vicinity of the installation (Manhattan and Tuttle Creek Lake) are presented in Table 1.6-1. These data show mean annual temperatures of 10.7 to 12.8 degrees Celsius (°C) for the area, with mean lows of -1.8 to -7.0°C occurring in January and mean highs of 25.5 to 26.1°C occurring in July. Rainfall in the area averages approximately 85 centimeters (cm), with May and June being the wettest months (11.0 to 18.9 cm) and January being the driest month (1.55 to 2.18 cm). Precipitation in the form of snowfall averages approximately 50 cm per year, with approximate equal distribution between the months of December, January, February, and March (Department of the Army, Headquarters, Forces Command, 1981). Prevailing winds are from the south-southwest, except for February and March, when they are from a northerly direction. The mean windspeed at FR varies between 12.9 and 19.3 kilometers per hour (kph).



SOURCES: DEPARTMENT OF THE ARMY, HEADQUARTERS, FORCES COMMAND, 1981.
ESE, 1984.

Figure 1.6-1
LOCATION MAP OF FORT RILEY AND VICINITY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 1.6-1. Climatological Data in the Vicinity of FR

Location	Month												Annual	Years of Record
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.		
Precipitation (cm)														
Manhattan	2.18	2.33	4.70	7.62	11.0	14.8	11.1	9.1	10.0	6.91	2.47	2.69	85.1	122
Tuttle Creek Lake	1.55	1.85	4.62	2.41	18.9	11.2	13.6	11.2	7.16	2.67	3.25	5.97	84.3	22
Temperature (°C)														
Manhattan	-1.8	1.1	5.6	9.5	18.4	23.5	26.1	25.8	20.6	14.8	6.4	0.2	12.8	122
Tuttle Creek Lake	-7.0	-3.8	4.9	10.0	18.2	19.6	25.5	24.4	19.6	12.3	4.4	0.5	10.7	22

Source: Modified from U.S. National Climatic Data Center, 1982.

1.6.3 GEOGRAPHY

Physiography

FR lies within the Osage Plains section of the Central Lowlands physiographic province. This area is bordered on the west by the Great Plains and on the east by the Ozark Plateau. Elevations on the post vary from 312 to 416 meters (m) above mean sea level (MSL) (Department of the Army, Headquarters, Forces Command, 1981). Terrain on the installation varies from alluvial bottom lands along the Republican and Kansas Rivers on the southern boundary through the hilly to steep country in the central section to the high uplands or prairies located toward the north. Drainages of FR contain deciduous forests, while the primary vegetation of the high upland is grass. The installation is drained by several streams and also contains numerous ponds, as described in the following surface hydrology section.

Surface Hydrology

The Kansas River and one of its major tributaries, the Republican River, form portions of the southern boundary of the installation. The numerous streams which originate on or flow through the installation eventually discharge into one of these streams. Perennial streams located on the installation include Wildcat Creek, Madison Creek, Timber Creek, and Threemile Creek. The lower portion of Threemile Creek is perennial due to the influx of water from the Custer Hill water pollution control plant (WPC). Major perennial and intermittent streams located on the installation are shown in Fig. 1.6-2, and discharge rates observed in May 1977 are listed in Table 1.6-2.

Numerous surface water impoundments exist on the installation, many of which were formerly farm ponds. Some are oxbow lakes, which were formed when the Kansas River changed course. Major surface impoundments on the installation are listed in Table 1.6-3, and approximate locations are shown in Fig. 1.6-2.

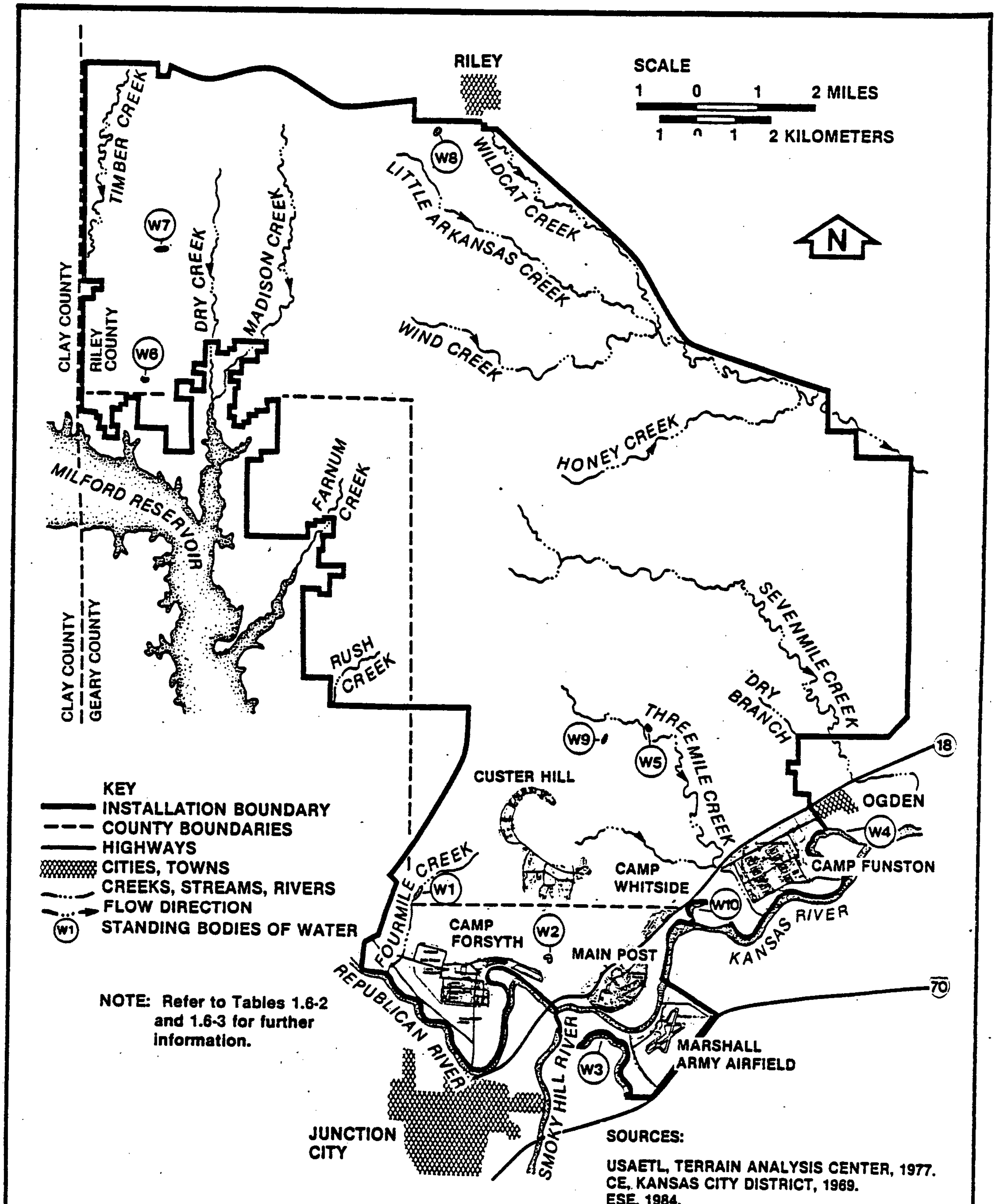


Figure 1.6-2
SURFACE DRAINAGE ON FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 1.6-2. FR Stream Discharge Rates

Stream (see Fig. 1.6-2)	Mean Annual Discharge (lpm)
Wildcat Creek	20,962
Madison Creek	4,646
Sevenmile Creek	6,494
Threemile Creek	3,903
Timber Creek	6,217
Fourmile Creek	2,561
Kansas River	4,678,944
Republican River	1,471,302

lpm = liters per minute.

Source: U.S. Army Engineer Topographic Laboratories (USAETL), Terrain Analysis Center, 1977.

Table 1.6-3. Surface Impoundments on FR

Map No. (see Fig. 1.6-2)	Name	Size (ha)	Impoundment Structure
W1	Breakneck Lake	1.3	Earthen dam
W2	Moon Lake	3.0	Earthen dam
W3	Marshall Lake	16.0	None, oxbow lake
W4	Funston Lake	10.0	None, oxbow lake
W5	Beaver Lake	0.8	Earthen dam
W6	Williams Pond	0.4	Earthen dam
W7	Sinn Pond	1.0	Earthen dam
W8	Roblyer Pond	0.4	Earthen dam
W9	Rimrock Lake	0.2	Earthen dam
W10	Whitside Lake	2.0	None, oxbow lake

Source: USAETL, Terrain Analysis Center, 1977.

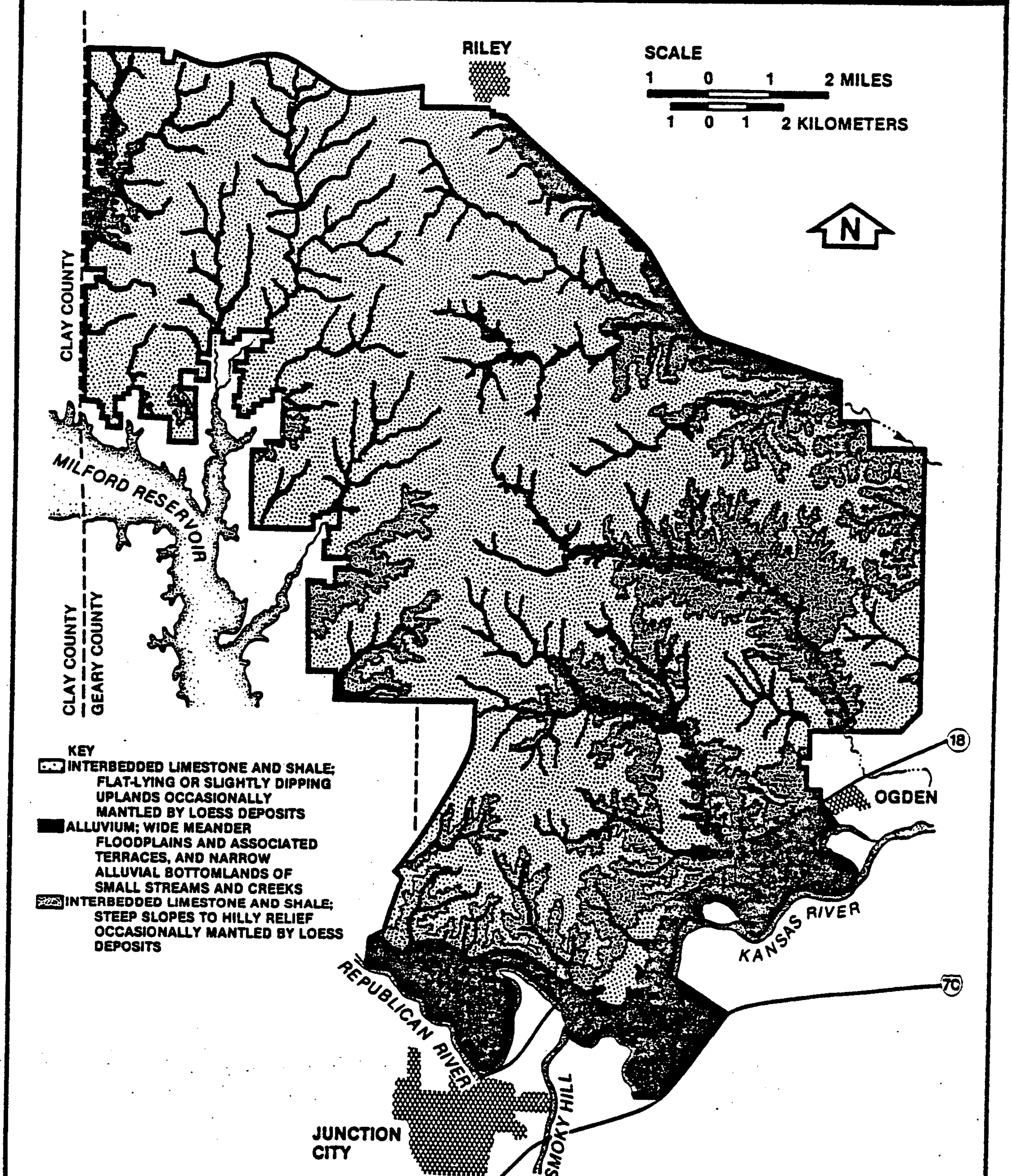
1.6.4 GEOHYDROLOGY

Geologic Setting

FR lies within the Osage Plains section of the Central Lowlands physiographic province. The rocks exposed in the FR area range in age from Lower Permian to Recent and consist of alternating limestones and shales (see Fig. 1.6-3). The principal Permian strata exposed in the FR area are the Winfield, Doyle, Barneston, Matfield, and Wreford Formations of the Chase Group. Distinct members of alternating limestones and shales of variable thickness occur within each formation. The Kansas River has cut downward into the underlying Council Grove Group, which consists of the Speiser, Funston, Blue Rapids, Crouse, Easly Creek, Bader, and Stearns Formations. These formations also consist of alternating limestone and shale members that are not exposed at the surface in the FR area but are present in the subsurface underlying the river alluvium (see Fig. 1.6-4).

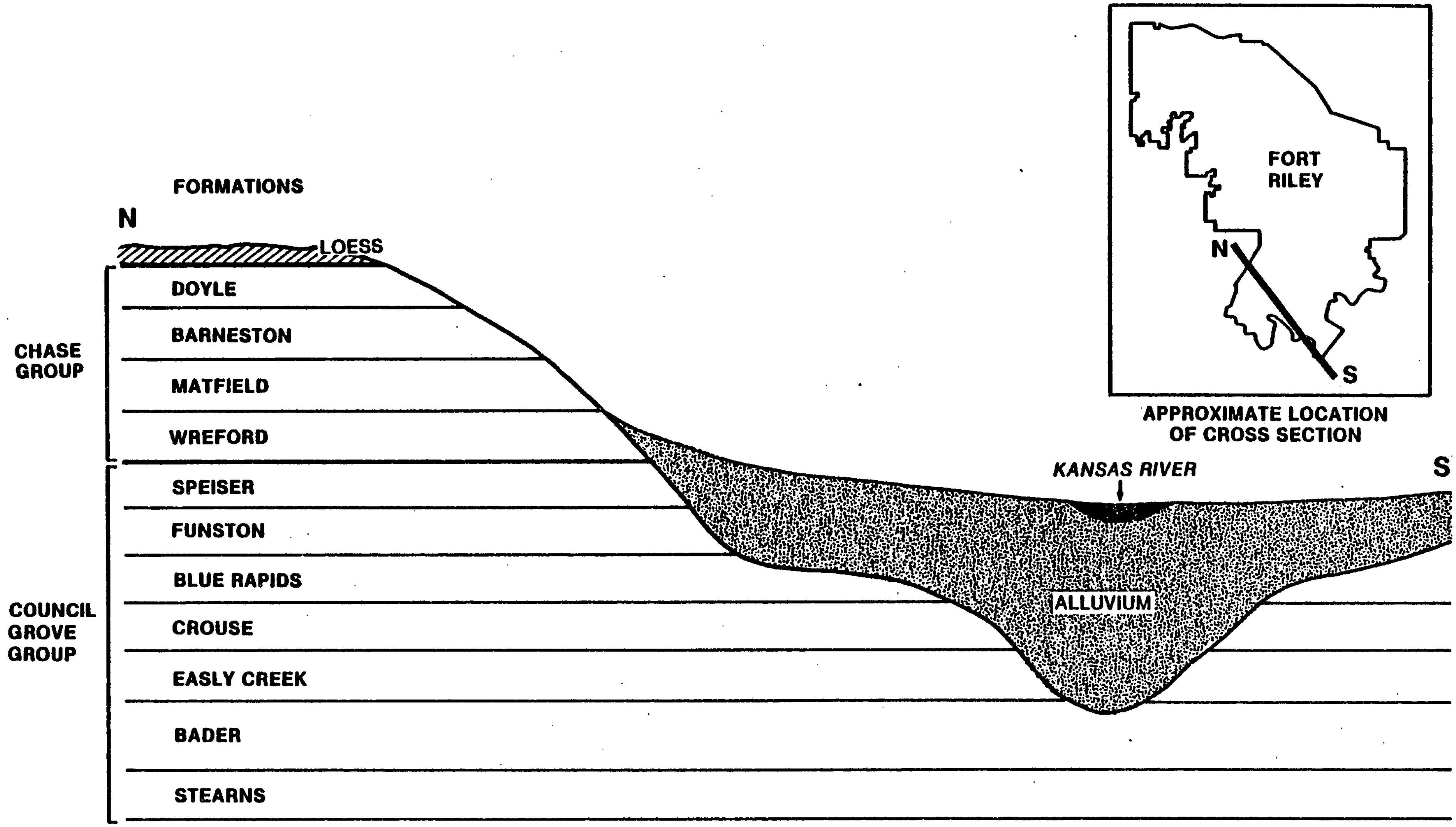
The post can be divided into three geological-topographical units (Jewett, 1941). The first is the "uplands" unit, consisting of flat-lying to gently, northwesterly dipping limestones and shales. The "uplands" unit is usually covered with various shale units which overlie the escarpment-forming limestones. Small streams have dissected these thick shale units and eroded much of the area into a rolling plateau. Local relief ranges from 50 to 73 m in the "uplands" unit. The second major unit is the "alluvial bottom lands" of the Kansas and Republican Rivers; relief in this unit ranges from 7.6 to 18.3 m. The third section is the hilly to steep country composed of alternating limestones and shales, which extend from the "uplands" down to the "alluvial bottom lands."

Overlying the bedrock are alluvial deposits and windblown loess of Pleistocene and Recent age. The windblown loess is the oldest of the unconsolidated deposits and is believed to be partly Pleistocene and partly Recent in age (Jewett, 1941). The loess deposits on FR range from 0 to 0.6 m in thickness (USAETL, Terrain Analysis Center, 1977).



SOURCES: USAETL, TERRAIN ANALYSIS CENTER, 1977. ESE, 1984.

Figure 1.6-3 GEOLOGIC MAP OF FORT RILEY	**Prepared for:** **U.S. Army Toxic and Hazardous Materials Agency** **Aberdeen Proving Ground, Maryland**



NOTE: WINFIELD FORMATION DOES NOT OUTCROP ON FORT RILEY.

SOURCES: USAETL, TERRAIN ANALYSIS CENTER, 1977.
ESE, 1984.

Figure 1.6-4
GENERALIZED GEOLOGIC CROSS SECTION THROUGH FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

The loess is composed of approximately 15 percent fine sand and 85 percent silt and clay material. The alluvial deposits underlying the southern section of FR are part of the flood plain deposits of the Republican and Kansas Rivers. The alluvium near the surface consists of silt, clay, and very find sand; at greater depths, coarser sand and gravel are the predominant sediment types. The coarser sediment at the bottom of the alluvium may, in part, be colluvium from the weathered shale and limestones of the adjacent river valley. The maximum thickness of the alluvium on FR as determined from well logs was 27.7 m. As mentioned previously, the alluvium is Recent in age and overlies the Permian age limestones and shales.

Soils

Soils found at FR can be divided into three categories: river flood plain soils, windblown silt and loess, and weathered limestone and shale (Fig. 1.6-5). The river flood plain areas and the underlying bedrock are covered by Recent alluvial deposits to a maximum depth of approximately 27 m. These flood plain soils consist of silty, sandy loam with fairly good drainage characteristics. The flood plain soils have a high potential for flooding where artificial barriers have not been constructed. Soils in the upland regions consist of soils from windblown silt and loess and those from weathering of limestone and shale deposits. Both types of soil in the upland region consist of fine-grained silts and clays. In many FR upland areas, these soils have been removed, and bedrock escarpments have formed along primary and secondary streams. These soils range in thickness from 0 to 8 m and overlie the consolidated limestone and shale bedrock.

Ground Water

To a limited extent, the limestones and shales of the Permian bedrock function as aquifers. The FR and Florence limestones are the chief bedrock aquifers, with water occurring in solution channels and joints. Yield from these aquifers is usually low, with a maximum flow of

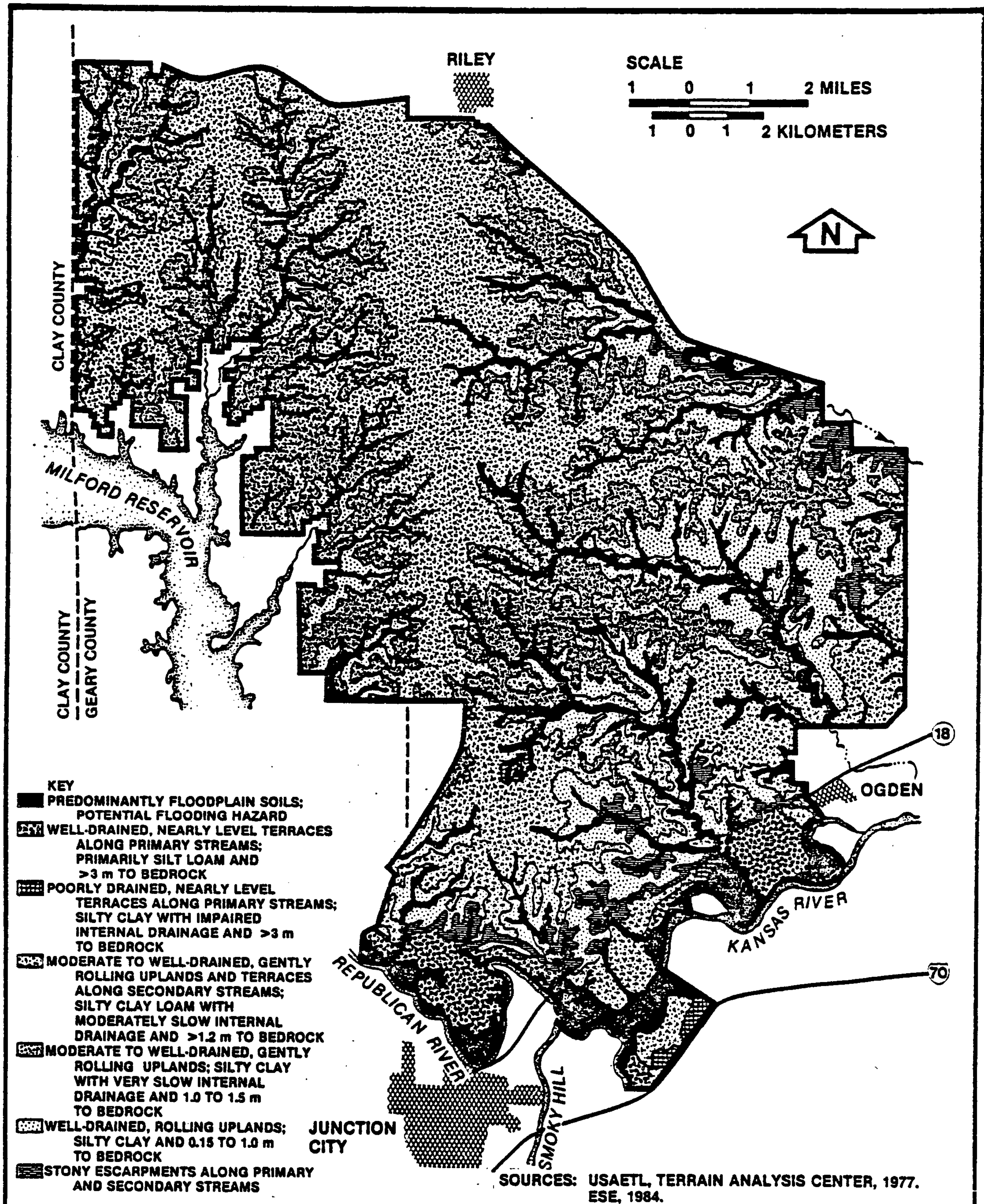


Figure 1.6-5
SOILS MAP OF FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

379 lpm. If soil cover is thick enough, water in the bedrock also occurs perched on top of the local shale units. Supplies adequate for local drinking water and moderate-scale agricultural activities can be derived from the bedrock wells. Depth and presence of ground water varies depending on local physiographic, geologic, and hydrologic conditions.

Where alluvium is present in sufficient thickness, the valley fill alluvium of the Republican and Kansas Rivers provides large quantities of ground water (1,136 to >3,785 lpm). Recharge of the alluvium aquifer occurs through direct infiltration of rain, seepage from limestone and shales, and almost unlimited recharge by the adjacent rivers. Ground water flow direction is variable depending on the stage of the river. In the alluvium deposits, water levels in tightly cased wells on FR generally ranged from 4.6 to 7.6 m below land surface. FR potable supply wells are located in the Republican and Kansas River alluvium.

Wells

FR's cantonment area water supply is furnished by eight active wells [FR Nos. 1, 3, 4, 5, 6, 7, and Forsyth (FOR) Nos. 1, 2], located in the extreme southern area of the post in the alluvium of the Republican and Kansas Rivers (Fig. 1.6-6). These wells range in depth from 18.6 to 25.9 m [61 to 86 feet (ft)] deep and have the following general characteristics. Table 1.6-4 provides further detail.

FR No. 1: Originally drilled in 1928 and redrilled in 1965, this well is 45.7 cm (18 in) in diameter. It penetrates 23.8 m (78 ft) of alluvium.

FR No. 3: Drilled in 1928, this well is 45.7 cm (18 in) in diameter, with a 45.7-cm (18-in) concrete screen. It penetrates 20.7 m (68 ft) of alluvium.

FR No. 4: Drilled in 1937, this well is 66 cm (26 in) in diameter, with a 66-cm (26-in) stainless steel screen. It penetrates 21.3 m (70 ft) of alluvium.

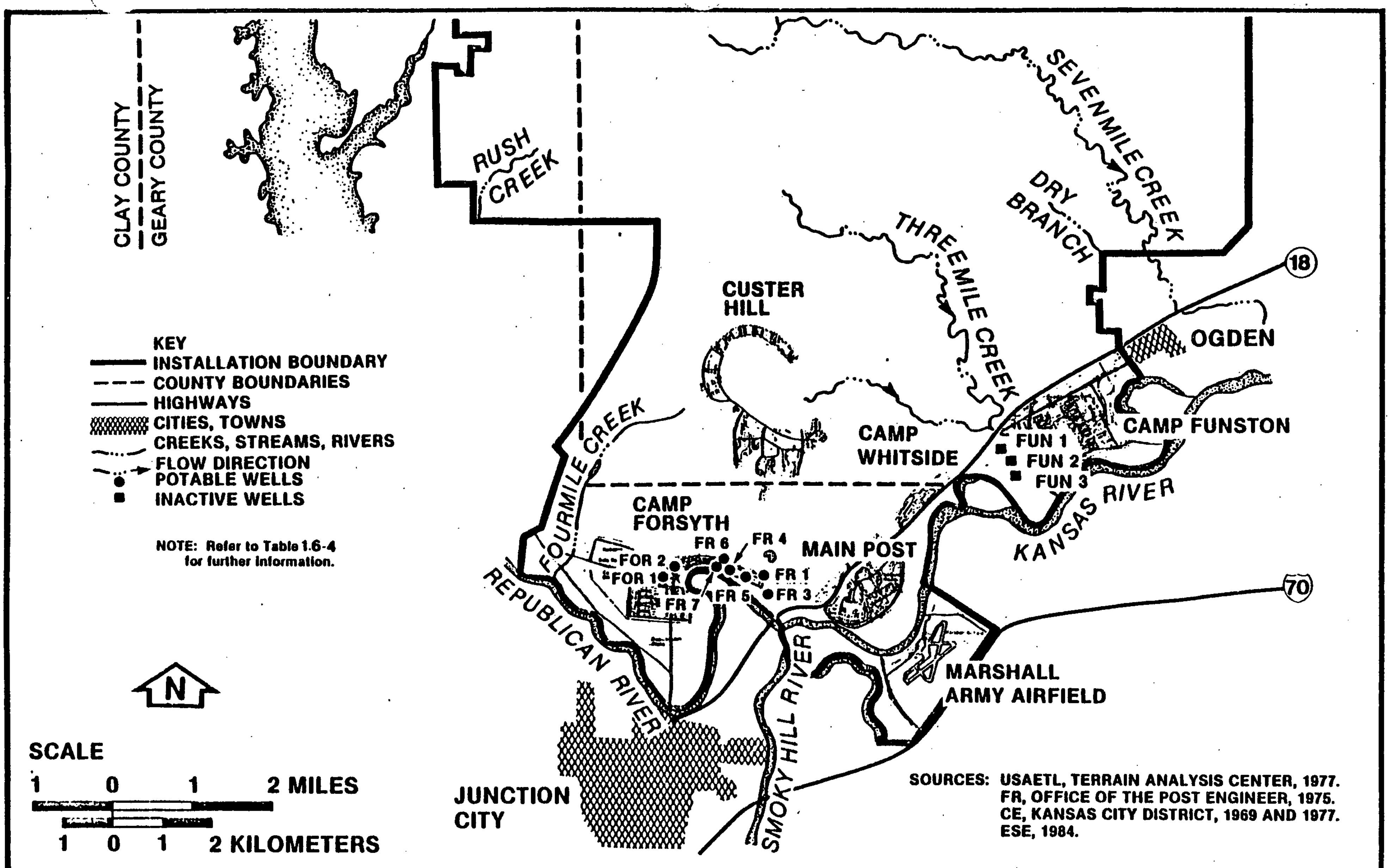


Figure 1.6-6
WELL LOCATIONS ON FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 1.6-4. Physical Characteristics of FR Wells (Locations Are Shown in Fig. 1.6-6)

	FUN Well No. (Inactive)			FOR Well No. (Active)		FR Well No. (Active)						
	1	2	3	1	2	1*	2	3	4	5	6	7
Total depth (ft)	67.9	75	61	82	81	78.25	67	68.33	70	71	86.6	91.5
Casing diameter outside (in)	38	38	38	—	—	52	None	None	38	38	—	—
Casing diameter inside (in)	26	26	26	—	18	18	18	18	26	26	—	—
Screen diameter (ft)	26	26	26	—	18	18	18	18	26	26	—	—
Depth-top of screen (ft)	35	50	36	57	61	58	34	35	40	46	71	76
Date constructed	1940	1940	1941	1941	1941	1928/ 1965	1943	1928	1937	1942	1958	1958
Date terminated	1969	1969	1967	N/A	N/A	N/A	1983	N/A	N/A	N/A	N/A	N/A
Capacity (gpm)	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000	+1,000
Status	Not used/ not plugged	Not used/ not plugged	Not used/ not plugged	In use	In use	In use	Plugged and abandoned	In use	In use	In use	In use	In use
Screen length (ft)	30	25	25	25	20	20	33	33	30	25	15	15

— = Not reported.
N/A = Not applicable.
FUN = Funston.
in = inches.
gpm = gallons per minute.

* Note: FR No. 1 was reconstructed in May 1965.

Sources: FR DFAE, 1983h, 1983i, 1983j, and 1983k.
ESE, 1984.

FR No. 5: Drilled in 1942, this well is 66 cm (26 in) in diameter, with a 66-cm (26-in) stainless steel screen. This well penetrates 21.6 m (71 ft) of alluvium.

FR Nos. 6 and 7: Drilled in 1958, these wells are 45.7 cm (18 in) in diameter, with well depths of 26 and 27.7 m (86 to 91 ft) to the top of bedrock, respectively.

FOR Nos. 1 and 2: Drilled in 1941, these wells are 45.7 cm (18 in) in diameter, with well depths of 25 and 24.7 m (82 and 81 ft).

Three additional wells operated at Camp Funston from 1940 to approximately 1975 (FUN Nos. 1, 2, and 3). The FR potable water supply and distribution system was consolidated in the mid-1970s, and, currently, the Camp Funston wells are not in use. These wells are no longer used due to water quality problems that may be associated with the nearby former landfill (see Sec. 2.3.2 for further discussion). At the time of the site visit, the wells had not been plugged or dismantled.

In addition to the cantonment area wells, several small-volume supply wells are used in outlying areas. These wells penetrate fissured limestone deposits and are located at the Tank Gunnery Training Facility (two wells), range control (one well), the Keats Tactical Training Facility (one well), and the Milford Reservoir Recreational Area.

1.6.5 BIOTA

Vegetation

FR is located in the Bluestem Prairie section of the Tall Grass Prairie biotic province, as classified by Bailey (1976). This biotic system is characterized by rolling plains, dissected by stream valleys. Prior to settlement, these plains were dominated by tall grasses (1.5 to 3.0 m high) with deep roots, which produced a dense, tough sod and deep humus soil. This system maintained itself naturally by means of wildfires, uneven distribution of annual rainfall (25 to 75 cm per year total), and grazing by herbivores (primarily bison, *Bison bison*). To a large degree, the ecosystems of this province have been extensively modified by settlement and conversion to cropland.

In contrast to the surrounding area, approximately 75 percent of the vegetative cover at FR is maintained as tall grass prairie (Department of the Army, Headquarters, Forces Command, 1981) as a consequence of the land being used for training rather than for farming or grazing.

FR is located in the eastern portion of the biotic province, approximately 160 km west of the Oak-Hickory-Bluestem Parkland section, where extensive woody vegetation and tree cover decrease the dominance of grasses. As a consequence of the annual rainfall total (78.5 cm per year average) at FR, which is at the upper limit for maintaining prairie rather than forest/parkland, parkland and oak-hickory forest occur on the stream valley slopes and bottomlands. These systems are a western extension of the Oak-Hickory-Bluestem Parkland biotic designation of Bailey (1976). The deciduous tree species are typically in leaf from early April to mid-October. Eastern red cedar (Juniperus virginiana) is the only coniferous species occurring outside the cantonment areas.

Four major vegetation communities occur on FR: the tall grass prairie, oak-hickory forest, oak-hickory parkland, and woody scrub. No complete species list exists for FR vegetation.

The tall grass prairie is the largest vegetative unit on FR. Big bluestem (Andropogon gerardi), little bluestem (A. scoparius), switchgrass (Panicum virginatum), and Indian grass (Sorgastrum nutans) are the dominant species. According to USAETL, Terrain Analysis Center (1977), large portions of the installation are mowed for hay two to three times per year, and the grassland system is maintained by burning on a 2- to 3-year rotation.

The forest land is dominated by bur, red, and chinquapin oaks (Quercus macrocarpa, Q. rubra, and Q. muehlenbergii), American elm (Ulmus americana), and red mulberry (Morus rubra) on the upper slopes and black walnut (Juglans nigra), black willow (Salix niger), hickories (Carya spp.), honey locust (Gleditsia triacomthos), and green ash (Fraxinus pennsylvania var. subintegerrima) on the lower slopes and along the streams in the western portion of the installation. Flood plain forests along the Kansas and Republican Rivers and the lower reaches of the perennial streams are dominated by cottonwood (Populus deltoides), sycamore (Platanus occidentalis), box elder (Acer negundo), and hackberry (Celtis accidentalis).

Along the streams and in the flood plain, very dense understory vegetation exits, predominantly made up of gooseberry (Ribes spp.), redbud (Cercis canadensis), roughleaf dogwood (Cornus drummondi), greenbrier (Smilax spp.), black raspberry (Rubus occidentalis), poison ivy (Rhus radicans), Virginia creeper (Parthenocissis quinquefolia), and vigorous overstory seedling regeneration.

The oak-hickory parkland occurs in place of forest along the upper slopes and upper reaches of certain streams. In general, tree species similar to those in the forest, oaks, elm, and hackberry predominate. The canopy is open, and prairie grasses are interspersed with trees and shrubs.

The woody scrub consists of small trees and shrubs in scattered small areas throughout the installation. The scrub areas characteristically occur at the inferface between prairie and forest land. Dominant scrub vegetation includes white mullberry (Morus alba), honey locust, wild plum (Prunus americana), redbud, sumac (Rhus sp.), roughleaf dogwood, elderberry (Sambucus canadensis), grapevine (Vitis linecumii), Virginia creeper, and prairie rose (Rosa setigera).

The practice of burning and mowing has greatly diminished the area of scrub by replacement with prairie. Noxious weed species such as nodding thistle (Carduus natans), field bindweed (Convoluulus aruensis), and Johnson grass (Sorghum halepense) are also controlled by this mowing/burning program. According to USAETL, Terrain Analysis Center (1977), the only forestry management practices employed at FR are concerned with black walnut husbandry. Dutch elm disease has caused extensive overstory damage since 1961, and large numbers of shade trees have been lost in the cantonment area and range and training areas.

Wildlife

Prior to settlement, the bison was the principal herbivore of the Tall-Grass Prairie Association, with grey and red wolves (Canis lupus and C. niger, respectively) and cougar (Felis concolor) as the larger predators. Small mammalian herbivores, including many species of mice and voles (family Cricetidae), shrews (Sorex spp.), prairie dogs (Cynomys spp.), pocket gophers (family Geomyidae), ground squirrels (Citellus spp.), jack rabbits (Lepus spp.), and cottontail rabbits (Sylvilagus floridanus) were abundant. The chief predators of these smaller animals were badgers (Taxidea taxus), coyotes (Canis lantrans), black-footed ferret (Mustela nigripes), long-tailed weasel (M. frenata), red fox (Vulpes fulva), birds of prey, the blue racer (Coluber constrictor foxi), bull snake (Pituophis melanoleucus sayi), and prairie rattler (Crotalus viridis viridis). Arthropods, particularly grasshoppers (Melanoplus spp.), were highly abundant. Characteristic birds included prairie chickens (Tympanuchus cupido), meadowlarks (Sturnella spp.), longspurs (Calcarius spp.), bobolinks (Dolichonyx oryzivorus), horned larks (Eremophila alpestris), sparrows, owls, hawks, and vultures.

The bison is now present in the tall grass prairie only as a captive population, and the larger predators have been largely extirpated. A bison herd exists at FR, corralled between the Main Post and Custer Hill cantonment areas. No comprehensive animal species list exists for FR. However, because of the low level of human activity normally occurring in the range and training areas, the presence of three different distinct vegetative habitats and ecotones, and range/wildlife management practices, FR contains a highly developed, diverse fauna compared to the surrounding area. More common species which exist at FR are presented in the FR environmental impact statement (EIS) (Department of the Army, Headquarters, Forces Command, 1981). Listings of birds sighted at FR are available in Van Doren-Hazard-Stallings (1982).

In addition to nongame populations, FR supports large populations of big game, upland game, and migratory game birds. Hunting is permitted in the range and training areas (FR DFAE, 1983c). A cooperative agreement (App. B) exists between FR, the Kansas Fish and Game Commission, and the U.S. Fish and Wildlife Service (FWS) for management of game animals and fish at FR (FR *et al.*, n.d.). Game populations on FR are larger than those of the surrounding region because human activity in the range and training areas is less than in offpost areas. The major game species at FR are:

White-tailed deer	(*Odocoileus virginianus*)
Bobwhite quail	(*Colinus virginianus*)
Ring-necked pheasant	(*Phasianus colchicus*)
Mourning dove	(*Zenaidura macroura*)
Prairie chicken	(*Tympanuches cupido*)
Jack rabbit	(*Lepus* spp.)
Cottontail rabbit	(*Sylvilagus floridanus*)
Raccoon	(*Procyon lotor*)
Coyote	(*Canis lantrans*)
Squirrel	(*Citellus* spp.)
Mallard duck	(*Anas platyrhynchos*)
Pintail	(*A. acuta*)
Blue-winged teal	(*A. discons*)
Green-winged teal	(*A. cardinensis*)

Duck populations on FR are generally smaller than those on the adjacent Milford and Tuttle Creek reservoirs.

Aquatic Biota

No studies exist on the aquatic biota of FR. Fish stocking and management of aquatic resources are undertaken as a component of the cooperative wildlife management agreement (see App. B). The aquatic system of FR consists of perennial streams (Madison, Timber, and Wildcat Creeks), intermittent streams, old riverbed lakes along the Republican and Kansas Rivers (Whiteside Lake, Funston Lake, and Marshall Lake), the rivers themselves, numerous farm ponds, and Cameron Springs. The flowing water habitat may be characterized as a hard water system, with a light sediment load in the upper reaches of streams and a heavy sediment load in the lower reaches of the streams and the rivers. The waters of the riverbed lakes and ponds also are turbid.

Stream bottoms are generally hard clay or silt, with intermittent gravel and sand beds providing for a well developed benthic invertebrate fauna. The river bottoms consist primarily of sand and gravel bars and would harbor diverse populations of benthic organisms, interspersed with reaches of shifting bed sediments, which contain a reduced fauna in terms of diversity and numbers. Lake and pond bottoms generally are made up of deep layers of silt and organic matter and would harbor only those organisms tolerant of periods of anaerobic conditions and deposition of fine sediments. Cameron Springs is a unique habitat consisting of cold, clear, flowing water. According to FR DFAE (1983b) and Van Doren-Hazard-Stallings (1982), this spring was impounded in 1980 to increase its recreational value and to provide for a fish hatchery.

Recreational fishing is permitted on FR and is managed by the Fish and Wildlife Conservation Office. Three perennial streams are reportedly stocked (Madison, Timber, and Wildcat Creeks), and, according to FR DFAE (1983b), the following ponds and lakes are managed for fishing: Breakneck Lake, Moon Lake, Vinton Pond, Roblyer Pond, Beck Pond, Miller Pond, Funston Lake, Whiteside Lake, and Marshall Lake. These systems support a fishery primarily consisting of:

Largemouth bass	(Micropterus salmoides)
Channel catfish	(Ictalurus punctatus)
Bullhead	(Pylodictis ovlivariso)
White crappie	(Pomoxis annularis)
Bluegill	(Lepomis macrochirus)

Green sunfish	(*Lepomis cyaneallis*)
Northern pike	(*Esox lucius*)

Cameron Springs is stocked with rainbow trout (*Salmo gardineri*) on a put-and-take basis.

Aquatic weed problems exist in Moon Lake, Beck Pond, Breakneck Lake, and Vinton Pond. Herbicides, as described in Sec. 2.1.7, are applied on a regular basis. The white amur is stocked in several lakes as a weed control measure. In addition to aquatic weed control, control of fish populations is practiced using rotenone to control populations of "rough fish" and to prevent over population of the smaller system by small-sized centrarchids (bluegill, crappie, green sunfish) to maintain the bass, catfish, and pike fishery and to provide for larger-sized panfish.

Threatened and Endangered Species

Federally listed endangered animal species that may occur at FR are the bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*) (Schwilling, 1981). The bald eagle is regularly observed in the winter along the Milford and Tuttle Creek Reservoirs and, according to Department of the Army, Headquarters, Forces Command (1981), possibly use the installation during migration. During the onsite visit, eight adult and one juvenile eagle were observed on the FR side of the Republican and Kansas Rivers. Reportedly, no nesting occurs at FR; however, eagles do winter onpost. According to Department of the Army, Headquarters, Forces Command (1981), there has been one confirmed observation of the peregrine falcon in Geary County. No sitings have been reported in the last 2 years; this bird may migrate through the FR area.

No plant species at FR is listed as protected or endangered by Federal or state agencies. The state of Kansas has not enacted legislation protecting plants (Department of the Army, Headquarters, Forces Command, 1981). No habitat exists on FR suitable for Meads milkweed (*Asclepias meadii*) and prairie white-fringed orchid (*Plantanthera leucophaea*), which have been proposed for Federal protection.

Reportedly, the state-listed (Schwilling, 1981) threatened fish, the Topeka shiner (*Notropis topeka*), occurs in Wildcat Creek.

1.7 LAND USE

1.7.1 LEASES AND AGREEMENTS

FR currently consists of 39,416.2 ha of land owned in fee. An additional 1,450 ha of land offpost at the Milford Reservoir Recreation Area are used for training purposes under a memorandum of understanding (No. DACW41-4-68-425) with the U.S. Army Corps of Engineers (CE), Kansas City District (1967). No other inleases were reported.

According to FR (1983b), 28,154.13 ha of onpost land are currently outgranted for various purposes. The majority of the outgrants (27,997.95 ha) are unrestricted agricultural leases to local residents. The remaining outgrants (licenses, leases, easements, permits) involve rights-of-way to Government and commercial agencies for utilities and transportation accesses, housing facilities, use of onpost office space, and use of land for educational purposes (see App. C). None of these real estate instruments are of interest from the standpoint of toxic/hazardous materials.

1.7.2 EXCESSING ACTIONS

The land currently occupied by FR was acquired in three major transactions. The first occurred in 1855, when approximately 9,677.5 ha were withdrawn from public domain in the area currently south of Vinton School Rd. This area contains the present day cantonment areas. In 1941, approximately 12,837.5 ha north of the original acquisition were purchased to accommodate expanded training requirements. The final acquisition occurred in 1965 and involved the purchase of approximately 18,771.2 ha to the north and west of the 1941 tract. This area was also acquired for training purposes.

Lesser parcels have been disposed of in the past. In 1866, 1,624.5 ha were excessed by Congressional Act for highway and railroad purposes. The changing course of the Republican River, which forms part of the FR southern boundary, resulted in the loss of 213.7 ha of onpost land in 1867, 1956, and 1959. Other excesses in 1972 totaled 9.3 ha. According to CE, Kansas City District (1969), these excessed areas were on the perimeter of the installation and likely were not subject to contamination by military activities.

1.7.3 ADJACENT LAND USE

FR lies in Riley County (east and north) and Geary County (west and south) (see Fig. 1.6-1). Agriculture is the dominant land use in both counties (67 and 68 percent, respectively), with urban areas comprising less than 2 percent of the land use of each. Urban concentrations near the FR borders center around the cities of Junction City to the south, Ogden and Keats to the east, Riley to the north, and Milford to the west. Manhattan and Junction City are the largest of these and contain large residential areas, as well as some industry.

To the west of FR, the land is dominated by Milford Reservoir, which encompasses 6,590 ha. The northern and eastern boundaries of the installation abut agricultural areas and rangeland. The southern and southeastern boundaries exist near both agricultural and urban/ residential areas (Department of the Army, Headquarters, Forces Command, 1981).

1.8 <u>LEGAL CLAIMS</u>

Reportedly, no legal claims relating to toxic/hazardous materials are currently pending against FR, nor have there been past claims. Between July 1979 and November 1981, however, nine formal complaints were made by citizens in surrounding communities concerning noise from installation low-flying aircraft, artillery firings, and quarry blasts. The majority of the complaints claim the noise to be a nuisance, while others report loss of egg production in domestic poultry, broken windows, and cracks in building mortar (MAAF, 1983).

According to Department of the Army, Headquarters, Forces Command (1981), complaints from tanks and artillery noise average about three per year. The complaints are on file with the Environmental Office of DFAE.

2.0 PAST AND CURRENT ACTIVITY REVIEW

2.1 INSTALLATION OPERATIONS

2.1.1 INDUSTRIAL OPERATIONS

The primary mission of FR is to provide stationing and training facilities for the 1st Infantry Division (Mechanized) and its associated military units. A second, and lesser, mission is to provide base support for Army Reserve functions in Kansas and neighboring states. Because FR activities are primarily training and stationing, the preponderance of industrial operations are related to vehicle maintenance. Other industrial operations at FR are support-type activities. The various industrial operations at FR are described in the following paragraphs.

Motor Vehicle Maintenance Shops

There are five major vehicle maintenance shops at FR: the DIO shop (Bldg. 8100), the DFAE shop (Bldg. 130), the Kansas National Guard/ Mobilization and Training Equipment Site (KNG/MATES) shop (Bldg. 1470), the DPCA Automotive Self-Help Shop (Bldg. 7753), and the MAAF shop (Bldg. 866). These maintenance shops provide complete maintenance support for all motor vehicles operated at FR. In addition to these facilities, maintenance facilities for minor repairs are available at the various Custer Hill tactical equipment motor pools and the Main Post motor pools.

The DIO motor vehicle maintenance shop has been located in Bldg. 8100 since 1982 and is managed by Lear Siegler, Inc. Prior to the consolidation of all DIO activities into Bldg. 8100, vehicle maintenance activities were conducted in several buildings located in the Camp Funston area. The DIO facility provides maintenance support for all tactical vehicles and equipment used for training purposes and for all equipment stored at the equipment concentration site (ECS) area in Camp

Funston. Maintenance activities include routine maintenance (e.g., engine tuning and overhaul, oil changing, etc.), engine boiling capabilities, radiator repair, and drive train repair. Petroleum naphtha (Stoddard solvent) is the sole solvent used in these maintenance activities (see Sec. 2.2.1 for discussion of disposal of wastes generated from vehicle maintenance activities).

In addition to these maintenance activities, DIO also operates a battery shop at Bldg. 8100 (formerly in Bldg. 1605) and a vehicle paint shop (formerly at Bldg. 1693). The DIO battery shop handles all lead-acid batteries at FR, except those used by KNG/MATES; battery shop activities include routine maintenance (e.g., charging and adding water) and dead battery disposal (see Sec. 2.2.1). The DIO paint shop has two adjoining spray booths capable of handling all wheeled vehicles operated out of the tactical equipment areas and ECS area. The paint shop is not equipped with sandblasting capabilities.

The DFAE maintenance shop has been located in Bldg. 130 since the early 1940s and provides maintenance service for approximately 150 pickup trucks, 100 heavy trucks, and 1,000 push mowers and other nonpropelled pieces of equipment. The bulk of the activities conducted at the shop involve routine maintenance (e.g., engine tuning and overhaul, oil changing, lubrication, etc.). The DFAE shop does not contain battery maintenance facilities; battery service activities for DFAE are provided at the DIO facility. The DFAE shop has a small spray paint booth but no sandblasting capability; the only painting activity conducted is touchup work using aerosol spray cans. A discussion of the types of waste generated and method of disposal from the DFAE shop is presented in Sec. 2.2.1.

The KNG/MATES maintenance shop has been in operation since 1976 and is located in Bldg. 1470. The KNG/MATES shop provides maintenance service for approximately 250 track vehicles and 400 wheeled support vehicles. The bulk of the activities conducted at the shop are routine maintenance operations (e.g., engine tuning and overhaul, oil changing, lubrication, etc.). The KNG/MATES shop provides battery servicing for its vehicles (see Sec. 2.2.1 for discussion of battery maintenance and disposal activities). The shop is also equipped with spray booth facilities; however, spray painting reportedly is rarely performed.

The DPCA Morale Support Activity operates an Automotive Self-Help Shop in Bldg. 7753 (Custer Hill area). Minor engine repairs, parts replacement, and parts cleaning are conducted by post personnel. Parts cleaning includes the use of a 100-gal alkaline sodium hydroxide cleaning bath. This solution reportedly is changed twice a year, with disposal of spent solution to the sanitary sewer system.

The MAAF maintenance shop is located in Bldg. 866 and is operated by Doss Aviation, Inc., under DIO command. The shop provides maintenance for helicopters and small fixed-wing aircraft operating out of MAAF. The bulk of the activities conducted at the shop are routine maintenance activities. The batteries used in the aircraft are nickel-cadmium batteries, and recharging is the only service provided (see Sec. 2.2.1 for discussion of battery disposal operations). The shop is equipped with a spray paint booth; however, the booth is too small for painting other than touchup work using aerosol cans.

<u>Vehicle Wash Racks</u>

There are 87 wash rack facilities at FR. The locations of these wash racks and summaries of the type of wastewater treatment provided are presented in Table 2.1-1. The individual treatment systems at the Custer Hill wash racks will be replaced by a centralized treatment system (see Sec. 2.2.1 for discussion of the treatment and disposal of wash rack wastewater).

<u>Boiler Plants</u>

There are seven high-pressure (HP) boilers at FR which provide steam for cleaning, industrial processes, and heating. Two 1,000-pound per hour

Table 2.1-1. Summary of Wash Rack Facilities at FR

Location of Source	Receiving Water	Treatment
<u>Custer Hill Area</u>		
15 wash racks from Bldg. 8340, 8320, 8300, 8360	Threemile Creek	Sedimentation basin with oil and grease separator
5 wash racks from Bldg. 7960	Forsyth Creek	Sedimentation basin with oil and grease separator
5 wash racks from Bldg. 7940	Forsyth Creek	Sedimentation basin with oil and grease separator
2 wash racks from (East) Bldg. 7920	Forsyth Creek	Sedimentation basin with oil and grease separator
7 wash racks from Bldgs. 7920, 7900	Threemile Creek	Sedimentation basin with oil and grease separator
5 wash racks from Bldg. 7780	Threemile Creek	Sedimentation basin with oil and grease separator
5 wash racks from Bldg. 7760	Threemile Creek	Sedimentation basin with oil and grease separator
10 wash racks from Bldgs. 7740, 7720	Fourmile Creek	Sedimentation basin with oil and grease separator
10 wash racks from Bldgs. 7520, 7500	Fourmile Creek	Sedimentation basin with oil and grease separator
5 wash racks from Bldg. 7530	Fourmile Creek	Sedimentation basin with oil and grease separator
11 wash racks from Bldgs. 7170, 7130	Fourmile Creek	Sedimentation basin with oil and grease separator
<u>Camp Funston*</u>		
2 wash racks	Main Post WPC Plant	Sedimentation basin with oil and grease separator followed by secondary sewage treatment at the WPC plant

Table 2.1-1. Summary of Wash Rack Facilities at FR (Continued, Page 2 of 2)

Location of Source	Receiving Water	Treatment
<u>Main Post</u>		
1 wash rack each at Bldgs. 1734, 147	Main Post WPC Plant	Sedimentation basin with oil and grease separator followed by secondary sewage treatment at the WPC plant
<u>Camp Whitside</u>		
1 wash rack from Bldg. 873	Main Post WPC Plant	Sedimentation basin with oil and grease separator followed by secondary sewage treatment at the WPC plant
<u>Camp Forsyth*</u>		
1 wash rack	Camp Forsyth WPC Plant	Sedimentation basin with oil and grease separator followed by secondary sewage treatment at the WPC plant
<u>MAAF</u>		
1 wash rack from Bldg. 864	Main Post WPC Plant	Secondary sewage treatment at the WPC plan

Note: All wash racks use water only for cleaning; no detergents or other cleaning agents are used.

* Building locations were not reported.

Sources: Department of the Army, Headquarters, Forces Command, 1981.
ESE, 1983.

(lb/hr) boilers are located at IAH, two 500-lb/hr boilers are located at Bldg. 8073 on Custer Hill, and three 350-lb/hr boilers are located at the laundry (Bldg. 2.39). All boilers are typically fueled by natural gas and can be converted to fuel oil firing depending on gas availability. Boilers are inspected and serviced approximately every 6 months (see Sec. 2.2.1 for discussion of the handling and treatment of boiler wastewater). The boilers operate under state of Kansas air permits, as described in Sec. 2.4.

Laundry and Drycleaning

The FR laundry facility has been located in Bldg. 239 since the early 1940s. The facility provides laundry service for the installation utilizing detergents and chlorine bleach. Laundry wastewater is disposed of as described in Sec. 2.2.1. The drycleaning plant was located in Bldg. 109 from the early 1940s to October 1983; the plant is now located in Bldg. 216. The drycleaning solvent used until 1966 was Stoddard solvent; since then, tetrachloroethylene has been used. Both solvents were distilled and recycled. Disposal of drycleaning wastes is discussed in Sec. 2.2.1.

Furniture Repair and Upholstery Shops

Furniture and upholstry repair shops have been located in Bldg. 8100 since 1982; prior to that, the furniture repair shop was located in Bldg. 749, and the upholstery shop was located in Bldg. 748. Furniture repair activities consist primarily of stripping and refinishing office furniture, with minor wood working. The furniture shop is equipped with a spray paint booth; wastes associated with stripping and painting activities are disposed of as described in Sec. 2.2.1. The upholstery shop activities involve reupholstering office furniture.

Print Shop

The print shop has been located in Bldg. 54 since the early 1940s, and six offset printing presses are operated there. Perchloroethylene is the sole solvent/cleaner used at the shop and is disposed of as described in Sec. 2.2.1.

2.1.2 LESSEE INDUSTRIAL OPERATIONS

No past or current lessee industrial operations were reported at FR.

2.1.3 LABORATORY OPERATIONS

Laboratory operations on FR include Department of Pathology laboratories at IAH, the IAH radiology laboratory, dental clinic laboratories, the veterinary laboratory, the DIO oil analysis laboratory, the TASC photographic laboratory, the DPCA hobby photographic laboratory, and water analysis laboratories at the Preventive Medicine (PVNTMED) Activity (IAH) and at the Custer Hill WPC plant.

Pathology Laboratory

The Department of Pathology at IAH (Bldg. 485) houses laboratories that perform histological, bacteriological, and blood and urine chemistry analyses. These laboratories use various analytical reagent acids (acetic, sulfuric, hydrochloric), bases (ammonium hydroxide, potassium hydroxide), alcohols (ethanol, methanol, isopropyl), and organic solvents (acetone, formalin, ethyl acetate). Additionally, various nutrient agars and biological stains are used. With the exception of acids and bases, the only EPA-listed (EPA, 1982b) toxic/hazardous material used in the laboratory is xylene. Xylene is used to clear the unstained areas of mounted tissue samples for histological examinations. This use of xylene in the hospital was reported on the FR Resource Conservation and Recovery Act (RCRA) permit application (FR DFAE, 1980). Since 1976, xylene [16 liters per month (l/month)] has been disposed of by mixing with fuel oil and burning in the steam plant. In the last 6 months, the histology laboratory has substituted a nonhazardous material (Histoclear®), a vegetable-oil-based solvent, for xylene.

Acids and bases used in the laboratories are dilute (10^{-2} molar or less), and disposal of reagents containing these solutions is by dilution in laboratory sink drains connected to the sanitary sewer system. The disposal of laboratory wastes to the sanitary sewer is exempt from RCRA regulations due to the small quantities involved, the degree of dilution in the sanitary sewer, and the fact that the WPC plant is covered under National Pollutant Discharge Elimination System (NPDES) permits. Bacteriological testing involves the use of stains and various nutrient culture media. Liquid wastes generated by these tests are diluted and discharged to the sanitary sewer system via laboratory sink drains. Solid wastes are autoclaved for sterilization (as appropriate) and disposed of as ordinary waste.

Radiology Laboratory

The Department of Radiology at IAH generates spent X-ray developing and processing solutions. These solutions are transferred to a central silver recovery unit in Medical Maintenance Logistics for treatment. This central recovery unit is also used to process X-ray solutions from the dental clinics and the veterinary activity. Following silver recovery operations, solutions are discharged to the sanitary sewer. Prior to 1979, when Medical Logistics moved from the old hospital facility at Camp Whitside to IAH, no central recovery of silver from X-ray solutions was practiced. Individual X-ray units in the hospital and dental clinics were equipped with silver recovery units, which discharge to the sanitary sewer system. Reportedly, silver recovery from X-ray solutions has been practiced since the construction of IAH in the mid-1960s. Solutions from X-ray units that were formerly located in the old hospital (Camp Whitside) were discharged to the sanitary sewer with no silver recovery.

Dental Clinic Laboratories

Dental clinics are located in Bldgs. 485, 2511, 938, 7665, and 7670. Spent X-ray developing solutions are transferred to the central recovery unit at Medical Maintenance Logistics (IAH) for silver recovery. Amalgam scraps and gold leaf scraps are recovered and turned in to Medical Logistics as part of the precious metals recovery program.

Veterinary Activity Laboratory

The veterinary activity laboratory (Bldg. 66) generates X-ray solutions and reagents from blood tests. For the past 3 to 4 years, spent X-ray solutions have been transported to the central recovery unit in Medical Logistics at IAH. Prior to that, spent X-ray solutions were discharged to the sanitary sewer system via sink drains with no silver recovery. Reagents used in the laboratory include Wrights stain, isopropyl alcohol, and formalin. Small quantities of these reagents are disposed of by discharging to sink drains connected to the sanitary sewer system.

Waste mercury is generated by each of the health care laboratories from broken thermometers and other medical instruments. In the past, mercury spills were cleaned up and the waste mercury disposed of in the post sanitary landfill. In the past year, waste mercury from spill cleanup has been accumulated [<5 kilograms (kg)] and is stored in Bldg. 292 awaiting disposal via hazardous waste contract. [Subsequent to the site visit, it was reported that the feasibility of recycling mercury wastes from breakage of laboratory instruments is being investigated.]

DIO Oil Analysis Laboratory

The DIO oil analysis laboratory (Bldg. 8100) performs tests on vehicle lubricants for viscosity, water content, concentrations of 11 metals by emission spectroscopy, and infrared spectroscopic characterization. The laboratory uses two solvents, trichloroethane and trichlorotrifluoro-ethane, which are listed as hazardous under RCRA regulations (EPA, 1982b). These solvents currently are being disposed of along with the waste oil samples (400 l/month) by mixing with waste oils generated by vehicle maintenance operations. These waste oils are picked up by a waste oil recovery company under DPDO contract (see Sec. 2.2.1). Comingling hazardous wastes with nonhazardous materials is contrary to RCRA regulations. [Subsequent to the site visit, it was reported that the oil analysis laboratory has been advised to dispose of waste solvents by transfer to DPDO.]

TASC Photographic Laboratory

The DCE TASC photographic laboratory (Bldg. 54) generates approximately 100 l/month of spent photographic developing solution that is transferred to DPDO for silver recovery. Waste film is also sent to DPDO for processing. The TASC laboratory has been located in Bldg. 54 since 1957; prior to that, it was located in Bldg. 52. Various name changes have also occurred. Prior to the late 1960s, it was known as the Signal School Laboratory, then the Special Services Signal Laboratory, and, since 1971, TASC. Silver recovery of photographic solutions has been practiced beginning about 1968. The first few years, an inhouse silver recovery unit was used, then solutions were transferred to DPDO for recovery, as is the current practice. Prior to 1968, spent photographic processing solutions were discharged untreated to the sanitary sewer system via laboratory sink drains.

DPCA Hobby Photographic Laboratory

A small hobby photographic laboratory is operated in Bldg. 196. This operation generates approximately 40 l/month of waste photographic processing solutions, which are discharged to the sanitary sewer system with no silver recovery. Reportedly, a silver recovery unit is on hand, but it has not been placed in service. U.S. Department of Defense (DOD) (n.d.) policy and procedures require silver recovery of spent photographic solutions.

PVNTMED Activity Water Analysis Laboratory

Personnel at the PVNTMED laboratory at IAH (Bldg. 485) perform bacteriological (coliforms), chlorine, and fluoride determinations on the FR potable water, as required by Federal and state drinking water regulations. The PVNTMED laboratory is certified by the state of Kansas for drinking water analyses.

Fluoride analyses are performed using an ion-selective electrode following sample ionic strength adjustment with a total ionic strength adjustment buffer (TISAB). TISAB contains acetic acid, sodium hydroxide, sodium chloride, and a complexing agent, cyclohexane diamine tetraacetic acid (CDTA). Chlorine determinations are performed using the DPD (n,n-diethyl-P-phenylenediamine) method. Waste reagents and water samples from fluoride and chlorine analyses are diluted and discharged to the sanitary sewer system via laboratory sink drains.

DFAE Water Analysis Laboratory

The DFAE water analysis laboratory, located adjacent to the Custer Hill WPC plant, conducts operational surveillance of the potable water, as well as NPDES compliance monitoring of the WPC effluents. The laboratory is certified by the state of Kansas. Potable water operational monitoring includes fluoride, chlorine, and phosphate analyses. Hexametaphosphate is added to the potable water as a conditioner and corrosion inhibitor (see Sec. 2.3.3 for discussion of potable water treatment processes). WPC plant effluent analyses include biochemical oxygen demand (BOD), chemical oxygen demand (COD), volatile solids, suspended solids, alkalinity, volatile acid, oil and grease, and pH. Diluted reagents and water samples are disposed of by discharging to the sanitary sewer system via laboratory sink drains. This laboratory has been located at the Custer Hill WPC plant since its construction in the mid-1960s. Prior to that, the laboratory was located at the Main Post WPC plant.

2.1.4 MATERIEL PROOF AND SURVEILLANCE TESTING

No proof or surveillance testing by contractors has occurred at FR in the past or is occurring at present. With the following exception, no materiel proof or surveillance testing activities by the military have occurred at FR.

In 1981, the U.S. Air Force (USAF) conducted a 3-month test of the "copperhead" system, a cannon-launched, high explosive, 155-millimeter (mm) antitank projectile. During that test period, approximately 100 rounds were reportedly fired with no misfires. Currently, the Army conducts approximately 1 test per year of this system and plans to test approximately 40 rounds in 1984. Tests are conducted in the training areas.

No testing involving radioactive materials currently occurs at FR, and none has occurred in the past.

2.1.5 TRAINING AREAS AND ACTIVITIES

Training, maneuver, and exercise areas (exclusive of range and impact areas) are located primarily to the north of the cantonment areas. The locations of the major (lettered) maneuver areas, tank gunnery complex, and drop zones are shown in Fig. 2.1-1. The lettered areas outside of the original land acquisition area are divided into smaller exercise/ maneuver areas, as shown in U.S. Defense Mapping Agency (DMA), Hydrographic/Topographic Center (1979). Twenty-four numbered exercise/ maneuver areas are located adjacent to the cantonment area south of Vinton School Rd. In addition, amphibious training and river crossing training occurs in Block G and extends into flood control land held by the CE and used by FR through a memorandum of understanding (see Sec. 1.7.1). In general, the remaining training areas have multiple uses, including bivouac; defensive maneuvers; terrain analysis/ reconnaissance; field training exercises (FTXs); division proficiency exercises; infantry operational readiness training tests; squad and platoon patrolling; technical proficiency inspections; infantry and armored vehicle maneuvers; and day and night small unit, counter-insurgency/counter-guerilla, squad to batallion-level, and tactical live-fire attacks. Because of the nature of the terrain, the uses of each area change, and no general listing of activities by area is available.

Training activities involving toxic and hazardous materials currently include the use of riot control agent CS (o-chlorobenzylidene

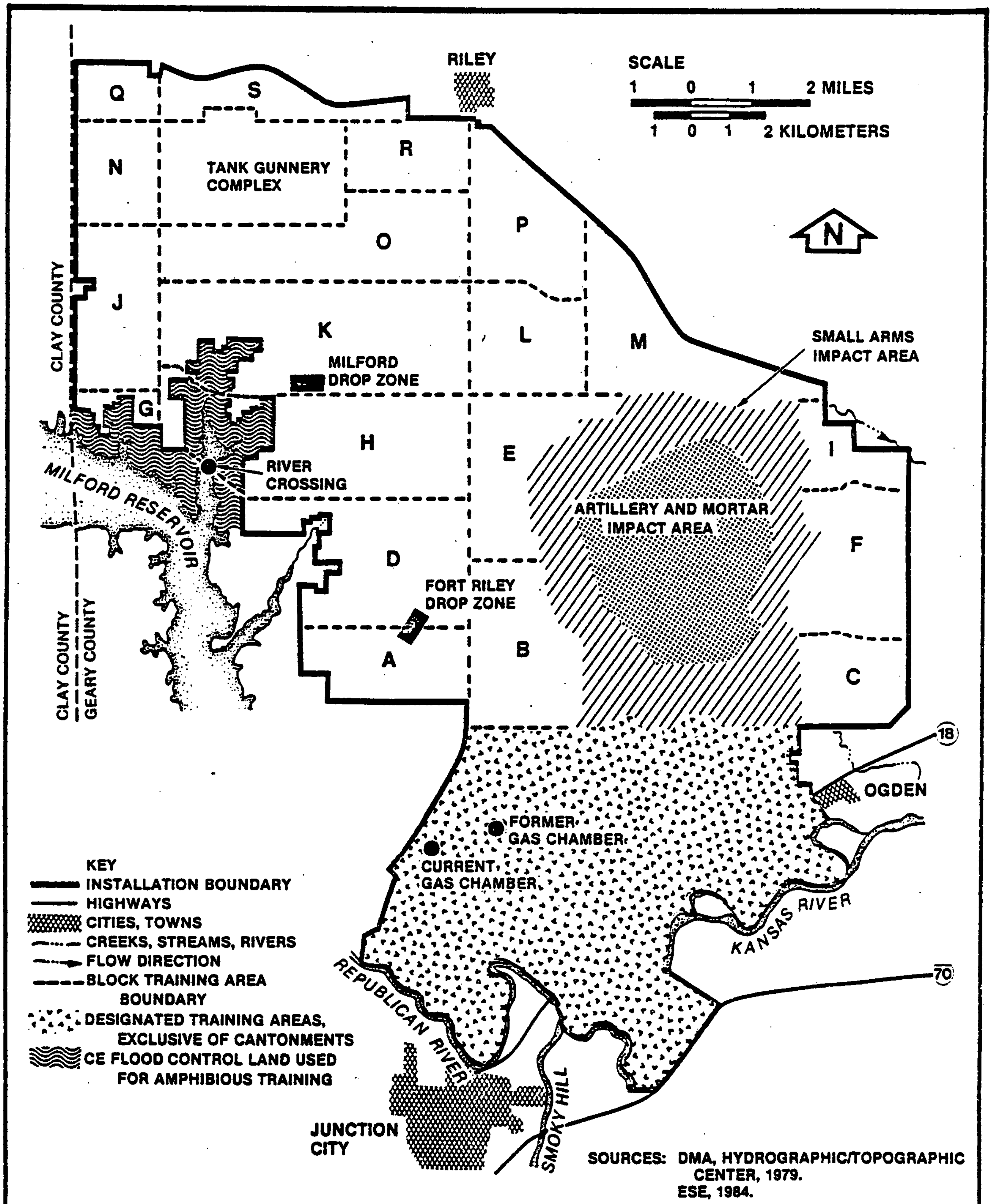


Figure 2.1-1 TRAINING AREAS ON FORT RILEY RILEY	Prepared for: U.S. Army Toxic and Hazardous Materials Agency Aberdeen Proving Ground, Maryland

malononitrile) in the gas chamber and in maneuvers and the use of smoke agents on the maneuver ranges, impact areas, and at the river crossing site located adjacent to Training Area G (USAEHA, 1979). The locations of the current and former gas chambers are shown in Fig. 2.1-1. Use of chemical/biological (CB) simulants in agent identification training is discussed in Sec. 2.1.7.

Demolition training and live-fire training occur at the explosive ordnance disposal (EOD) and Claymore mine areas and at ranges located adjacent to the impact area. These activities are discussed in the following section.

2.1.6 RANGES

FR has a total of 28 designated ranges and 64 artillery and mortar firing points. Small arms ranges are located in two areas of the installation. The first area is located in the Kansas River Valley, adjacent to the Camp Forsyth cantonment area. Fire from these ranges is directed into backstops and the adjacent steep hillsides. The remaining small arms ranges are located surrounding the central impact area. Fire from the artillery and mortar firing ranges, from the tank gunnery complex, and from aerial gunnery ranges is directed to the artillery and mortar impact area located in the east-central portion of the installation. Fig. 2.1-2 shows the locations of the ranges, firing points, impact area, and main unexploded ordnance (UXO)-containing area. Aerial gunnery fire from the east is directed into the artillery and mortar impact area. The tank gunnery complex is also shown in Fig. 2.1-2, along with the fire fan boundary danger area for high explosive antitank (HEAT), high explosive plastic (HEP), and SABOT fire. Table 2.1-2 (keyed to Fig. 2.1-2) shows the designated weapons use at each range. Impact areas and ranges are adequately marked with danger signs, as required. The Claymore mine and HE grenade training area (Ranges 16 and 25) is incorrectly identified as an EOD pit in the EPIC aerial imagery [State of Kansas, Department of Health and Environment (KDHE), 1967]. EOD and demolition training occur in Range 16.

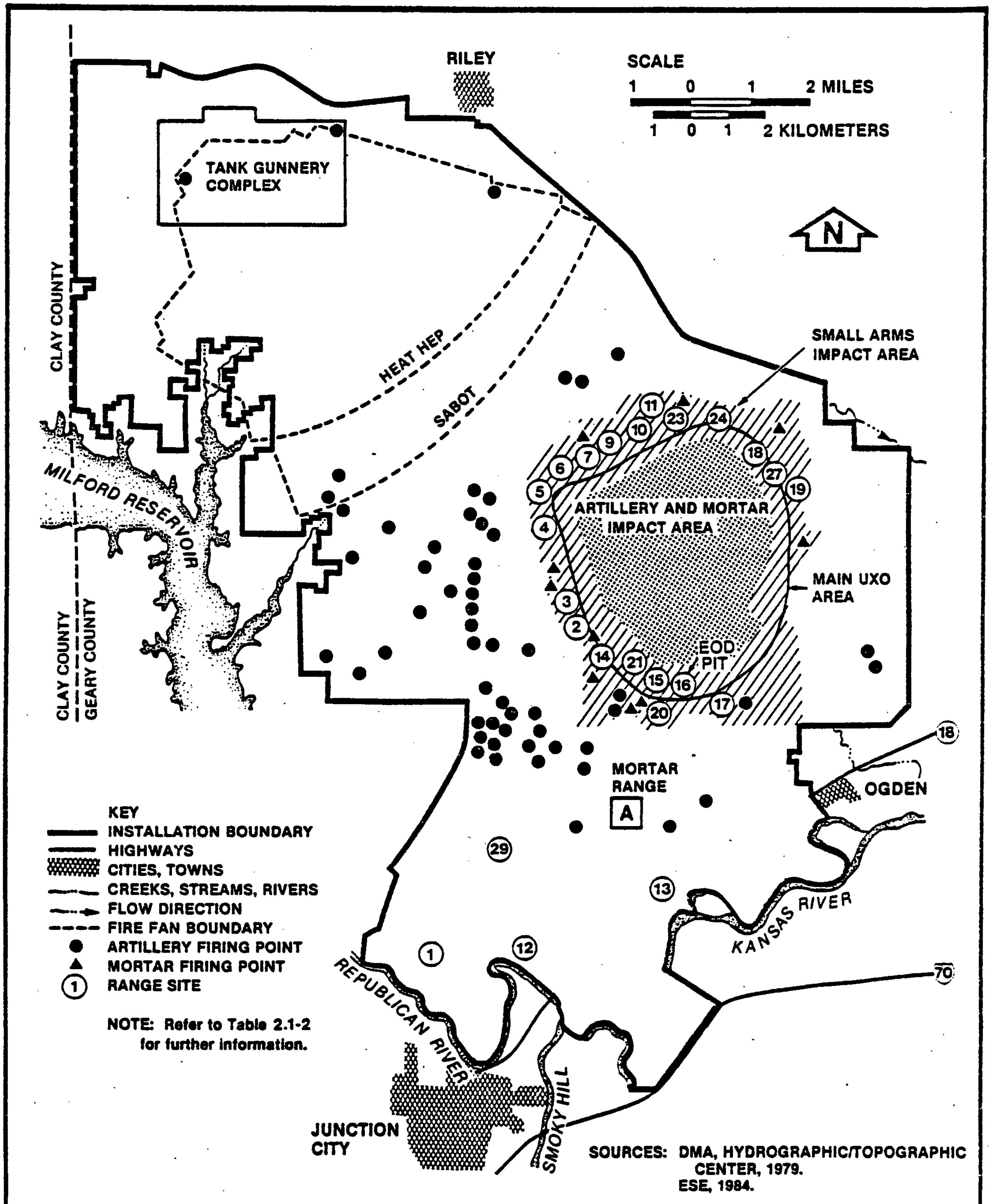


Figure 2.1-2
RANGES AND IMPACT AREAS ON FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 2.1-2. FR Range Inventory

Range Number (Keyed to Fig. 2.1-2)	Range Designation	Weapons Capacity
1	National Rifle (Match)	5.56-mm, 7.62-mm rifle; .38/.45-cal pistol; 12-ga shotgun; .45-cal submachinegun
2	Trainfire 1	5.56-mm, 7.62-mm rifle
3	Trainfire 2	5.56-mm, 7.62-mm rifle
4	Trainfire 3	5.56-mm, 7.62-mm rifle; .22-cal, .38/.45-cal pistol
5	Trainfire 4	5.56-mm, 7.62-mm rifle; 12-ga shotgun; .22-cal pistol; .45-cal submachinegun; .50-cal machinegun; 7.62-mm machinegun; .38/.45-cal pistol
6	Trainfire 5	5.56-mm, 7.62-mm rifle; 12-ga shotgun; .22-cal, .38/.45-cal pistol; .45-cal submachinegun; .50-cal machinegun; 7.62-mm machinegun
7	Trainfire 6	5.56-mm, 7.62-mm rifle; .22-cal, .38/.45-cal pistol
8—Not shown	Range 7	7.62-mm, 5.56-mm rifle; 12-ga shotgun; .22-cal, .38/.45-cal pistol; .45-cal submachinegun; .50-cal machinegun; 7.62-mm machinegun
9	Trainfire 8	5.56-mm, 7.62-mm rifle
10	Trainfire 9	5.56-mm, 7.62-mm rifle
11	Trainfire 10	5.56-mm, 7.62-mm rifle; 12-ga shotgun; .22-cal, .38/.45-cal pistol; .45-cal submachinegun
12	Range 5	.22-cal, .38/.45-cal pistol
13	Range 12	12-ga shotgun; .22-cal, .38/.45-cal pistol
14	Range 14	14.5-mm subcaliber/M-1 SABOT
15	Demo Pit 15	Demolition materials
16	Range 17	M203/M79 grenade launcher

Table 2.1-2. FR Range Inventory (Continued, Page 2 of 2)

Range Number (Keyed to Fig. 2.1-2)	Range Designation	Weapons Capacity
17	Range 18 (Tank Gunnery South)	5.56-mm, 7.62-mm rifle; 7.62-mm machinegun; .50-cal machinegun; 105-mm HEAT/HEP/inert
18	Range 25	Handgrenades, HE
19	Range 29	Specific approval by range control
20	Range 34	40-mm inert; 12-ga shotgun; .22-cal, .38/.45-cal pistol; .45-cal submachinegun
21	Range 37	Specific approval by range control
22	Range 42	.38/.45-cal pistol; .22-cal pistol
23	Range 51	5.56-mm, 7.62-mm rifle
24 (Not shown)*	Range 52	Aerial gunnery range
25 (Not shown)*	Range 54	Aerial gunnery range
26 (Not shown)	Range 55	.22-cal pistol
27	Target Detection Range 16	Claymore mines
28	Target Detection Range 20	Not designated
29	Target Detection Range 22	Not designated
30	Target Detection Range 23	Not designation

* Aerial gunnery fire is from the east into the impact area.

cal = caliber.
ga = gauge.
HE = High explosive.

Source: FR Range Control, 1983.

Reportedly, no chemical rounds have been used at FR. Weapons used range from .22 cal pistols and service revolvers to 155-mm HE.

In the past, several personnel have been killed by illegally tampering with UXO in the impact area or by UXO illegally removed. All these personnel were military and, in most cases, were not authorized to be in the impact area.

During World War II and the Korean Conflict, 4.2-in and 81-mm mortar ranges (shown as A on Fig. 2.1-2) were located north of Camp Whitside and east of the Custer Hill cantonment areas. Prior to World War II, small arms ranges were located immediately north of Route 18 in the southern portion of the installation, and artillery fire was directed from this area into the impact area.

2.1.7 TOXIC/HAZARDOUS MATERIALS (HANDLING AND STORAGE)

This section describes past and current handling and storage of pesticides, polychlorinated biphenyls (PCBs), chemicals, radiological materials, and CB agents.

Pesticides

Pesticides are stored and/or used at FR by the following: (1) DFAE Land Management Branch personnel, who store and apply herbicides and a limited amount of insecticides; (2) DPCA Golf Course Activity personnel, who store and apply herbicides, fungicides, and insecticides; (3) DFAE Wildlife Conservation Office personnel, who store and apply herbicides, algicides, and fish toxicants; and (4) Anti-Pest, Inc., Manhattan, Kans., which has a contract to control insect and rodent pests on FR. In addition to the above, Dr. Marvin D. Whitehead, Georgia State University, Atlanta, Ga., had contracts in 1976, 1977, and 1978 to treat elm trees on FR against Dutch elm disease.

DFAE Land Management Branch--The Land Management Branch pesticide storage facility (Bldg. 292) is marked with appropriate warning signs and is secured, heated, and ventilated in accordance with EPA (1982g) and USAEHA (1975). In addition, pesticide formulations were segregated by type and stored off the floor on wooden pallets under signs containing the name of the formulations, in accordance with EPA (1982g) and USAEHA (1975). Adequate curbing is present around the storage area, except along a wall separating the storage area from an adjacent paint and equipment storage room. At the time of the site visit, it was reported that plans were underway to completely curb the pesticide storage area. A floor drain beneath an overhead shower in the storage room had been sealed to prevent pesticide-contaminated water or spills from entering the sewer system. A current inventory (Table D-1, App. D) of stored pesticides is maintained by the pest control personnel, and pesticide stocks are checked periodically for leaking items. Pesticide applicators and supervisory personnel are DOD-certified, and pesticide usage is recorded monthly on DOD Form 1532, in accordance with U.S. Army Regulation (AR) 420-76 (U.S. Army, 1981). Pest control personnel receive periodic physical examinations, and blood cholinesterase levels are monitored three times yearly.

Formulation and mixing of pesticides occurs at the site of application, using water from a mobile tank truck. Pest control personnel triple-rinse, crush, and bury empty pesticide containers in the installation sanitary landfill. Pesticide-container rinse water and pesticide-contaminated wastewater generated by rinsing spraying equipment is currently disposed of by either spraying over the area just treated or using it as diluent for subsequent pesticide formulations. This practice has been in effect since the mid-1970s. Prior to that, pesticide wastewaters and/or inadvertent spills when formulating pesticides were allowed to run onto the ground in the equipment washing area behind the pesticide storage facility (Bldg. 292). This former practice has resulted in contamination of soils in the area behind this building. Analysis of routine soil samples in 1974 for the Army Pesticide Monitoring Program showed very high levels of several pesticides in soils in this area (Table 2.1-3). These pesticides

Table 2.1-3. Results of Department of the Army Pesticide Monitoring Program Pesticide Analsyes in Soils and Sediments at FR

USAEHA Sample No.	Date of Collection	Place of Collection	Substrate	Pesticides Found and Quantity (mg/kg) Mala-thion	Dia-zinon	Meth-oxychlor	Mirex	Chlor-dane	Diel-drin	Aldrin	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	o,p'-DDD
00224	15 May 73	Cantonment Area	Soil	—	—	—	—	—	—	—	0.033	—	0.023	0.018	—
00409	18 Sep 73	Cantonment Area	Soil	—	—	—	—	0.60	—	—	0.08	—	0.24	—	—
00411	18 Sep 73	Moon Lake	Sediment	—	—	—	—	—	—	—	—	—	—	—	—
00742	26 Jun 74	Republican River	Sediment	—	—	—	—	—	—	—	—	—	—	—	—
00743	26 Jun 74	Miller Pond	Sediment	—	—	—	—	—	—	—	—	—	—	—	—
00744	26 Jun 74	Kansas River Outflow	Sediment	—	—	—	—	—	—	—	—	—	—	—	—
00754	01 Jul 74	Disposal Landfill	Soil	—	—	—	—	—	—	—	—	—	—	—	—
00755	01 Jul 74	Recrea-tional	Soil	—	—	—	—	—	—	0.01	0.03	—	0.07	—	—
00760	01 Jul 74	Pesticide Storage	Soil	87.70	29.85	824.04	3.72	423.53	4.98	—	53.78	47.75	1.30	37.87	16.98
00761	01 Jul 74	Family Gardens	Soil	—	—	0.17	—	0.18	—	—	0.02	—	0.03	—	—
00762	01 Jul 74	Housing Area	Soil	—	—	—	—	—	—	—	0.03	—	0.05	—	—
00775	15 Jul 74	Range and Training	Soil	—	—	—	—	—	—	—	—	—	—	—	—

— = Not detected.
mg/kg = milligrams per kilogram.
DDT = dichlorodiphenyltrichloroethane.
DDE = 1,1,dichloro-2,2-bis(4-chlorophenyl)-ethylene.
DDD = dichlorodiphenyldichloroethane.

Source: Modified from USAEHA, 1976a.

included chlordane (423.53 mg/kg), methoxychlor (824.04 mg/kg), malathion (87.70 mg/kg), diazinon (29.85 mg/kg), and DDT and its metabolites (DDD and DDE) (157.80 mg/kg). Due to these excessive levels, a followup survey was conducted by the USAEHA in 1975 (USAEHA, 1976a). USAEHA found that pesticide contamination of soils extended behind the storage and mixing facility and into the sediments of a small ditch that runs behind this area (Table 2.1-4). [Subsequent to the site visit, it was reported that the soil and stream sediments in the drainageway behind Bldg. 292 will be resampled and analyzed for pesticides. Based on the results of these analyses, soil decontamination will be conducted, as necessary.]

DPCA Golf Course Activity—The golf course pesticide storage facility (Bldg. 6426), located at the Custer Hill golf course, is used to store herbicides, insecticides, fungicides, fertilizers, and miscellaneous equipment. Most of the pesticides are dry, ready-to-use granular formulations (Table D-2, App. D). This building is not a single purpose storage facility, as required by EPA (1982g). Pesticides should be separated from other items (equipment and fertilizer) to avoid contamination. Bldg. 6426 is an old, temporary wooden structure with an uncurbed concrete floor. Several boards were missing from the roof and wall of the building, and pesticide containers (paper bags) stored inside showed evidence of water damage by rainfall. EPA (1982g) requires that pesticides be stored in a dry and secure facility. [Subsequent to the site visit, it was reported that actions are being taken to provide the storage building with expedient weatherproofing and a backflow-prevention device. The feasibility of constructing a more satisfactory storage facility is being investigated.]

The golf course pesticide applicator is DOD-certified, maintains a current inventory of pesticide stocks, and compiles monthly usage data for DOD Form 1532. The applicator receives appropriate medical surveillance (physical examinations, blood cholinesterase tests).

Table 2.1-4. Results of Pesticide Analyses of Soils and Stream Sediments Behind Bldg. 292

USAEHA Sample No.	Date of Collection	Place of Collection	Substrate	Pesticide Found and Quantity (mg/kg)*										
				Durs-ban	Dia-zinon	Mala-thion	Chlor-dane	Meth-oxychlor	Diel-drin	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	o,p'-DDD
SP-224	23 Nov 74	75' from rear of formulating and storage area	Soil	0.67	0.41	0.29	544.6	118.5	9.2	159.5	50.0	12.5	—	—
SP-225	23 Nov 74	Bulk storage area in rear of formulating area	Soil	—	—	0.58	12.8	370.0	0.51	30.0	8.8	2.0		
SP-226	23 Nov 74	Unlined ditch in rear of formulating area	Water	—	—	—	—	—	—	—	—	—	—	—
SP-227†	23 Nov 74	Unlined ditch in rear of formulating area	Sediment†	—	—	—	0.28	0.36	—	0.10	0.02	0.015	0.03	—
SP-228	23 Nov 74	Outside fence in rear of formulating area	Soil	—	—	0.50	8.6	1.5	0.15	4.5	0.76	0.26	—	—
SP-229	23 Nov 74	Outside fence in rear of formulating area across concrete lined ditch	Soil	—	—	—	—	—	—	—	—	—	—	—
SP-230†	23 Nov 74	Unlined ditch where it flows into Kansas River	Sediment†	—	—	—	0.18	0.98	—	0.13	0.04	0.02	0.05	0.01
SP-231	23 Nov 74	Unlined ditch where it flows into Kansas River	Water	—	—	—	—	—	—	—	—	—	—	—

* All samples were also analyzed for 2,4-D, 2,4,5-T, and silvex. Sample No. SP-225 contained 1.72 mg/kg 2,4,5-T, 0.19 mg/kg silvex, and 0.14 mg/kg 2,4-D. All other samples contained less than 0.1 mg/kg of these compounds.
† Data are the mean of four replicates for sample Nos. SP-227 and SP-230.

-- = Not detected.
2,4-D = dichlorophenoxyacetic acid.
2,4,5-T = trichlorophenoxyacetic acid.

Source: Modified from USAEHA, 1976a.

There is no designated formulation and mixing facility for formulating liquid pesticides used by the golf course pesticide applicators. It was reported that when mixing of rinsing water is needed, any available water source is used. No backflow-prevention device is used to prevent back siphoning of pesticides into the potable system. Empty pesticide containers are triple-rinsed, crushed, and disposed of in the post sanitary landfill. Pesticide-contaminated wastewaters are disposed of by spraying over the area just treated. Disposal practices for containers and wastewaters are in accordance with EPA (1982g).

DFAE Wildlife Conservation Office—Personnel from the Wildlife Conservation Office store and apply algicides, herbicides, and fish toxicants for use in controlling the growth of nuisance aquatic vegetation and fish. Aquazine algicide (simazine; EPA Reg. No. 100-437) is used to control filamentous algae, Weed-Rhap herbicide (2,4-dichlorophenoxyacetic acid; EPA Reg. No. 39511-77) is used to control pondweed and watermilfoil, and Nusyn-Noxfish fish toxicant (rotenone; EPA Reg. No. 432-550) is used to control populations of rough fish. Application of the above pesticides occurs principally during the summer months (June, July, August, and September). Small quantities of these pesticides are stored in Bldg. 198. While Bldg. 198 does not meet the requirements of EPA (1982g), the small quantity (18 kg of Aquazine; 18 kg of Weed-Rhap; 15 l of Noxfish) in storage does not pose a serious problem. Consideration should be given, however, to the possibility of storing these stocks in the DFAE pesticide storage facility (Bldg. 292), which more closely conforms to the storage requirements of EPA (1982g).

Wildlife personnel are not DOD-certified; however, AR 420-76 (U.S. Army, 1981) only requires certification if personnel spend more than 25 percent of their onduty time as pesticide applicators. Pesticides applied by wildlife personnel are not reported for inclusion in the monthly DOD Form 1532, as required by AR 420-76 (U.S. Army, 1981).

Anti-Pest, Inc., Manhattan, Kans.—Anti-Pest, Inc. has a contract to control insects and rodents in buildings on FR. Anti-Pest, Inc. has been contracted to provide this service since 1974. Prior to contract pest control, DFAE personnel provided insect and rodent control services. Anti-Pest personnel store and dispose of pesticides and pesticide wastes offpost. Some formulation and mixing of pesticides occurs on FR by Anti-Pest applicators at the job site using water transported in containers on contractor vehicles. Anti-Pest, Inc. pest controllers are state of Kansas and DOD certified in pest control.

PCBs

In December 1979, DFAE electrical shop personnel conducted a name-plate survey of in-service electrical equipment to identify items potentially containing PCB fluids (Table E-1, App. E). All items were labeled in accordance with EPA (1982f) regulations.

Out-of-service electrical equipment (Table E-2, App. E) suspected of containing PCB fluids is stored in metal conex containers in a fenced area of the DFAE maintenance yard. These containers have been equipped with curbed, impermeable metal flooring, are marked with PCB warning signs, and are locked, as required by EPA (1982f) regulations. DFAE personnel are in the process of sampling and analyzing the fluids in these items prior to turn-in to DPDO for contract disposal. A hazardous materials storage facility has recently been constructed in the DPDO area. [Subsequent to the site visit, it was reported that the transfer of accountability (for disposal) of four PCB items to DPDO was accomplished in August 1984. No sampling was performed due to a waiver of the requirement by DPDO. The installation intends to sample and transfer all future waste PCB items, as needed. The installation intends to temporarily store selected waste PCB items, as needed.]

Since 1978, non-PCB electrical equipment removed from service is picked up under a reciprocity agreement with Solomon Electric Co. (Solomon, Kans.), which has an electrical service contract with DFAE. The value of the electrical equipment picked up by Solomon Electric Co. is deducted from billings resulting from contract work performed for DFAE.

Prior to Toxic Substances Control Act (TSCA) control of PCBs in the late 1970s, all unserviceable, out-of-service electrical equipment was contract sold through DPDO.

Chemicals

Selected activities on FR use toxic and hazardous chemicals in support of specific missions. These activities are: (1) the medical laboratories, (2) the fuel analysis laboratory, (3) the photographic laboratories, (4) the WPC water analysis laboratory, (5) pest control services, and (6) various industrial operations. Use and disposal of chemicals specific to each activity are discussed in the sections on laboratories (Sec. 2.1.3), pesticides and radiological materials (Sec. 2.1.7), and industrial operations (Sec. 2.2.1). During the site visit, no incompatible chemicals were observed being stored together.

Radiological Materials

Radiological materials are stored and used on FR by personnel at the NBC School, DFAE personnel at the Custer Hill and Forsyth WPC plants, the 95th Calibration Service Company (TMDE Support Team No. 11), the Nuclear Weapons Support Branch, and the 937th Engineer Group. Table 2.1-5 lists the radioactive items onpost, isotope type and activity, and storage locations.

NBC School—Personnel at the NBC School (Bldg. 34) store two PDR 27 meters and radioactive test samples containing sealed sources of 5 milliCuries (mCi) of krypton-85. Storage and use of these items is covered under a U.S. Nuclear Regulatory Commission (NRC) license held by the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM) at Rock Island, Ill.

Table 2.1-5. Radiological Materials on FR

Item	Description	Isotope	Serial No.	Location	NRC License Holder
AN/UDM-2	Radiac Calibrator	Strontium-Yttrium-90	071	Bldg. 463	CECOM
AN/UDM-2	Radiac Calibrator	Strontium-Yttrium-90	486	Bldg. 463	CECOM
AN/UDM-2	Radiac Calibrator	Strontium-Yttrium-90	452	Bldg. 8100	CECOM
AN/UDM-2	Radiac Calibrator	Strontium-Yttrium-90	88	Bldg. 8100	CECOM
AN/UDM-6	Radiac Calibrator	Plutonium-239	A1122	Bldg. 8100	CECOM
AN/UDM-6	Radiac Calibrator	Plutonium-239	382	Bldg. 8100	CECOM
MC-1	Soil Density Meter	Cesium-137; Americium-241	M17122113	Bldg. 8037	TACOM
MC-1	Soil Density Meter	Cesium-137; Americium-241	M18022182	Bldg. 8037	TACOM
—	Sludge Gauge	Cesium-137	850233	Bldg. 8130	AMCCOM
—	Sludge Gauge	Cesium-137	SH-302-56	Bldg. 2592	AMCCOM

CECOM = U.S. Army Communications Command.
TACOM = U.S. Army Tank-Automotive Command.
— = Not reported.

Source: FR RPO, 1983b.

DFAE WPC Plants—Sludge gauges are stored (one each) at the Custer Hill and Forsyth WPC plants. These gauges utilize sealed sources containing 200 mCi (Forsyth) and 500 mCi (Custer Hill) of cesium-137. Storage and use of these items are authorized under an NRC license held by AMCCOM. The storage areas are secure and are marked with warning signs, in accordance with NRC (1982).

The post Radiation Protection Officer (RPO) conducts periodic wipe tests of these items.

95th Calibration Service Company—The 95th Calibration Service Company is a DARCOM detachment from MICOM (Redstone Arsenal) and stores two AN/UDM-2 Radiac calibrators in Bldg. 463. These calibrators contain sealed sources of 200 mCi of strontium-yttrium-90. These items are licensed under an NRC license held by CECOM at Fort Monmouth, N.J. The storage area is secure and is marked with warning signs, in accordance with NRC (1982).

The post RPO conducts periodic wipe tests of these items.

Nuclear Weapons Support Branch—The Nuclear Weapons Support Branch stores two AN/UDM-2 and two AN/UDM-6 Radiac calibrators in Bldg. 8100. The AN/UDM-2 calibrators contain sealed sources of 200 mCi of strontium-yttrium-90 and the AN/UDM-6 calibrators contain sealed sources of plutonium-239 (activity = 1.4×10^6 counts per minute). Use and storage of these items under an NRC license held by CECOM. The storage area is secure and is marked with warning signs, in accordance with NRC (1982).

These sources are wipe tested on a periodic basis by the post RPO.

937th Engineer Group—The 937th Engineers (Bldg. 8037) store and use two MC-1 soil density gauges. These gauges utilize sealed sources containing 10 mCi of cesium-137 and 60 mCi of americium-241. The gauges are licensed under an NRC license held by TACOM. The storage area is secure and is marked with warning signs, in accordance with NRC (1982).

These items are wipe tested on a routine basis by the post RPO.

Additional Sources—Additional radiological items on FR include an unspecified number of low-light-level rifle sights containing promethium-147, light antitank weapons (LAW) sights containing promethium-147, and lensatic compasses containing tritium. These items are stored within various troop units at FR. In the event that these items are damaged, they are turned in to the DIO Supply Division and stored in Bldg. 199. This facility is fenced, locked, and marked with radiation warning signs, in accordance with NRC (1982) regulations. Upon accumulation of such quantity of these items to make shipment economically feasible, the post RPO notifies AMCCOM for disposition instructions, including packaging and monitoring procedures. The last shipment of items (fall 1983) for disposal was to Southwest Nuclear Co., Pleasanton, Calif. App. F contains a list of the items shipped and disposition instructions from AMCCOM.

CB Agents

The NBC School conducts training exercises using riot control agent CS, BUSH (n-butyl mercaptan), PEG 200 (polyethylene glycol), and talc (powder). CS is stored in the Ammunition Supply Point (ASP), while BUSH, PEG 200, and talc are stored at the NBC School. CS is used in open field training areas, as well as in the gas chamber (Bldg. 9455).

Prior to the early 1970s, chemical identification (I.D.) training exercises included the use of I.D. test sets. These exercises involved K149 and K951-952 test sets containing dilute (5 percent) solutions of mustard (H), lewisite (L), phosgene (CG), and chlorpicrin (PS). In 1976, 19 unused sets were shipped to Aberdeen Proving Ground-Edgewood Area (APG-EA) for eventual demilitarization.

Since the mid-1970s, I.D. training exercises have included the use of Simulant Chemical Agent Identification Training Sets (SCAITS). The chemicals used as agent simulants in the SCAITS kit are as follows:

Agent	Simulant
H	Dimethyl sulfate [0.3 milliliter (ml)/ampule]
L	3.5-percent iodine and 2.5-percent potassium iodine in water (0.3 ml/ampule)
Nerve	Glacial acetic acid (1.0 ml/ampule)
Blood-1	5.25-percent sodium hypochlorite (1.0 ml/ampule)
Blood-2	Saturated aqueous solution of sodium thiocyanate (1.0 ml/ampule)

Decontamination (DECON) training exercises use innocuous simulants (talc powder and water). No DECON chemicals are used for training purposes, although troop units store supratopical bleach (STB) and decontaminating solution-2 (DS-2). DS-2 consists of a ternary mixture of 70-percent diethylene triamine, 27-percent methyl cellosolve, and 3-percent sodium hydroxide. Both STB and DS-2 are alkaline compounds and, thus, are corrosive. NBC School personnel conduct monthly inspections of DECON chemical stocks. Out-dated and/or unserviceable items are overpacked in vermiculite-containing drums and shipped to DPDO for eventual disposal via hazardous waste contract.

2.1.8 PETROLEUM, OILS, AND LUBRICANTS (POL) HANDLING AND STORAGE

POL products used at FR are fuel oil, automotive gasoline, diesel fuel, aviation fuel, solvents (primarily Stoddard solution), engine oil, propane, and natural gas. These POL, with the exception of engine oil, are stored in bulk quantities in storage facilities, as summarized in Table 2.1-6; engine oil is generally stored in 55-gal drums; natural gas is delivered by pipeline. The POL storage tanks are of steel construction, with the exception of those of Bldg. 8100, which are fiberglass. POL products are delivered to FR by truck. Annual consumption of POL at FR is as follows: fuel oil, 3,990,388 liters (l); automotive gasoline, 3,793,407 l; diesel fuel, 5,497,334 l; aviation

Table 2.1-6. Summary of POL Storage Facilities at FR

Building No./ Location	Substance	No. of Tanks	Capacity Per Tank (gal)	Tank Type: Above-ground	Tank Type: Under-ground
94	Fuel Oil No. 2	1	7,500		X
158	Gasoline/Diesel Fuel	2	12,000		X
212	Fuel Oil No. 2	3	25,000		X
217	Stoddards Solvent	1	10,000		X
255	Fuel Oil No. 2	1	5,000		X
485	Diesel Fuel	1	5,000		X
486	Fuel Oil No. 2	3	20,000		X
495	Fuel Oil No. 2	1	9,450		X
828	Aviation Fuel	4	25,000		X
858	Fuel Oil No. 2	1	3,000		X
1044	Gasoline/Diesel Fuel	10	5,000		X
1190	Gasoline/Diesel Fuel	2	10,000		X
1245	Gasoline/Diesel Fuel	6	10,000		X
1470	Fuel Oil No. 2	1	4,000		X
1498	Gasoline/Diesel Fuel	2	10,000		X
1539	Gasoline/Diesel Fuel	10	Varies		X
1637	Gasoline/Diesel Fuel	15	Varies		X
1890	Gasoline/Diesel Fuel	10	Varies		X
1940	Gasoline/Diesel Fuel	6	12,000		X
1950	Fuel Oil No. 2	1	4,000		X
2340	Gasoline/Diesel Fuel	2	10,000		X
2341	Gasoline/Diesel Fuel	2	10,000		X
2345	Gasoline/Diesel Fuel	5	Varies		X
2584	Diesel	1	500		X
2585	Fuel Oil No. 2	1	500		X
6232	Fuel Oil No. 2	1	10,000		X
6940	Fuel Oil No. 2	1	8,500		X
6945	Fuel Oil No. 2	1	9,500		X
7120	Fuel Oil No. 2	1	20,000		X
7123	Gasoline/Diesel Fuel	2	10,380		X
7171	Gasoline/Diesel Fuel	10	Varies		X
7353	Gasoline/Diesel Fuel	10	Varies		X
7503	Gasoline/Diesel Fuel	10	Varies		X
7523	Gasoline/Diesel Fuel	10	Varies		X
7670	Fuel Oil No. 2	1	5,000		X
7700	Fuel Oil No. 2	1	2,000		X
7708	Diesel Fuel	1	500		X
7709	Fuel Oil No. 2	1	500		X
7723	Gasoline/Diesel Fuel	2	10,000		X
7743	Gasoline/Diesel Fuel	2	10,000		X
7753	Fuel Oil No. 2	1	3,000		X
7763	Gasoline/Diesel Fuel	10	Varies		X
7783	Gasoline/Diesel Fuel	10	Varies		X
7903	Gasoline/Diesel Fuel	10	Varies		X

Table 2.1-6. Summary of POL Storage Facilities at FR (Continued, Page 2 of 2)

Building No./ Location	Substance	No. of Tanks	Capacity Per Tank (gal)	Tank Type	
				Above-ground	Under-ground
7923	Gasoline/Diesel Fuel	10	Varies		X
7943	Gasoline/Diesel Fuel	10	Varies		X
7958	Fuel Oil No. 2	1	550		X
7963	Gasoline/Diesel Fuel	10	Varies		X
8073	Fuel Oil No. 2	3	25,000		X
8100	Fuel Oil No. 2 and Engine Oil	4	5,000		X
8300	Fuel Oil No. 2	1	10,000		X
8303	Gasoline/Diesel Fuel	2	10,000		X
8320	Fuel Oil No. 2	1	10,000		X
8323	Gasoline/Diesel Fuel	2	10,000		X
8340	Fuel Oil No. 2	1	10,000		X
8343	Gasoline/Diesel Fuel	2	10,000		X
8360	Fuel Oil No. 2	2	10,380		X
8363	Gasoline/Diesel Fuel	2	10,380		X
Range Bldgs.	Fuel Oil No. 2	42	Varies		X
Milford Marina	Gasoline	1	500		X
Main Post Auto Shop	Oil	1	500		X
1844	Propane	1	500	X	
9000	Propane	1	1,000	X	
9142	Propane	1	500	X	
9146	Propane	1	500	X	
9151	Propane	1	500	X	
9156	Propane	1	500	X	
9166	Propane	1	500	X	
9171	Propane	1	500	X	
9176	Propane	1	500	X	
9178	Propane	1	500	X	
9186	Propane	1	500	X	
9191	Propane	1	500	X	
9158	Propane	1	500	X	
9157	Propane	1	500	X	
9301	Propane	1	500	X	
9302	Fuel Oil No. 2	1	500	X	
9303	Fuel Oil No. 2	1	500	X	
9308	Fuel Oil No. 2	1	500	X	

Sources: FR DFAE, 1983d.
FR, 1979.

gasoline, 6,201 l; JP-4 jet fuel, 3,437,464 l; engine oil, 300,000 l; propane, 72,218 l; and natural gas, 38.39 million standard cubic meters (m^3).

The FR Spill Prevention Control and Countermeasure Plan/Installation Spill Contingency Plan (SPCC/ISCP) has been in effect since March 1979 (FR, 1979). The plan calls for a minimum of monthly inventory checks on buried tanks and daily inspections of aboveground tanks for leakage. Additionally, all underground tanks are inspected annually to determine the need for cleaning. Reportedly, the only abandoned underground tank is located at Bldg. 1245; this tank was pumped out and sealed in 1973.

Waste engine oil and spent solvents are comingled at the point of generation and disposed of through DPDO (see Sec. 2.2.1). Cross-contaminated fuels, storage tank sludges, and/or water-contaminated fuels are disposed of in the firefighting training pit (see Sec. 2.1.5).

2.2 DISPOSAL OPERATIONS

2.2.1 INDUSTRIAL WASTES

The industrial wastewater streams generated at FR are associated with the various vehicle and equipment maintenance activities conducted at the installation. The types of wastewater generated and methods of treatment are presented individually in the following paragraphs.

Vehicle Wash Racks

There are 87 wash rack facilities at FR; 80 of these racks are in the Custer Hill maintenance area, 2 each are in Camp Funston and the Main Post area, and 1 each is at Camp Whitside, Camp Forsyth, and MAAF. A summary of the wash rack locations and the types of treatment provided is presented in Table 2.1-1.

The individual Custer Hill area wash rack treatment systems will be replaced by a single, centralized wash rack treatment system located immediately west of the track vehicle wash rack reservoir. The new treatment system consists of a pond (the track vehicle reservoir), two oil/water separators, a four-cell lagoon system, and a buried 2,000-gal storage tank. Wastewater flow from the wash rack facility will go first to the pond, where floating booms collect and direct any floating material (i.e., POL, oil, scum, etc.) to the buried storage tank. It is estimated that 5,000 to 6,000 gal of waste oil will be generated annually and disposed of through DPDO.

At the outlet side of the pond are the oil/water separators, and the removed oil is also routed to the storage tank. After leaving the pond, the flow is routed to the four-cell lagoon system, which is designed to operate in series or parallel, with the front cells providing sedimentation and the back cells serving as storage. Treated water from the back storage pond will be recycled and reused as wash water at the wash rack facility. Any excess water will be discharged to Threemile Creek. It is estimated that the sedimentation (front) lagoons will be dredged at 5-year intervals, with the dredged material disposed of at the sanitary landfill.

The new treatment facility was scheduled to be in operation in November 1982; due to design modifications required to ensure proper functioning of the system, it is now expected to be fully functional by mid-1984. The new facility is considered to be best practical treatment (BPT) technology by EPA (Department of the Army, Headquarters, Forces Command, 1981).

The Camp Funston, Main Post, Camp Whitside, and Camp Forsyth wash racks are all equipped with oil/water separators and sedimentation basins, with the pretreated water being conveyed to either the Main Post or Camp Forsyth WPC plants for biological treatment. The waste oil collected at these facilities is disposed of through DPDO, and collected sediment is dredged and disposed of in the sanitary landfill.

The wash rack facility at MAAF flows to an industrial waste treatment system located in Bldg. 862. The system at Bldg. 862 consists of POL/water separation units and a sediment trap; however, the system has not been operational for approximately 15 years. In addition to the waste wash water; spent solvent (Stoddard solution) from aircraft maintenance activities are dumped down the wash rack drain system at a rate of approximately 758 l/month. All wash rack water and solvents are piped to the Main Post WPC plant for treatment and disposal.

Battery Shops

There are two active battery maintenance shops at FR; one is operated by DIO at Bldg. 8100, and the second is operated by KNG/MATES at Bldg. 1460. Both battery shops neutralize the spent electrolyte with aqueous ammonia to a pH between 6 and 8 prior to discharge to the sanitary sewer system. The neutralized acid from the Bldg. 8100 shop goes to the Custer Hill WPC plant; neutralized acid from Bldg. 1460 flows to the Main Post WPC.

The acid neutralization at Bldg. 8100 occurs in a specially designed tank system connected to the sanitary sewerline. Approximately 800 l/month of acid are treated at this facility. This DIO battery shop was formerly located at Bldg. 1605 (from the early 1940s to 1981) in the Camp Funston area; the Bldg. 8100 shop has been in used since mid-1981. Battery maintenance operations are essentially unchanged from the past to the present; while the shop was at Bldg. 1605, the neutralized acid was treated at the Main Post WPC plant.

The KNG battery shop at Bldg. 1460 treats approximately 200 l of drained electrolyte per month. The electrolyte neutralization process is not performed with specialized equipment; rather, the electrolyte is drained into 55-gal drums, aqueous ammonium hydroxide is added, and the resulting neutralized acid is dumped into a floor drain connected to the sanitary sewer. The KNG maintenance facility has been in operation since 1976, and the battery treatment procedure is unchanged from the past to the present.

In 1980, USAEHA performed the EPA toxic extraction procedure (TEP) for heavy metals on a sample of neutralized electrolyte from the DIO battery maintenance shop (then located at Bldg. 1605); the TEP analysis was also performed on a dried sludge sample from the Main Post WPC plant. Results of these analyses, presented in Table 2.2-1 indicate that for the neutralized electrolyte, levels of lead and cadmium are slightly less than RCRA allowable limits. The remaining metals for the neutralized electrolyte sample and all metals for the dried sludge sample are well under the RCRA allowable limits. Based on these results, USAEHA recommended that the neutralized electrolyte be routinely tested to ensure that heavy metals do not make neutralized electrolyte a hazardous waste (USAEHA, 1980). Reportedly, this recommendation is not being followed.

Boiler Plant Wastes

Boiler blowdown and boiler cleaning wastes from the steam plants at FR are discharged directly into the sanitary sewer system. The blowdown and cleaning wastes from the hospital and laundry boilers go to the Main Post WPC plant, wastewater from the Custer Hill boilers goes to the Custer Hill WPC plant. Discharges from the boilers are not metered for flow. Boiler feed water is treated with a poly-phosphate compound to reduce scaling potential. A chromium-based antiscaling agent may have been used in the past; however, this could not be verified. Boiler cleaning is performed semiannually using sulfuric acid.

Laundry and Drycleaning

Wastewater containing detergent and bleach from the laundry facilities at FR is discharged to the sanitary sewer and treated at the Main Post WPC plant. The drycleaning plant, which was located at Bldg. 109 from 1950 to October 1983, does not generate a water-based waste stream; however, a still residue (consisting of soil and tetrachloroethylene solvent) is generated at a rate of approximately 80 l/month. Tetrachloroethylene has been used as a drycleaning solvent since 1966; prior to 1966, Stoddard solution reportedly was used as the drycleaning

Table 2.2-1. Chemical Analyses of Neutralized Battery Electrolyte and Main Post WPC Plant Sludge

Parameter	Metal	TEP Concentration (mg/1)	RCRA Limits (mg/1)
Battery Electrolyte After Neutralization	Arsenic (As)	ND	5
	Barium (Ba)	ND	100
	Cadmium (Cd)	1.01	1
	Chromium (Cr)	0.116	5
	Lead (Pb)	4.83	5
	Mercury (Hg)	ND	0.2
	Selenium (Se)	ND	1
	Silver (Ag)	ND	5
WPC Sludge	Arsenic (As)	0.031	5
	Barium (Ba)	0.5	100
	Cadmium (Cd)	0.022	1
	Chromium (Cr)	0.025	5
	Lead (Pb)	ND	5
	Mercury (Hg)	ND	0.2
	Selenium (Se)	ND	1
	Silver (Ag)	ND	5

mg/1 = milligrams per liter.
ND = Not detected.

Source: Modified from USAEHA, 1980.

solvent. This still residue has been disposed of by pouring it on the ground behind the building. Tetrachloroethylene still bottoms are a listed RCRA hazardous waste. A site inspection of Bldg. 109 showed an area of badly deteriorated asphalt measuring approximately 10 square meters (m^2) outside the back door. In 1980, USAEHA recommended that the drycleaning solvent be contracted for offsite disposal (USAEHA, 1980). [Subsequent to the site visit, it was reported that the soil in the vicinity of Bldg. 109 will be sampled and analyzed for tetrachloroethylene. Based on the results of these analyses, soil decontamination will be conducted, as necessary.]

Motor Vehicle Maintenance Shops

Waste products generated at the motor vehicle maintenance shops are battery electrolyte (discussed previously), waste oil and solvents, wastewater from engine boiling operations, waste antifreeze, waste paint and paint solvents, and floor drain water.

Waste oil, hydraulic fluid, and solvents (nonhazardous, Stoddard-type) generated at the DIO and KNG shops are comingled at the point of generation and drained to underground storage tanks through an oil floor drain system. The DIO waste oil tank has a capacity of 4,000 gal and is pumped out monthly for disposal through DPDO by a waste oil recycling company (Richard Bigda, Tulsa, Okla.). The KNG waste oil tank has a capacity of 1,000 gal and is also pumped out and disposed of monthly through DPDO. Waste oil and hydraulic fluids and spent solvent from the DFAE maintenance shop are kept segregated; waste oil and fluids are manually dumped into a 1,000-gal underground tank, and spent solvents are dumped into a 55-gal drum. Both the waste oil and waste solvent are collected monthly and disposed of through DPDO. Waste oil and solvents generated at the DPCA Automotive Self-Help Shop are comingled at the point of generation and are drained to a 1,000-gal underground tank. The tank is pumped out approximately bi-monthly and disposed of through DPDO.

Waste oil and waste solvents (Stoddard) generated at the MAAF maintenance shop are segregated at the point of generation. Waste oil is stored in 55-gal drums, and approximately 750 l/month are disposed of through DPDO. The waste solvent generated at MAAF is collected and stored similarly to waste oil; however, the solvent is dumped into a wash rack drain at Bldg. 864 which is connected by a sanitary sewerline to the Main Post WPC plant. Because the oil/water separation unit associated with this wash rack is nonoperational, the solvent is not pretreated prior to entering the WPC plant. DIO was informed of this practice during the site visit and, reportedly, will be modifying the waste oil disposal contract to include disposal of the waste solvent. [Subsequent to the site visit, it was reported that aircraft maintenance activities have been advised to dispose of waste degreasing solvents by transfer to DPDO.]

In addition to these major and continuous generators of waste oil and waste solvents, there are several underground waste oil tanks located at the Custer Hill tactical equipment motor pools and the Main Post motor pools. These tanks are rarely used, because vehicle maintenance activities are generally not performed at the motor pools.

Prior to 1971, waste oils and solvents were collected in the manner described previously; however, the bulk of the disposal was accomplished through landfilling (see Sec. 2.2.3 for a discussion of POL landfilling practices).

Wastewaters from engine boiling operations are generated at the DIO maintenance facility (Bldg. 8100) and at the DPCA Automotive Self-Help Shop (Bldg. 7753). The DIO engine boiling tank has a capacity of approximately 1,000 gal. The tank is filled with water and approximately 160 kg of sodium hydroxide; the tank is emptied approximately every 3 to 4 months to the sanitary sewer flowing to the Custer Hill WPC plant. The Automotive Self-Help Shop tank has a capacity of approximately 500 gal and is filled with water and approximately 70 to 90 kg of sodium hydroxide. The Self-Help Shop tank is emptied every 6 months to the sanitary sewer flowing to the Custer Hill WPC plant. Due to the caustic (corrosive) characteristic of these solutions, they may be classified as RCRA hazardous wastes due to corrosivity. [Subsequent to the site visit, it was reported that the decision to discharge caustic solution to the sanitary sewer will be based on the results of laboratory analyses for corrosivity and trace metals content. The discharge of caustic cleaning solution to the sewer system is prohibited without prior consultation with the facilities engineer.]

Waste antifreeze (ethylene glycol) from the DIO maintenance shop has been settled, drummed, and disposed of through DPDO since 1982. Prior to 1982, waste antifreeze was comingled with waste oil and drained to the waste oil storage tank. Waste antifreeze from the DFAE shop is and has been drained to the waste oil storage tank. At the KNG/MATES shop, antifreeze is settled and recycled; supernatant from the settling is disposed of in the sanitary sewer system. Waste antifreeze from the Automotive Self-Help Shop is drained to the waste oil storage tank.

Waste paint, paint sludges, and paint solvents and thinners are generated at the DIO maintenance shop (Bldg. 8100) only. The DFAE, KNG/MATES, and MAAF maintenance shops are equipped with spray booths; however, only touchup work using aerosol-type cans is performed. The DIO maintenance shop uses cellulose acetate butyrate and cellulose nitrate as paint thinners and acetone as a solvent. Waste solvents, thinners, and paint sludges are stored in 5-gal cans in a steel locker; these materials are picked up monthly and disposed of through DPDO. Additionally, about 200 air filters from the paint booth are disposed of annually in the sanitary landfill. Since lead-based paints and chromate primers are used in painting operations, these filters were analyzed by USAEHA using the RCRA extraction procedure toxicity test (EPA, 1982b). The results of this analysis indicated that the filters were nonhazardous and, therefore, landfill disposal is appropriate (USAEHA, 1982). Prior to 1982, the DIO paint shop was located in Bldg. 1693; types and quantities of materials used and method of disposal are essentially unchanged since the early 1970s.

All vehicle maintenance shops at FR are equipped with floor drains connected to the sanitary sewer system. Shop floors are periodically washed down with water; the wash water will contain dirt and soil and any oil and/or solvent spills. Wash water from the floor drains at the DIO maintenance building and Automotive Self-Help Shop are treated at the Custer Hill WPC plant. Wash water from the floor drains at the DFAE, KNG/MATES, and MAAF maintenance shops is treated at the Main Post WPC plant.

Furniture Repair Shop

The furniture repair shop is located in Bldg. 8100 and generates stripped paint sludge wastes, waste paint thinner, and paint sludge. The paint thinner used is cellulose nitrate; the paint remover is unidentifiable due to incomplete labeling, and acetone and tetrachloroethylene (perchloroethylene) are used as solvents. All waste sludges, solvents, thinners, and containers are disposed of in the trash and landfilled at the sanitary landfill. The total volume of waste generated is estimated at 50 l/month, of which approximately 20 l are thinner and solvents, and the remainder is paint stripper and paint sludge. Since tetrachloroethylene is an RCRA-listed hazardous waste, this disposal practice is contrary to EPA regulations (EPA, 1982b). Prior to 1981, the repair shop was located in Bldg. 749; types of materials used and disposal practices are unchanged. [Subsequent to the site visit, it was reported that the furniture shop has been advised to dispose of tetrachloroethylene wastes by transfer to DPDO.]

Adjutant General (AG) Printing Shop

The printing shop is located in Bldg. 54 and generates a waste consisting of solvent- and ink-soaked rags used for press cleaning and empty solvent and printing ink containers. The solvent used is tetrachloroethylene at an estimated rate of 20 l/month. All waste rags and containers are placed in the trash and disposed of in the sanitary landfill. Since tetrachloroethylene is an RCRA-listed hazardous waste, this disposal practice is not in accordance with RCRA regulations (EPA, 1982b). [Subsequent to the site visit, it was reported that the print plant has been advised to dispose of tetrachloroethylene wastes by transfer to DPDO.]

2.2.2 WASTEWATER TREATMENT

There are three wastewater treatment plants in operation at FR. The wastewater treatment plants are referred to as WPC plants and have a combined treatment capacity of 17.4 million liters per day (MLD) of wastewater. The WPC plants treat primarily domestic sanitary sewage; however, some industrial wastewater discharges are routed to the WPC plants (see Sec. 2.2.1). The three WPC plants are located at Main Post, Camp Forsyth, and Custer Hill, and all plants operate under NPDES Permit No. KS0029505. Discussions of the WPC plants follow.

Main Post WPC Plant

The Main Post WPC plant has a design capacity of 6.8 MLD and typically operates at a flow of 4.2 MLD. The plant provides treatment for wastewaters generated at the Main Post, MAAF, Camp Whitside, and Camp Funston areas. The overwhelming majority of the flow to the WPC plant is a sanitary sewage; small (and unmetered) quantities of wastewater come from laundry operations, wash rack areas (see Sec. 2.2.1), the photography laboratories, neutralized battery acid from the KNG/MATES area, and boiler blowdown and boiler wash water from steam plants. Treated effluent is discharged to the Kansas River.

The treatment system at the Main Post WPC plant consists of uncovered standard rate trickling filters preceded and succeeded by primary and secondary clarifiers, respectively. Sludge wastes from these clarifiers are digested in anaerobic digestors, and the digested sludge is dried on open sand beds. Supernatant from the digestors and filtrate from the dry beds are returned to the head of the plant for treatment. The dried sludge is disposed of in the sanitary landfill. The Main Post WPC plant has been in operation since 1940, with present operational practices unchanged from those of the past. The plant operates within its NPDES effluent limitation guidelines (USAEHA, 1981a) but is occasionally upset, reportedly by solvents (see Sec. 2.2.1 regarding the MAAF wash racks).

Camp Forsyth WPC Plant

The Camp Forsyth WPC plant has a design capacity of 5.7 MLD and operates at an average daily flow of 2.7 MLD. The plant treats wastewater generated at Camp Forsyth and Colyer Apartment areas. The overwhelming majority of the flow to the plant is sanitary sewage, with a minor contribution from vehicle wash racks (see Sec. 2.2.1). Treated effluent is discharged to the Republican River.

The treatment system at the Camp Forsyth WPC plant utilizes the same unit processes for wastewater treatment and sludge treatment and disposal as the Main Post WPC plant. The Camp Forsyth WPC plant has been in operation for approximately 40 years, with past and current operational practices unchanged. The plant is in compliance with NPDES permit requirements (USAEHA, 1981a), and upsets rarely have been reported.

Custer Hill WPC Plant

The Custer Hill WPC plant has a design capacity of 5.7 MLD and operates at an average daily flow of 7.2 MLD (Department of the Army, Headquarters, Forces Command, 1981). The plant treats sanitary sewage generated at the Custer Hill maintenance, troop housing, and family housing areas and also receives industrial wastewaters (neutralized battery acid, engine boiling wastewaters, and floor drain waters) from the Custer Hill maintenance area (primarily from Bldg. 8100). Treated effluent is discharged to Threemile Creek, a tributary to the Kansas River.

The treatment system at the Custer Hill WPC plant utilizes the same unit processes for wastewater treatment and sludge treatment and disposal as the Main Post WPC plant. The Custer Hill WPC plant has been in operation since 1955, and, while additional treatment units have been added to the plant, operations are essentially unchanged from the past to the present. USAEHA (1981b) states that the Custer Hill WPC plant was unable to consistently meet NPDES permit limitations from 1977 to 1981 because of high organic loading into the plant and hydraulic problems within the various unit processes. Recommended plant modifications based on the USAEHA 1981 study (USAEHA, 1981b) resulted in "marginal compliance" with NPDES effluent limitations (USAEHA, 1981a). Since the 1981 modifications, the plant is reported to be generally in compliance; however, some excesses of NPDES effluent limitations have been noted. Additionally, the plant occasionally is reported to be upset due to "solvents" originating from the maintenance area.

2.2.3 LANDFILLS/SOLID WASTE

Solid waste generated on FR has been disposed of by incineration, open burning, landfilling, and/or some combination of these methods. Locations and dates of operation for the various landfills on the installation are shown in Fig. 2.2-1. Historically, the earliest known landfill at FR was located in a ravine area just northwest of the present day commissary. This landfill operated from approximately the late 1800s through the early 1900s. At the present time, a parking lot has been constructed at the landfill site, but debris is still visible in the ravine.

From 1917 to about the mid-1950s, a sanitary landfill existed south of the Main Post and is believed to have been the Main Post dump area. With increased activity in the early 1940s, two additional sanitary landfills began operations. One existed near the southeast corner of Camp Funston. This site consisted of an incinerator and landfill and is reported to have operated from 1941 to approximately the mid-1950s; however, the method of operation is unknown. The incinerator was

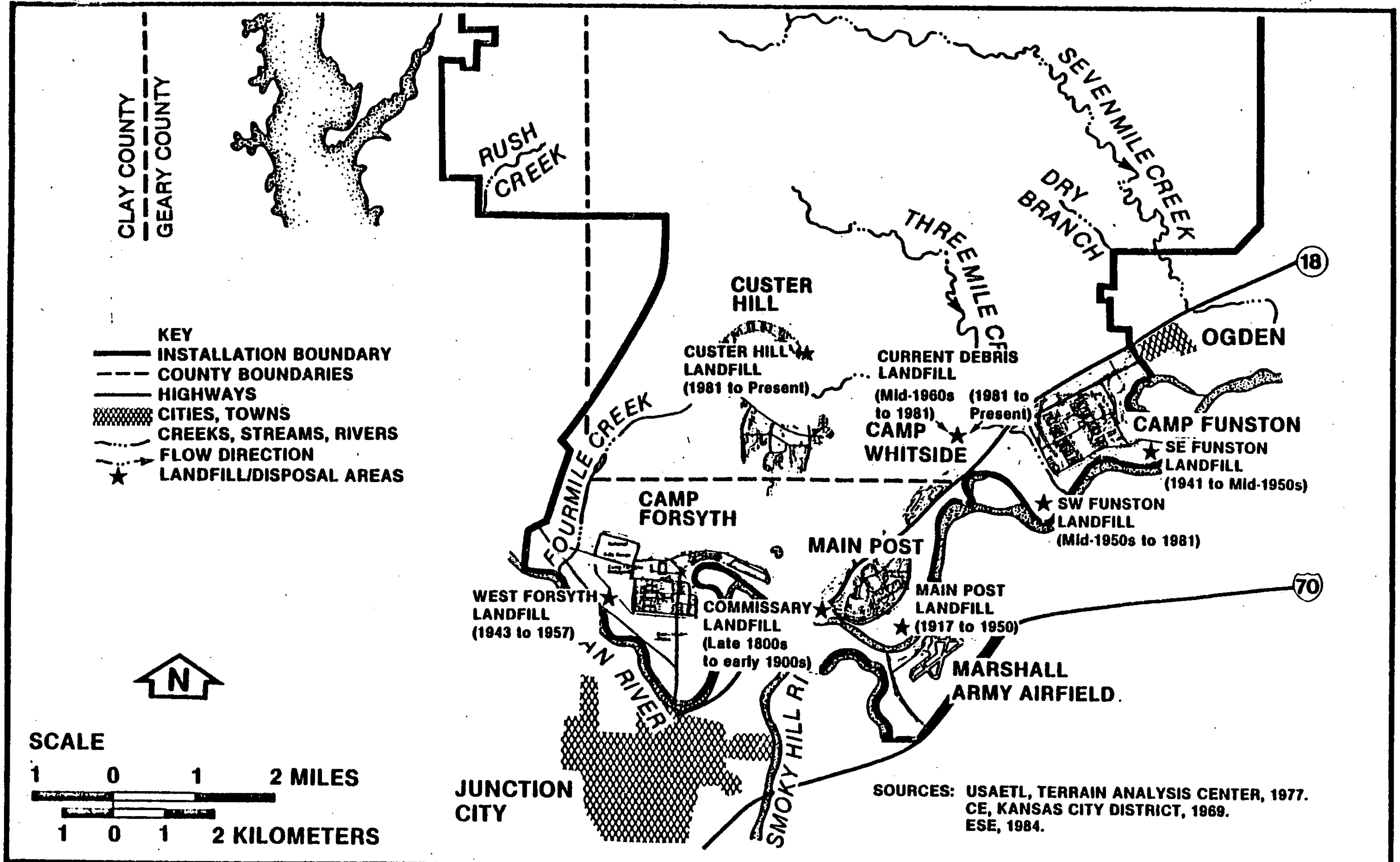


Figure 2.2-1
LANDFILL LOCATIONS ON FORT RILEY

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

dismantled in 1967. The second sanitary landfill during this period was located approximately 0.8 km west of Camp Forsyth, near the Republican River. This landfill operated from about 1943 to 1957 and was both the debris and sanitary landfill for Camp Forsyth.

In the mid-1950s, the Main Post dump (located south of Main Post) was closed, and operation began at a landfill located near the southwest corner of Camp Funston. This landfill consisted of approximately 43.3 ha in alluvial materials just north of the Kansas River. This area is believed to have operated from the mid-1950s to 1981 and was the principal sanitary landfill during that period. This operation used both trench and area methods of landfilling, with trench depths of approximately 5 m. Reportedly, ground water was present in the trenches, depending on the river stage. All types of waste material, including metal drums of comingled waste oils and solvents (until 1970), were accepted at this landfill. In the past, various chlorinated solvents were used for degreasing engine parts. Material was often burned in the trenches, and underground fires were quite frequent. The landfill ceased operation in 1981, and a KDHE-approved closure plan (Permit No. 370) was enacted. The plan involved the installation of six monitor wells, surficial soil cover, and topographic regrading. At the time of the site visit, the installation was in the process of developing a sampling and analysis plan, and no water quality or potentiometric surface maps had been constructed for the landfill. Onsite investigation also revealed the lack of proper soil cover. Debris was visible at the landfill surface, and a continuous 0.6-m cover was not uniform over the area. [Subsequent to the site visit, it was reported that a sign which prohibits the disturbance of surface soils at the closed landfill has been posted. The installation intends to place soil cover in the eroded areas of the landfill.] Due to the permeable alluvial deposits, the relatively high solubility of degreasing solvents disposed of in the landfill, and the proximity of the Kansas River, which forms the installation boundary, the potential exists for offpost migration of toxic or hazardous materials from this landfill.

Therefore, a limited sampling and analysis program was undertaken by USATHAMA to provide additional data for the purpose of evaluating the need for USATHAMA to conduct a Phase II Environmental Contamination Survey. The results of the limited sampling and analysis program are presented in Sec. 3.1.16.

The current landfill system consists of a sanitary landfill and a debris landfill, both of which are permitted by the state of Kansas. The current sanitary landfill (Permit No. 385), located east of Custer Hill, began operation in 1981, following closure of the Camp Funston landfill. The soils in this area consist of silty clay loams with moderately slow to very slow internal drainage, which overlie flat-lying limestones and shales. The landfill is operated by the trench method, and individual trenches measure about 15 m wide, 5 m deep, and 76 m long. The landfill accepts all sanitary wastes from the post, including small amounts of special wastes such as asbestos. Prior to 1982, waste mercury generated by broken laboratory instruments was disposed of in the post sanitary landfill [<5 kilograms per year (kg/yr)]. Since 1982, waste mercury has been accumulated for disposal by hazardous waste contract. The filled areas are covered each day with a thin soil covering, and, at the time of the site visit, no ground water was visible in the bottom of the trenches. Reportedly, the landfill has problems with blowing paper and the reception of unexploded ammunition. The state of Kansas inspects the current landfill on a monthly basis.

The current debris landfill (Permit No. 366) is located in an abandoned limerock quarry to the north of Camp Whitside. This landfill receives the construction debris for the entire installation.

2.2.4 DEMOLITION AND BURNING GROUND AREAS

The demolition and destruction of unserviceable ammunition and UXO at FR are conducted by the 74th EOD detachment, a unit of the 543d Explosive Ordnance Detachment Command Center (EODCC), Fort Leonard Wood, Mo. Unserviceable ammunition and powder turned in to the ASP (approximately

100 kg/yr) are destroyed at the ammunition demolition area located near the southern portion of the main impact area near Range 17 (see Fig. 2.1-2). Unserviceable ammuntion is burned at that location in a pit approximately 6 m deep. Propellant is spread out on open ground and ignited. Excess powder is also destroyed by troops in pits adjacent to artillery firing points. Until 1978, this destruction was performed in empty 55-gal drums. Use of 55-gal drums for confining the powder was discontinued following an accidental explosion. A representative EOD Activity and Status Report for the 74th EOD during fiscal year (FY) 1983 is shown in Table 2.2-2.

The demolition area and powder burning area are operated under RCRA interim status as an EPA (1982a) hazardous waste thermal treatment facility. The burn area is a 5-m deep blowhole, with sides consisting of mostly clay materials. Analyses of residues and soil from the burn pit were performed by USAEHA in 1980 using TEP for toxic metals (USAEHA, 1980). Results of these analyses and the RCRA limits are presented in Table 2.2-3. With the exception of mercury, the residues and soils from the burn pit exhibit TEP toxicity metal levels that are below RCRA limits. As shown, mercury (0.28 mg/l) was slightly above the RCRA limit (0.20 mg/l). Subsequent discussions with USAEHA indicated that this difference (0.08 mg/l) was within analytical error. Due to the clay materials in the burn area, no significant quantities of leachate are anticipated.

At the time of the site visit, the EOD detachment was clearing the southern portion of the main impact area and the 40-mm grenade range of UXO. Reportedly, many live rounds occur in the main impact area, including 105-mm HE dating from the 1950s and modern HEAT and HEP. These UXO and others reported to EOD are detonated in place using charges of C-4 explosive.

Table 2.2-2. 74th EOD Activity and Status Report for Sept. 30, 1983

Line No.	Source	Manhours	Small Arms	Artillery/ Mortar	Grenades	Rockets/ Jatos	Pyrotechnics	Propellant* (lb)	Bulk Explosives† (lb)	Hazardous Explosive Materials**
1	ACR	132	—	229	138	3	258	156	9	464
2	Incidents	39	5,736	232	68	171	704	1	153	740
3	Ranges	—	387	1,179	—	1,143	80	—	—	11

— = Not reported.
lb = pound.
ACR = Armored Cavalry Regiment.
TNT = trinitrotoluene.
C-4 = composition-4.

* Propellant: rocket motors, propellant charges (artillery, mortar), cordite propellant.
† Bulk explosives: TNT, C-4, blasting caps, detonating cord.
** Hazardous explosive materials: unserviceable ammunition (Code H), small arms through artillery shells, all encased munitions and Shape charges.

Source: 74th EOD, 1983.

Table 2.2-3. TEP Analyses of the Demolition/Burn Area Soil

Parameter	TEP Concentration (mg/l)	RCRA Limit (mg/l)
Arsenic	ND	5.0
Barium	0.026	100.0
Cadmium	0.062	10
Chromium	0.36	5.0
Lead	ND	5.0
Mercury	0.28	0.2
Selenium	ND	1.0
Silver	1.64	5.0

ND = Not detected.

Source: USAEHA, 1980.

2.2.5 DEMILITARIZATION

Currently, no demilitarization activities other than the destruction of unserviceable ammunition and UXO by the 74th EOD are conducted at FR. No records exist of other demilitarization activities occurring in the past at FR.

2.2.6 RCRA STATUS

FR is considered to be a treatment, storage, and disposal facility, as well as generator of hazardous waste due to the storage, thermal treatment, and land disposal of reactive wastes at the installation. KDHE (1983) has determined that FR generates the following hazardous wastes:

1. Waste explosives (D003), which either land at the impact area or are thermally treated;
2. Small quantities of spent solvents (D001) used to clean paint guns; and
3. Battery acid (D002), which is neutralized and discharged to the sanitary sewer system. This waste is exempt from regulation under RCRA, however, because the FR sewage treatment facilities are not publically owned treatment works (POTWs).

KDHE also states that air filters from the spray paint booths are a potential hazardous waste due to possible contamination with lead or chrome.

FR submitted to EPA on Nov. 18, 1980, a Notification of Hazardous Waste Activity and Part A of a Hazardous Waste Permit Application (FR DFAE, 1980). FR received Acknowledgement of Notification of Hazardous Waste Activity from EPA on Nov. 20, 1980, and was issued EPA Identification No. KS6214020756. KDHE requested that FR revise and resubmit the Part A application; a revised application was submitted to KDHE on Apr. 18, 1983 (FR DFAE, 1983g). FR is anticipating a request to submit a Part B application to KDHE in late 1984.

KDHE conducted a RCRA compliance inspection of FR in August 1983 and noted the following items of noncompliance (KDHE, 1983):

1. The FR waste analysis plan does not contain information on the reactive and ignitable wastes generated at the installation;
2. The personnel training documentation does not include a description of the type and amount of training given each person or records of training given; and
3. The final contingency plan does not contain the name, address, and phone number of the designated emergency coordinator.

At the time of the site visit, Item Nos. 1 and 2 had been corrected, and the installation was seeking clarification of Item No. 1 from KDHE.

2.3 WATER QUALITY

2.3.1 SURFACE

As described in Sec. 1.6.3, FR is drained by various intermittent creeks and streams which eventually drain into the Republican-Kansas River waterway system. Streams located along the southern portion of the installation (Sevenmile Creek, Threemile Creek, Republican River, Kansas River—see Fig. 1.6-2) receive stormwater runoff from the various cantonment areas and WPC plant discharges from Camp Forsyth (Republican River), Main Post (Kansas River), and Custer Hill (Three Mile Creek tributary). In addition, Sevenmile Creek is the principal stream draining the central impact area. Water quality data are available for several of these streams and rivers.

In November 1977, USAEHA conducted a water quality investigation to evaluate any potential stream contamination associated with the use of munitions and other training activities within the FR impact area (USAEHA, 1977). The center of the impact area is drained by Sevenmile Creek and its tributaries. A sampling station was, therefore, established at a point where Sevenmile Creek exits the impact area near the intersection of the creek and Engineer Rd. To evaluate the effect of activities in the impact area on the water quality of Sevenmile

Creek, a control station was established on Threemile Creek, because it is similar to the impact area stream in its topographic origin, and it does not receive runoff from the impact areas. The location of the sampling site on Threemile Creek was at the point where the creek intersects 1st Division Rd., upstream of the Custer Hill WPC plant effluent discharge. A third sampling plant was selected on the Kansas River near MAAF where Henry Dr. crosses the river. This is upstream of the confluence of Sevenmile and Threemile Creeks with the Kansas River. Sampling station locations are shown in Fig. 2.3-1.

Samples were collected at these stations for seven consecutive days. Analyses included pH, dissolved oxygen, specific conductance, phosphorus, nitrate, calcium, magnesium, and 14 trace metals. The chemical data are summarized (means) in Table 2.3-1; the complete data set is in USAEHA (1977).

A review of the data in Table 2.3-1 indicates comparable levels of trace metals in all three streams. Only mercury was higher in the impact area stream (Sevenmile Creek) than in the other two streams. This mean value was at the analytical detection limit and resulted from one sample (0.0005 mg/l) being above the detection limit (0.0004 mg/l). It should be noted that this value is approximately an order of magnitude below both the aquatic life criteria (0.004 mg/l) and the drinking water standard (0.002 mg/l). The EPA criteria given in Table 2.3-1 are the maximum allowable (i.e., acute) levels for protection and propagation of aquatic life. The level of protection afforded aquatic organisms by the EPA (1980, 1981b) criteria is that most aquatic life would be protected and aquatic ecosystem function would be preserved, but that a few untested species might be adversely affected if the highest allowable concentrations persisted for long periods of time. The EPA criteria listed for cadmium, chromium, copper, lead, nickel, silver, and zinc are established as functions of the natural logarithms of total water hardness. The criteria shown in Table 2.3-1 for these metals were calculated using a total hardness value of 351 mg/l as calcium carbonate

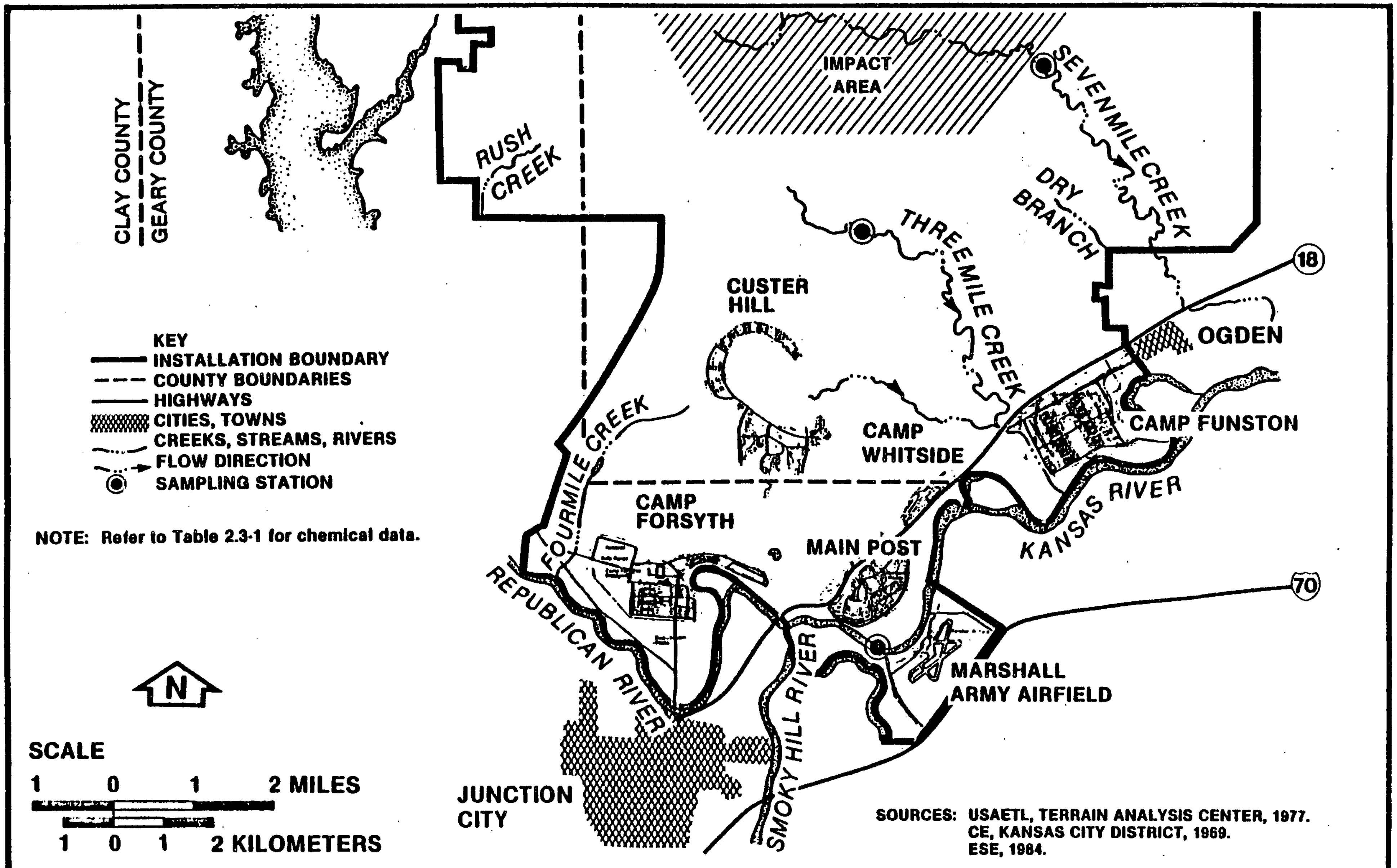


Figure 2.3-1
WATER QUALITY SAMPLING STATIONS ON SEVENMILE CREEK, THREEMILE CREEK, AND THE KANSAS RIVER

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 2.3-1. Chemical Data for Streams and Rivers on FR

Parameter*	Location† Sevenmile Creek	Threemile Creek	Kansas River	Aquatic Life Water Quality Criteria**
pH (units)	7.2	7.2	7.8	6.5-9.0
Specific Conductance (umhos/cm)	548.0	632.0	996.0	--
Dissolved Oxygen	10.8	10.9	11.7	>5.0
Calcium	104.4	107.1	105.8	--
Magnesium	19.5	22.1	22.6	--
Total Phosphorus	0.091	0.124	0.23	--
Nitrate (as N)	0.29	0.23	0.47	--
Arsenic	<0.01	<0.01	<0.01	0.440
Barium	<0.3	<0.3	<0.3	--
Boron	0.222	0.211	0.243	--
Cadmium	0.001	0.003	<0.001	0.012
Chromium	<0.02	<0.02	<0.02	18.9
Copper	0.021	0.051	<0.02	0.075
Iron	0.101	0.20	1.12	1.00
Lead	<0.01	<0.01	<0.01	0.836
Manganese	0.028	0.059	0.088	--
Mercury	0.0004	<0.0004	<0.0004	0.004
Nickel	<0.10	<0.10	<0.10	4.9
Selenium	<0.005	<0.005	0.007	0.260
Silver	<0.02	<0.02	<0.02	0.038
Zinc	0.036	0.298	0.052	0.941

* All values are in units of mg/l, unless shown otherwise.

† Data for Sevenmile and Threemile Creeks are means of seven consecutive daily composite samples collected Nov. 15 to Nov. 21, 1977. Data for Kansas River is the mean of two samplings on Nov. 15 and 18, 1977.

** EPA (1976, 1980, 1981b); values given are the maximum allowable for aquatic life (see text for discussion).

-- = Not applicable.
umhos/cm = micromhos per centimeter.
N = nitrogen.

Sources: USAEHA, 1977.
ESE, 1984.

($CaCO_3$), which was calculated from the means of the calcium and magnesium data.

As shown by the data in Table 2.3-1, highest levels of nutrients (phosphorus and nitrate) were observed in the Kansas River. These levels likely reflect the effects of various municipal WPC plant discharges into the river, as well as agricultural and pasture runoff.

2.3.2 SUBSURFACE

Subsurface water quality data are available from the U.S. Army Drinking Water Surveillance Program (USADWSP) data base (USAEHA, 1978b). The USADWSP sampled raw water from potable wells located on FR during the period 1972 to 1977. Analyses included major ions, various operational parameters, trace metals, and radioactivity. These data are contained in App. G and are summarized in Table 2.3-2, which contains mean values of two to four samplings by the USADWSP. Well locations corresponding to Table 2.3-2 are given in Fig. 1.6-6, and Table 1.6-4 gives construction characteristics for these wells. All of these wells are relatively shallow (depth = 18.6 to 25.9 m) and penetrate alluvial deposits. Due to the limestone geology of the region, the wells yield highly mineralized, hard to very hard water (252 to 463 mg/l as $CaCO_3$) with high levels of total dissolved solids (TDS) (405 to 584 mg/l). Because of dissolved carbonates, the ground water is very alkaline (188 to 377 mg/l as $CaCO_3$) and exhibits pH values ranging between 7.0 and 8.0.

As shown by Table 2.3-2, with the exceptions of iron, TDS, and manganese, the raw ground water does not exceed the National Interim Primary Drinking Water Regulations (NIPDWR) (EPA, 1982d) and National Secondary Drinking Water Regulations (NSDWR) (EPA, 1982e) MCLs. Well Nos. FR 3, FR 4, and FR 5 exceed the NSDWR MCL for manganese, Well No. FUN 1 exceeds the MCL for TDS, and Well Nos. FR 4 and FUN 1 exceed the MCL for iron. High levels of iron, manganese, and TDS are typical of ground water in the region. These parameters affect the aesthetic

Table 2.3-2. Ground Water Quality Data from Potable Wells on FR

Parameter	Well No. (Refer to Fig. 1.6-6 for Well Locations)									EPA MCLs
	FOR 1	FOR 2	FR 1	FR 3	FR 4	FR 5	FR 6	FR 7	FUN 1	
Alkalinity (as $CaCO_3$)	377.0	343.0	255.3	188.0	222.0	206.3	301.2	314.0	353.0	—
pH (units)	7.5	7.6	7.5	7.8	7.5	7.8	7.4	7.7	7.2	6.5-8.5
Hardness, Total (as $CaCO_3$)	388.5	341.5	309.7	253.0	275.2	252.0	361.5	353.7	463.0	—
Specific Conductance (umhos/cm)	770.0	671.0	709.0	697.0	690.0	678.0	757.0	646.0	942.0	—
Calcium	108.3	179.2	87.0	66.0	80.6	73.6	95.6	117.8	101.0	—
Potassium	5.3	3.7	5.2	9.5	9.5	8.9	5.7	6.3	2.6	—
Silica	38.0	31.8	23.5	18.5	24.9	19.9	23.9	28.7	21.4	—
Total Dissolved Solids	476.5	405.0	436.3	430.0	430.7	453.3	483.2	436.7	584.0	500.0
Copper	0.057	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	1.0
Iron	0.2	<0.1	0.1	<0.1	0.7	<0.1	<0.1	<0.1	0.9	0.3
Magnesium	28.1	31.1	21.3	15.8	14.7	16.2	23.6	26.8	32.6	—
Manganese	<0.03	<0.03	0.30	0.68	0.87	0.6	<0.3	0.07	0.06	0.05
Zinc	<0.015	<0.017	0.017	0.039	<0.017	<0.017	<0.016	<0.017	0.018	5.0
Chloride	6.1	6.5	25.0	43.2	36.3	44.7	15.7	11.6	27.8	250.0
Sulfate	37.1	31.7	66.8	104.5	80.4	91.3	69.5	47.7	95.0	250.0
Arsenic	<0.025	<0.020	<0.027	<0.020	<0.027	<0.020	<0.027	<0.020	<0.030	0.05
Barium	0.31	0.33	0.32	<0.30	0.36	<0.30	0.32	0.34	<0.30	1.0
Cadmium	<0.001	<0.003	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.005	0.01
Chromium	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.05
Fluoride	0.4	0.3	0.5	0.5	0.4	0.3	0.3	0.3	0.5	—
Lead	0.021	<0.008	<0.008	<0.007	<0.008	<0.007	<0.008	<0.007	<0.005	0.05
Mercury	0.0005	<0.0003	0.0003	<0.0003	0.0003	0.0006	0.0005	0.0006	<0.0002	0.002
Nitrate (as Nitrogen)	0.3	0.8	0.1	0.0	0.1	0.1	0.5	0.3	0.4	10.0
Silver	<0.015	<0.017	<0.017	<0.020	<0.017	<0.020	<0.017	<0.020	<0.025	0.05
Sodium	15.1	16.2	26.1	37.7	31.6	46.7	28.3	20.4	19.7	—
Gross Alpha (pCi/l)	7.2	2.8	1.9	1.8	3.0	2.1	2.4	2.6	<0.5	15.0
Gross Beta (pCi/l)	9.8	5.5	6.3	12.7	11.1	11.4	7.9	8.2	4.6	—
Tritium (pCi/l)	0.0339	0.0010	0.0503	0.0338	0.0503	0.0339	0.0504	0.0338	<0.100	20,000

Note: All values mg/l unless shown otherwise. Data are means of two to four samples from the USADWSP 1972-77 data base. Complete data set is contained in App. G.

MCL = Mean contaminant level.
pCi/l = picocuries per liter.
— = Not applicable.

Source: USAEHA, 1978b.

quality of the water and are not health-related. No NIPDWR metal or radioactivity MCLs were exceeded.

Well No. FUN 1 at Camp Funston is located within 900 m of the former Camp Funston landfill (see Sec. 2.2.3). This landfill was in operation from the mid-1950s to 1981, and the water quality data presented in Table 2.3-2 for this well were collected in the mid-1970s. As shown, the water from this well exhibited specific conductance values roughly 200 to 300 umhos/cm greater than the other FR wells. Specific conductance is a gross measure of dissolved ionic constituents and, as expected, this well also exhibited the highest concentrations of dissolved solids. Likewise, iron levels in the water from this well were elevated above the levels typical of the other wells. No toxic metals or radioactivity were above drinking water MCLs; in fact, most of the metals were below analytical detection. It should be noted, however, that no trace organic analyses have been performed on the water from this well. As described in Sec. 2.2.3, waste oils and organic solvents were disposed of in the landfill. Based on these data, it is difficult to determine definitively if the former landfill is affecting the ground water quality in the area of the Camp Funston wells. These wells should not be used unless a complete water quality investigation is performed, including analyses for halogenated hydrocarbons and oil and grease. [Subsequent to the site visit, it was reported that the installation plans to decommission the three former water supply wells in the vicinity of the Camp Funston landfill in Fiscal Year 1985 or 1986.]

2.3.3 POTABLE

The principal raw water supply for FR is ground water obtained from the alluvial deposits along the Republican and Kansas Rivers. Main Post, Camp Forsyth, and Camp Funston each had individual well fields prior to consolidation of the supply and distribution system in the mid-1970s. Currently, wells are operated at a site just west of the Main Post (six wells) and in Camp Forsyth (two wells). The three wells at Camp Funston are no longer in use. Sec. 1.6.4 describes the physical characteristics of these wells, and Fig. 1.6-6 shows the well locations.

In addition to the cantonment area production wells, several small wells are used at outlying areas. These wells are installed in fissured limestone formations and are located at the Tank Gunnery Training Facility (two wells), range control (one well), the Keats Tactical Training Facility (one well), and the Milford Recreational Area (two wells).

Potable water treatment of the cantonment area supply includes disinfection using gaseous chlorine, fluoridation using hydrofluorosilicic acid, and stabilization/conditioning using sodium hexametaphosphate. The outlying wells receive disinfection using chlorine.

Operational surveillance of the potable water is performed by DFAE personnel. Daily monitoring includes chlorine residual, fluoride, and phosphate analyses on samples taken at four points in the distribution system [Main Post (one), Custer Hill (one), Camp Forsyth (two)]. Medical surveillance monitoring (bacteriological, chlorine, fluoride) of the water in the distribution system is performed by the PVNTMED Activity. USAEHA conducts the required NIPDWR and NSDWR analyses for metals, anions (nitrate, sulfate, chloride), pesticides, and radioactivity.

The USAEHA laboratory is certified by the state of Kansas for these analyses. App. G contains results of the USAEHA USADWSP analyses of both the raw well water, as well as the finished water in the distribution system. Chemical characteristics of the raw water are discussed in detail in the previous section (Sec. 2.3.2). In general, both the raw and finished water meet the NIPDWR and NSDWR standards. Some problems have been reported relative to discoloration of the potable water. These problems are attributable to iron and manganese, which occur naturally in the raw water. Iron and manganese levels occasionally exceed NSDWR standards. These levels affect the aesthetic use of the water and are not health related. Adjustments in the dosage of sodium hexametaphosphate are used to control the discoloration problem.

2.4 AIR QUALITY

2.4.1 AMBIENT

FR is located in the North Central Kansas Air Quality Control Region (AQCR). This AQCR has been designated Priority I (indicates actual or anticipated nonattainment of standards) for suspended particulates and Priority III (indicates expected attainment of standards) for sulfur oxides, nitrogen oxides, carbon monoxide, and photochemical oxidants (USAEHA, 1978a). Records searched indicated that air quality monitoring conducted near FR (Junction City and Manhattan, Kans.) was discontinued in 1977 (Department of the Army, Headquarters, Forces Command, 1981). Data accumulated from these past air monitoring activities indicated that the primary standard for suspended particulates was exceeded during 1977 in the vicinity of Junction City. The primary sources of suspended particulates in the area are: agriculture, construction, and travel on unpaved roads. These sources account for approximately 97 percent of the suspended particulates in Kansas (Department of the Army, Headquarters, Forces Command, 1981). The ambient air quality at FR, considered to be good, is minimally affected by ongoing mission activities.

2.4.2 SOURCE EMISSIONS

Potential sources of emissions at FR include:

1. Incinerators;
2. Stationary combustion units;
3. Fuel storage tanks;
4. Small industrial operations (rock crushing, painting, and drycleaning);
5. Vehicular traffic;
6. Open burning; and
7. Firefighting training.

One incinerator, a Contro Model A-24 pathological incinerator, is located at IAH in the Camp Whitside area. This incinerator, approved for construction by KDHE in 1978, was tested upon completion and determined to be in compliance with applicable regulations for particulate and visible emissions (Department of the Army, Headquarters, Forces Command, 1981). This incinerator is evaluated by KDHE on an annual basis (FR DFAE, 1981; EPA Region VII, 1978; KDHE, 1978 and 1982a).

There are an estimated 3,150 stationary combustion units used for heating and cooling on FR. These combustion units which have inputs in excess of 1 x 10^6 British thermal units per hour (BTU/hr) are subject to KDHE regulations with respect to visible and particulate emissions. Records searched indicated that 39 stationary sources on the installation are subject to regulation (Department of the Army, Headquarters, Forces Command, 1981; EPA Region VII, 1978). These combustion units are fired by both fuel oil and natural gas and are evaluated by KDHE on an annual basis (FR DFAE, 1981; EPA Region VII, 1978; KDHE, 1979 and 1982a).

No heavy industrial operations exist at FR. Small industrial operations (painting, drycleaning, printing, motor repair, and rock crushing) do not generate volatile pollutants or suspended particulates in quanities which would significantly affect the air quality at FR.

Open burning is conducted at FR to dispose of tree trimmings, limbs, stumps, and other construction-type debris. Open burning is conducted in accordance with applicable KDHE regulations (see App. H). The current open burning area is located adjacent to the sanitary landfill at the Custer Hill area.

Open burning is also practiced on the range and training areas for vegetation control. Open burning on the ranges is subject to case-by-case approval by KDHE.

In either case, open burning is performed only when favorable weather conditions exist and the state has been notified and has approved the burning.

Quarterly firefighting training activities are conducted in a lined pit located at MAAF (Department of the Army, Headquarters, Forces Command, 1981). These activities result in the release of suspended particulates and hydrocarbons.

2.4.3 PERMITS

Numbered source permits are not issued by KDHE for the incinerator and boilers located on the installation. KDHE does require that the installation submit an annual emissions inventory (see App. I), as well as an annual inspection of regulated sources (see App. J).

Open burning is permitted by KDHE. At the time of the site visit, FR was operating under Permit No. 385, which was scheduled to expire on Jan. 1, 1984 (see App. H). All sources at FR are currently meeting KDHE regulatory requirements.

2.4.4 NOISE

Noise sources at FR include those normally associated with urban activities (vehicular, aircraft, construction, etc.), plus those associated with military operations (tank and artillery fire, explosive demolitions, fixed- and rotary-wing aircraft operations, truck convoys, etc.). The noise sources which have the greatest potential for generating complaints are produced by aircraft operations and tank and artillery firing.

Aproximately 47,000 aircraft operations are conducted per year at MAAF. Noise studies have been conducted, and it has been concluded that:

1. The daily average 65 decibel A-weighted (dBA) contour does not extend beyond the installation boundary,
2. The noise environment at MAAF is compatible with adjacent land use, and
3. The maximum sound generated by some flyovers could lead to annoyance and complaints (Department of the Army, Headquarters, Forces Command, 1981).

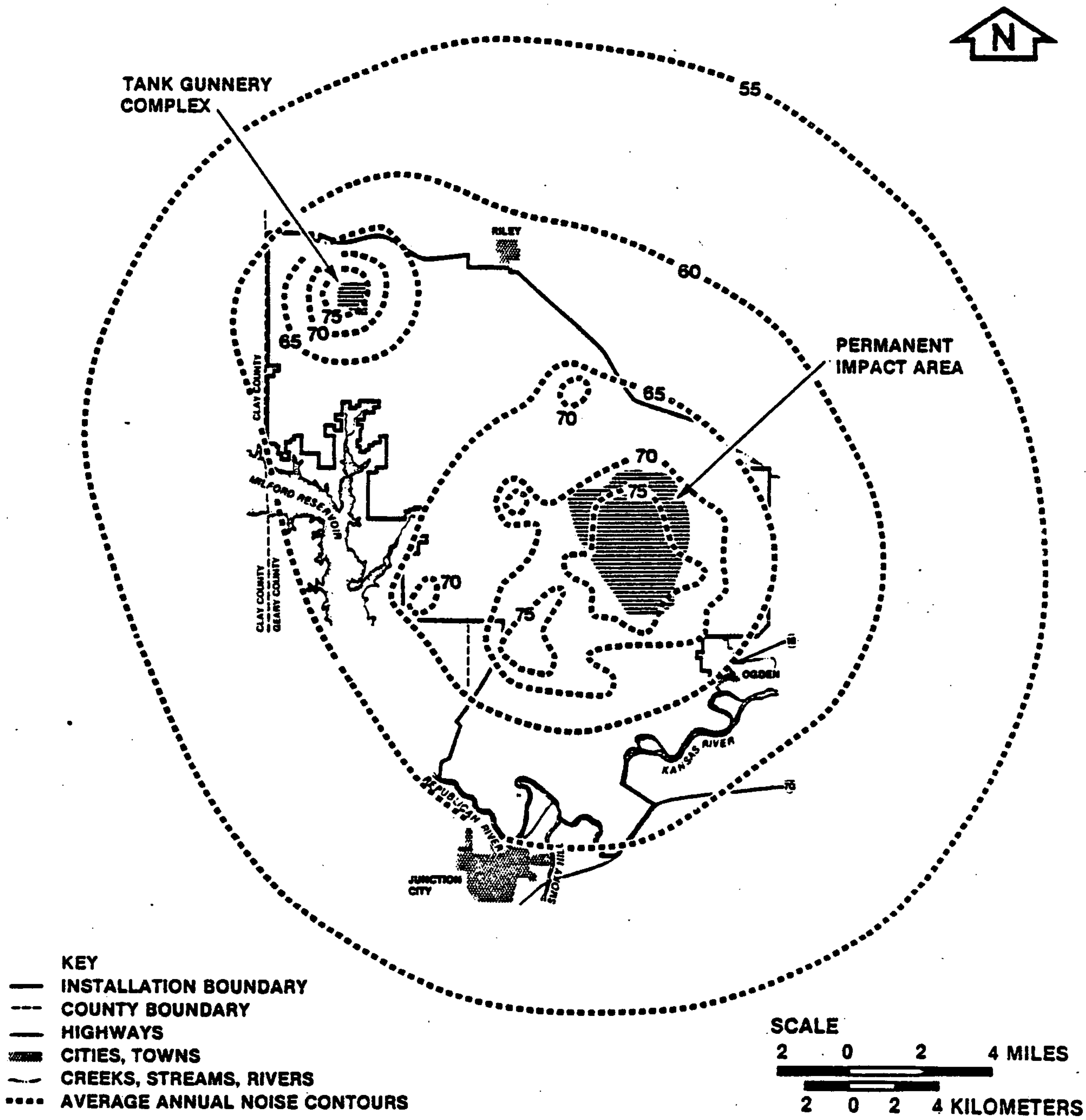
Training operations using aircraft also occur in the range areas and in areas adjacent to the installation. Regulations have been established by the installation Commander which designate flight corridors and heights which must be maintained to minimize noise levels in urbanized areas (Department of the Army, Headquarters, Forces Command, 1981).

Blast noise surveys have also been conducted for the firing of projectiles from tanks. These surveys indicated that the 65-dBA noise contour does extend offpost in a few areas (see Fig. 2.4-1), and the 70-dBA contour also extends beyond the installation boundary to the west of Custer Hill. Blast noise surveys have also been conducted for the firing of artillery weapons. These studies indicated that noise contours in excess of 65 dBA are found offpost (see Fig. 2.4-1). Current practices at FR are to specify times when firing can be accomplished in the training areas to minimize the possibility of complaints.

2.5 IMPACTS OF PAST AND CURRENT ACTIVITIES ON BIOTA

As described in Sec. 1.6.5, FR supports a higher habitat and wildlife diversity relative to the surrounding area. This occurs as a consequence of: (1) the low level of human activity in the range and training areas compared to the surrounding farmland areas, (2) land/vegetation management practices, and (3) the installation fish and wildlife management program. FR supports several mammal and bird species of recreational importance, as well as a game fishery. The bald eagle utilizes the installation during the winter. No other Federally listed endangered species occur on the installation. The Topeka shiner, listed as a threatened species by the state of Kansas, probably occurs in Wildcat Creek.

Impacts and potential impacts on these species and communities on FR are addressed in the installation EIS (Department of the Army, Headquarters, Forces Command, 1981) and may be caused by the following installation activities:



NOTE: The contours are L_{CDN} contours. "L_{CDN}" means C-weighted day-night equivalent level. The contours represent points of equal sound measured in decibels (dBC).

SOURCES: DEPARTMENT OF THE ARMY, HEADQUARTERS, FORCES COMMAND, 1981.
ESE, 1984.

Figure 2.4-1 BLAST NOISE CONTOUR MAP OF FORT RILEY	**Prepared for:** **U.S. Army Toxic and Hazardous Materials Agency** **Aberdeen Proving Ground, Maryland**

1. FTXs, including tactical training employing troops, equipment, and vehicles;
2. Missile, rocket, artillery, and mortar firing;
3. Aerial gunnery training;
4. Air support operations and low-level helicopter flying; and
5. Testing of military weapons.

High noise levels and the potential for wildlife displacement occurs at firing and test ranges. No evidence of long-term or permanent displacement of wildlife populations due to high noise levels has been observed.

The use of tracked vehicles and field artillery can cause soil compression, vegetation destruction, and subsequent soil erosion and loss of soil moisture. In addition to habitat destruction, a reduction of species diversity and productivity may be expected in such compacted and destroyed areas. A discussion of impacts resulting from tactical maneuvers on FR ranges and maneuver areas is provided in the installation EIS (Department of the Army, Headquarters, Forces Command, 1981).

No vegetation or wildlife losses have been reported on FR due to environmental contamination or past and current disposal of toxic and hazardous wastes.

2.5.1 VEGETATION

The natural vegetation types of the installation are maintained by mowing and controlled burning (Department of the Army, Headquarters, Forces Command, 1981). Minimum disturbance or adverse impact from installation activities occur may during a single growing season, but long range beneficial impacts over multiple seasons occur from installation management practices over approximately 60 percent of the range and training areas. Severe disturbances, characterized by adverse effects lasting 10 or more growing seasons, occur on 10 percent of the range and training areas. Herbicides are used to control weeds in the cantonment areas, roadsides, security areas, and fencelines. Applications of herbicides to control aquatic weeds to not have a significant adverse effect on the vegetation of FR or on wildlife populations.

In general, installation operations and management practices produce beneficial impacts on FR biota; resulting in a higher level of vegetative diversity, especially natural prairie, than the surrounding agricultural areas.

2.5.2 FISH AND WILDLIFE

Fish and wildlife populations on FR are well managed, as described in Sec. 1.6.5, and any potential impacts from training operations on these populations are thereby reduced. FR supports a higher density of both game and nongame species than the surrounding area. No major impacts to fish or wildlife from FR operations occur. Minor, localized siltation of certain ponds does occur, however, from tracked vehicle activity. This siltation does not cause significant adverse effects on pond biota, because the ecosystem present is adapted to such stress from natural causes. Discharge of sewage effluent into Threemile Creek results in decreased dissolved oxygen levels in the reach below the Custer Hill WPC plant. This condition is expected to limit the diversity of aquatic biota for a short (less than 1 km) reach of stream.

2.5.3 THREATENED AND ENDANGERED SPECIES

FR operations do not impact populations of bald eagles, which overwinter on the installation. Nor do impacts to fish populations occur in Wildcat Creek, the suspected habitat of the threatened Topeka shiner.

No threatened or endangered plant species are reported to occur on FR.

3.0 INSTALLATION ASSESSMENT

3.1 FINDINGS

3.1.1 METEOROLOGY

The climate of FR is characterized by hot, humid summers and cold winters. Monthly mean minimum temperatures range from -1.8 to -7.0°C (January), while monthly maximum temperatures range from 25.5 to 26.1°C (July). Rainfall averages 85 cm annually, with May and June being the wettest months.

3.1.2 GEOLOGY

The installation lies within the physiographic province generally called the Osage Plains section of the Central Lowlands. This area is bordered by the Great Plains to the west and the Ozark Plateaus to the east. The elevation ranges from 312 to 416 m above MSL.

The post is divided into three geological-topographical units. The first, the high uplands or prairies, consists of alternating layers of flat-lying to gently dipping limestone and shale. The second unit is the alluvial bottom lands of wide meandering river flood plains and associated terraces. The third unit is broken, hill-to-steep country composed of alternating limestones and shales. This unit extends from the uplands downward to the valley floors/river terraces.

3.1.3 HYDROLOGY

The installation lies in the drainage basin of the Kansas and Republican Rivers, which flow along the southern boundary of the post. The Kansas River is formed by the confluence of the Republican and Smoky Hill Rivers and then flows in an easterly direction to Kansas City, where it enters the Missouri River. Mean annual discharge of the Kansas River at FR is 77,866 lpm. The Republican and Kansas Rivers receive stormwater runoff from the cantonment area and effluent from FR WPC plants.

Ground water occurs in valley-fill (alluvium) deposits of the major streams and rivers, in the porous surface deposits, and in the fissured, near-surface limestone of the upland. Large quantities of ground water exist in the alluvial deposits of the Republican, Smoky Hill, and Kansas River valleys. The thickness of saturated deposits in the Kansas River valley ranges from 0 to 27.4 m, with an average thickness of 8.5 m. Saturated deposits of 6.1 to 12.2 m yield 1,136 to 3,785 lpm, and deposits greater than 12.2 m yield volumes greater than 3,785 lpm. Moderate quantities of ground water exist in the FR and Florence limestone formations. Where wells penetrate large fractures, yields as high as 379 lpm are possible.

3.1.4 BIOTA

Four major vegetation communities occur on FR: tall grass prairie, oak-hickory forest, oak-hickory parkland, and woody scrub. The installation serves as an excellent environmental sanctuary for wildlife and fish. Two Federally listed endangered species, the bald eagle and peregrine falcon, may occur on FR. Reportedly, the state-listed threatened fish, the Topeka shiner, occurs in Wildcat Creek.

3.1.5 LEASES AND AGREEMENTS

Various transportation and utility rights-of-way easements are in effect on FR. The majority of the FR outgrants are for agricultural purposes to local residents. No leases and agreements are important relative to toxic/hazardous materials.

3.1.6 LEGAL CLAIMS

Reportedly, no legal claims relating to toxic/hazardous materials are currently pending against FR nor have there been past claims.

3.1.7 INDUSTRIAL OPERATIONS

No large-scale manufacturing-type industrial operations have been conducted on FR. The primary industrial operation involves vehicle and aircraft maintenance, including engine repair, vehicle painting, and battery-shop-related operations. Industrial operations other than vehicle and aircraft maintenance include furniture repair, printing operations, and laundry and drycleaning services.

Vehicle maintenance activities generate the majority of industrial wastes, including waste POL (oils, fuels, and solvents), battery electrolyte wastes, and paint wastes. Waste engine oils and degreasing solvents (nonhazardous, Stoddard-type) are generated at a rate of 200,000 to 250,000 liters per year (lpy). Since 1970, these wastes have been disposed of offpost by waste oil recycling contractors through contracts with DPDO. Prior to 1970, these wastes were generally disposed of in the post landfill. Some wastes have been used for firefighting training exercises. Currently, nonhazardous naphtha Stoddard degreasing and cleaning solvents are used. In the past, chlorinated hydrocarbon solvents, including tetrachloroethylene, trichloroethylene, and carbon tetrachloride, were used.

Waste caustic sodium hydroxide solution is used for engine parts cleaning at the DIO maintenance facility (10,000 lpy) and the DPCA Automotive Self-Help Shop (4,000 lpy). These wastes are disposed of by discharging to the sanitary sewer system. Due to the caustic (corrosive) characteristic of these solutions, they may be classified as hazardous wastes under RCRA (EPA, 1982b). [Subsequent to the site visit, it was reported that the decision to discharge caustic solution to the sanitary sewer will be based on the results of laboratory analyses for corrosivity and trace metals content. The discharge of caustic cleaning solution to the sewer system is prohibited without prior consultation with the facilities engineer.]

Waste battery electrolyte (1,000 l/month) is neutralized and discharged to the sanitary sewer system. Paint wastes consist of sludges, solvents, and thinners that are picked up for DPDO contract disposal. Air filters (200 per year) from the paint spray booth are disposed of in the sanitary landfill. Since lead-based paints and chromate primers are used in some painting operations, these wastes may be classified as RCRA toxic due to lead and chromium content.

Waste Stoddard solvent (750 l/month) from aircraft maintenance at MAAF is disposed of by discharging into a wash rack at Bldg. 864. Since this wash rack is nonoperational, the solvent is not pretreated prior to entering the Main Post WPC plant. WPC plant personnel report occasional upsets of the plant that may be related to this disposal practice. This disposal of waste POL products is contrary to Army regulations (U.S. Army, 1982). [Subsequent to the site visit, it was reported that aircraft maintenance activities have been advised to dispose of waste degreasing solvents by transfer to DPDO.]

The furniture shop uses tetrachloroethylene as a solvent (240 lpy) to clean paint spray equipment. Wastes (residues, rags, containers) from this operation are disposed of in the sanitary landfill. Since tetrachloroethylene is an RCRA-listed hazardous waste, this disposal practice is contrary to RCRA regulations (EPA, 1982b). [Subsequent to the site visit, it was reported that the furniture shop has been advised to dispose of tetrachloroethylene wastes by transfer to DPDO.]

The AG print shop (Bldg. 54) operations include cleaning of printing equipment using tetrachloroethylene solvent (240 lpy). Wastes (rags, residues, containers) from cleaning operations are disposed of in the sanitary landfill. Since tetrachloroethylene is a RCRA-listed hazardous waste, this disposal practice is not in accordance with RCRA regulations (EPA, 1982b). [Subsequent to the site visit, it was reported that the print plant has been advised to dispose of tetrachloroethylene wastes by transfer to DPDO.]

The drycleaning plant uses tetrachloroethylene, which is recycled for use by distillation. Still bottoms from the distillation process are a RCRA hazardous waste and have been disposed of on the ground behind

Bldg. 109. An area of approximately 10 m^3 of soil is contaminated behind this building. The drycleaning operation was moved from Bldg. 109 in October 1983. [Subsequent to the site visit, it was reported that the soil in the vicinity of Bldg. 109 will be sampled and analyzed for tetrachloroethylene. Based on the results of these analyses, soil decontamination will be conducted, as necessary.]

3.1.8 LABORATORY OPERATIONS

The following types of laboratories function on FR:

1. Pathology Laboratories: These laboratories use various analytical reagents (acids, bases, organic solvents), nutrient agars, and biological stains. Liquid wastes are disposed of by dilution to the sanitary sewer. Solid wastes are sterilized (as appropriate) and disposed of by incineration or landfilling.
2. X-Ray Laboratories: X-ray facilities are located in the Radiology Department of IAH, dental clinics, and the veterinary clinic. Spent developing solutions have been treated for silver recovery since the mid-1960s. Following silver recovery, spent solutions are discharged to the sanitary sewer system.
3. Photographic Laboratories: Photographic laboratories are operated by the DCE TASC and the DPCA Multiple Crafts Shop. The TASC laboratory transfers spent developing solutions to DPDO for silver recovery. This has been practiced since the late 1960s. Prior to that time, spent solutions were discharged to the sanitary sewer system without silver recovery.
4. Oil Analysis Laboratory: The DIO oil analysis laboratory (Bldg. 8100) uses trichloroethane and trichlorofluoroethane solvents to clean glassware and equipment. These waste solvents are disposed of by comingling with nonhazardous waste motor oils and degreasing solvents that are contract sold to waste oil recycling companies through DPDO. Since trichloroethane and trichlorotrifluoroethane are RCRA-listed

hazardous wastes, this disposal practice is not in accordance with RCRA regulations (EPA, 1982b). [Subsequent to the site visit, it was reported that the oil analysis laboratory has been advised to dispose of waste solvents by transfer to DPDO.]

5. Water Analysis Laboratories: DFAE operates a water analysis laboratory at the Custer Hill WPC plant, and the PVNTMED Activity operates a water analysis laboratory at IAH. Diluted, waste reagents (acids, bases, inorganic chemicals) are disposed of by discharging to the sanitary sewer system via laboratory sink drains. The disposal of laboratory wastes to the sanitary sewer system is exempt from RCRA regulations due to the small quantities involved, the large degree of dilution in the sanitary sewer system, and the fact that the WPC plants are covered under NPDES permits.

Waste mercury is generated by the medical laboratories from broken instruments. Prior to 1982, the waste mercury (<5 kg/yr) was disposed of in the post sanitary landfill. Since 1982, waste mercury has been accumulated and is stored in Bldg. 292, awaiting disposal by hazardous waste contract. The installation should investigate the feasibility of recycling/reclaiming this mercury through supply channels. [Subsequent to the site visit, it was reported that the feasibility of recycling mercury wastes from breakage of laboratory instruments is being investigated.]

3.1.9 MATERIEL PROOF AND SURVEILLANCE TESTING

The only materiel proof and surveillance tests conducted at FR involved the USAF tests of the "copperhead" antitank projectile in 1981. These tests involved approximately 100 rounds and occurred in designated training areas.

3.1.10 TRAINING AREAS AND ACTIVITIES

Various training, maneuver, and exercise areas are located on FR north of the cantonment areas. Training activities involving toxic/hazardous materials other than ordnance include CB training and firefighting training.

CB training involves the use of CS riot control gas in chamber exercises and in open, designated training areas. SCAITS kits are used for agent identification training.

Firefighting training is conducted using waste fuels in a pit at the eastern end of MAAF.

3.1.11 RANGES

There are 28 designated ranges on the installation and 64 artillery and mortar firing points. Fire from artillery and mortar firing ranges, the tank gunnery complex, and aerial ranges is directed into the central impact area. All ranges and impact areas are secure and appropriately marked with warning signs.

3.1.12 TOXIC/HAZARDOUS MATERIALS (HANDLING AND STORAGE)

Toxic/hazardous materials (other than ordnance, laboratory reagents, and POL) stored and used on FR include pesticides, PCBs, and radiological materials.

Pesticides are stored and used by DFAE Land Management Branch, DPCA Golf Course Activity, DFAE Wildlife Conservation Office, and Anti-Pest, Inc., Manhattan, Kans.

The DFAE Land Management Branch stores pesticides in Bldg. 292. This facility is marked with appropriate warning signs and is secure, heated, and ventilated in accordance with EPA (1982g) and USAEHA (1975). The storage area is curbed to contain spills, and pesticide stocks are marked, segregated, and stored off the floor. Pesticide wastewaters are currently disposed of by either spraying over the area just treated or by using it as a diluent for subsequent formulations. This practice has been in effect since the mid-1970s. Prior to that, pesticide curbed, spillage of pesticides in the shed could contaminate adjacent soils. There is no formulation and mixing area for the golf course pesticide operation. Any available potable water source is used to provide make-up water, and no backflow-prevention device is used to prevent back siphoning of pesticides into the potable system. [Subsequent to the site visit, it was reported that actions are being taken to provide the storage building with expedient weatherproofing and a backflow-prevention device. The feasibility of constructing a more satisfactory storage facility is being investigated.]

The DFAE Wildlife and Conservation Office applies pesticides to ponds on FR in the summer to control growth of nuisance weeds, algae, and fish. These pesticides are not included in the monthly DOD Form 1532, as required by AR 420-76 (U.S. Army, 1981).

Anti-Pest, Inc. is under contract to DFAE (since 1974) to provide insect and rodent control in buildings on FR. Prior to contract pest control, DFAE personnel provided this service, and storage and mixing of pesticides occurred in Bldg. 292. Anti-Pest personnel store and dispose of pesticides and pesticide-related wastes offpost.

PCBs are found on the installation in in-service and out-of-service PCB and PCB-contaminated electrical equipment. Out-of-service items are stored in conex containers at the rear of the DFAE maintenance yard. The containers have been modified by addition of a welded steel inner floor with curbing. The containers are secure and are marked with PCB warning signs in accordance with EPA (1982f). A permanent hazardous materials storage facility recently has been constructed in the DPDO area. At the time of the site visit, DFAE personnel were conducting sampling and analyses of the out-of-service items prior to turn-in to DPDO. Prior to TSCA control of PCBs in the late-1970s, out-of-service electrical equipment was contract sold through DPDO. [Subsequent to the site visit, it was reported that the transfer of accountability (for disposal) of four PCB items to DPDO was accomplished in August 1984.

wastewaters, rinses, and/or inadvertent spills when formulating pesticides were allowed to run onto the ground in the equipment washing area behind Bldg. 292.

Analysis of routine soil samples in 1974 for the Army Pesticide Monitoring Program showed very high levels of several pesticides in soils in the area behind Bldg. 292. These pesticides included chlordane (423.53 mg/kg), methoxychlor (824.04 mg/kg), malathion (87.70 mg/kg), diazinon (29.85 mg/kg), and DDT and its metabolites (157.80 mg/kg). Due to these excessive levels, a followup survey was conducted by USAEHA in 1975. USAEHA found that pesticide contamination of soils extended behind the storage and mixing facility and into the sediments of a small ditch that runs behind this area. The contamination apparently occurred due to past spillage and/or washing of pesticide application equipment behind the storage facility, with subsequent runoff of water into the ditch. Based upon literature surveys, USAEHA concluded that pesticide levels in soils above 5 mg/kg should be considered excessive. Callahan et al. (1979) reviewed the water-related environmental fate of chlordane and DDT and its metabolites (DDD and DDE) and concluded that these chemicals are persistent in the environment, and sorption on sediments and bioaccumulation in tissue are important fate processes. Bioconcentration factors in aquatic organisms are reported to range from 10^3 to 10^5. The drainage ditch eventually empties into the Kansas River, approximately 1.5 km away. The areal extent and volume of contaminated soil behind Bldg. 292 are not known. [Subsequent to the site visit, it was reported that the soil and stream sediments in the drainageway behind Bldg. 292 will be resampled and analyzed for pesticides. Based on the results of these analyses, soil decontamination will be conducted, as necessary.]

The DPCA Golf Course Activity pesticide storage building is an old, temporary wooden shed with an uncurbed concrete floor. This structure is not weatherproof, and pesticide containers stored in the shed showed evidence of water damage by rainfall. Because the storage area is not

No sampling was performed due to a waiver of the requirement by DPDO. The installation intends to sample and transfer all future waste PCB items, as needed. The installation intends to temporarily store selected waste PCB items, as needed.]

Radiological materials are stored and used by NBC School personnel, the 95th Calibration Service Company (TMDE Support Team No. 11), the Nuclear Weapons Support Branch, the 937th Engineer Group, and DFAE WPC plant personnel.

The NBC School stores PDR 27 meters and associated radioactive test samples, the 95th Calibration Service Company and the Nuclear Weapons Support Branch store several Radiac calibrators, the 937th Engineer Group stores soil density gauges, and DFAE WPC plant personnel store sludge gauges. Radiological sources in these items are all sealed sources. The storage areas are secure and are marked with warning signs in accordance with NRC (1982) regulations. The post RPO maintains inventories of these items and conducts routine leak tests on the sources. No records were found that indicated disposal of radiological materials on FR.

3.1.13 POL HANDLING AND STORAGE

POL products used on FR are fuel oil, gasoline, diesel fuel, aviation fuel, solvents (primarily Stoddard solution), engine oil, propane, and natural gas. POL storage areas are listed in the SPCC/ISCP. Monthly inventory checks are performed for underground tanks, and aboveground tanks are inspected daily.

3.1.14 SANITARY WASTEWATER TREATMENT

There are three wastewater treatment plants in operation on the installation, with a combined capacity of 17.4 MLD. The three are located at Main Post, Camp Forsyth, and Custer Hill. Effluent from the

Main Post WPC plant is discharged to the Kansas River, the Camp Forsyth WPC plant discharges to the Republican River, and the Custer Hill WPC plant discharges into a tributary of Threemile Creek. All three plants provide secondary (trickling filter) treatment and operate under NPDES permit. Domestic sanitary wastewater constitutes the primary flow into the plants, with small contributions of industrial wastewaters (e.g., wash rack discharges, neutralized battery electrolyte, laundry wastewaters, diluted laboratory wastes, boiler blowdown). Dried sludge from the treatment plants is disposed of in the post sanitary landfill. Analysis of sludge from the Main Post WPC plant indicated that the sludge is well below the limits of the RCRA TEP hazardous waste characteristic.

3.1.15 INDUSTRIAL WASTEWATER TREATMENT

Small quantities of industrial wastes and wastewaters are discharged into the sanitary sewer system and are treated along with domestic sanitary wastewater at the WPC plants. These wastes include neutralized battery electrolyte, unneutralized engine parts cleaning caustic solution, laundry wastewaters, wash rack wastewaters, boiler blowdown and boiler washwater from steam plants, and diluted laboratory wastes. The discharge of these wastes to the WPC plants does not present serious problems. The volumes involved relative to the domestic sanitary wastewater flow are such that dilution occurs in the system, and the flow entering the head of the WPC plants is relatively homogeneous. The only possible exception to this is the discharge of waste Stoddard solvent to a wash rack at MAAF (see Sec. 3.1.7).

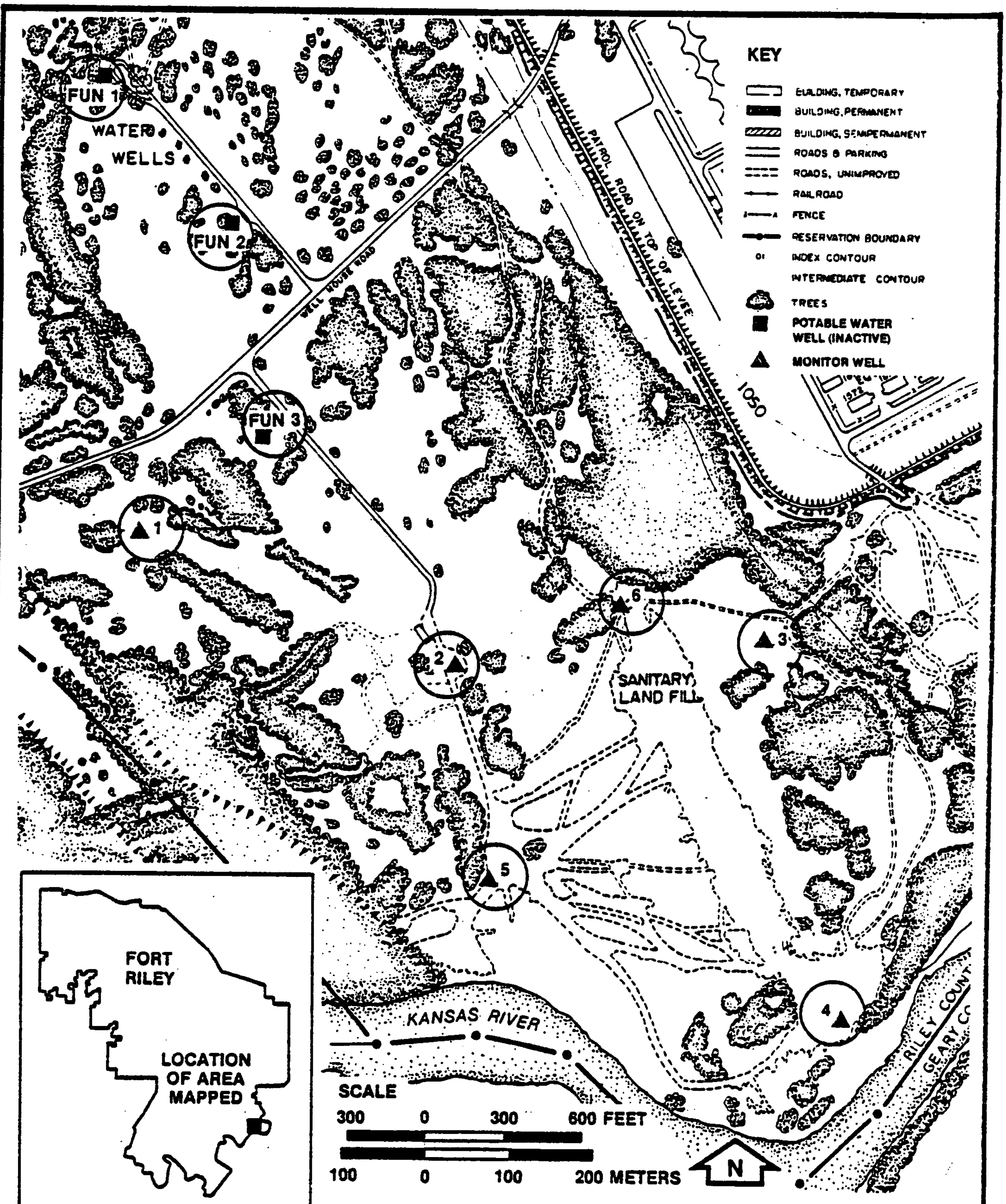
The only industrial wastewater that is not treated by the WPC plants is discharges from wash racks located in the Custer Hill vehicle maintenance area. These wash racks are equipped with sediment traps and oil/water separators, with eventual discharge to the stormwater sewer system. These discharges are covered under NPDES permit. Currently, a program is underway to consolidate wash rack discharges into a central treatment and water recycle system.

3.1.16 LANDFILL/DISPOSAL AREAS

Solid waste generated on FR has been disposed of by incineration, open burning, landfilling, and/or some combination of these methods. Seven solid waste disposal sites have been located on the installation dating from the late 1800s to the current trench and fill sanitary landfill.

The recently closed post sanitary landfill southwest of Camp Funston is located in alluvial deposits adjacent to the Kansas River. This landfill was operated from 1950 to 1981. Operation of this landfill utilized both trench and area methods of landfilling, with trench depths of approximately 5 m. Reportedly, ground water was visible in the bottoms of trenches during disposal operations, depending on the river stage. Material was often burned in the trenches. From 1950 to 1970, waste motor oils and degreasing solvents from vehicle maintenance operations were disposed of in this landfill. From 1970 to the present, these wastes (200,000 to 250,000 lpy) have been purchased on contract by a waste oil recovery company. In the past, most degreasing solvents (2,500 lpy) used in the motor pools consisted of chlorinated hydrocarbons, including trichloroethylene, tetrachloroethylene, and carbon tetrachloride, and were comingled with waste motor oils. Historically, the quantities of waste oils and solvents consumed on FR varied as troop strength and training activities fluctuated; however, the current generation rates probably represent average rates over the time period when the waste oil and solvents were being landfilled.

This landfill ceased operation in 1981, and a KDHE-approved closure plan (Permit No. 370) was enacted. This plan required the installation of six monitor wells, surficial soil cover, and topographic regrading. At the time of the site visit, the installation had installed ground water monitor wells around the landfill (Fig. 3.1-1), as required by the state of Kansas closure plan. The installation had not developed or instituted a plan for sampling and analysis of these wells. There are three standby potable wells installed in the alluvial deposits within 900 m of the former landfill. These wells should not be used as a



SOURCES: FR, OFFICE OF THE POST ENGINEER, 1975.
ESE, 1984.

Figure 3.1-1
MONITOR WELL LOCATIONS AT THE SW CAMP FUNSTON SANITARY LANDFILL

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

potable supply, unless a complete water quality investigation is performed, including analyses for halogenated hydrocarbons and oil and grease.

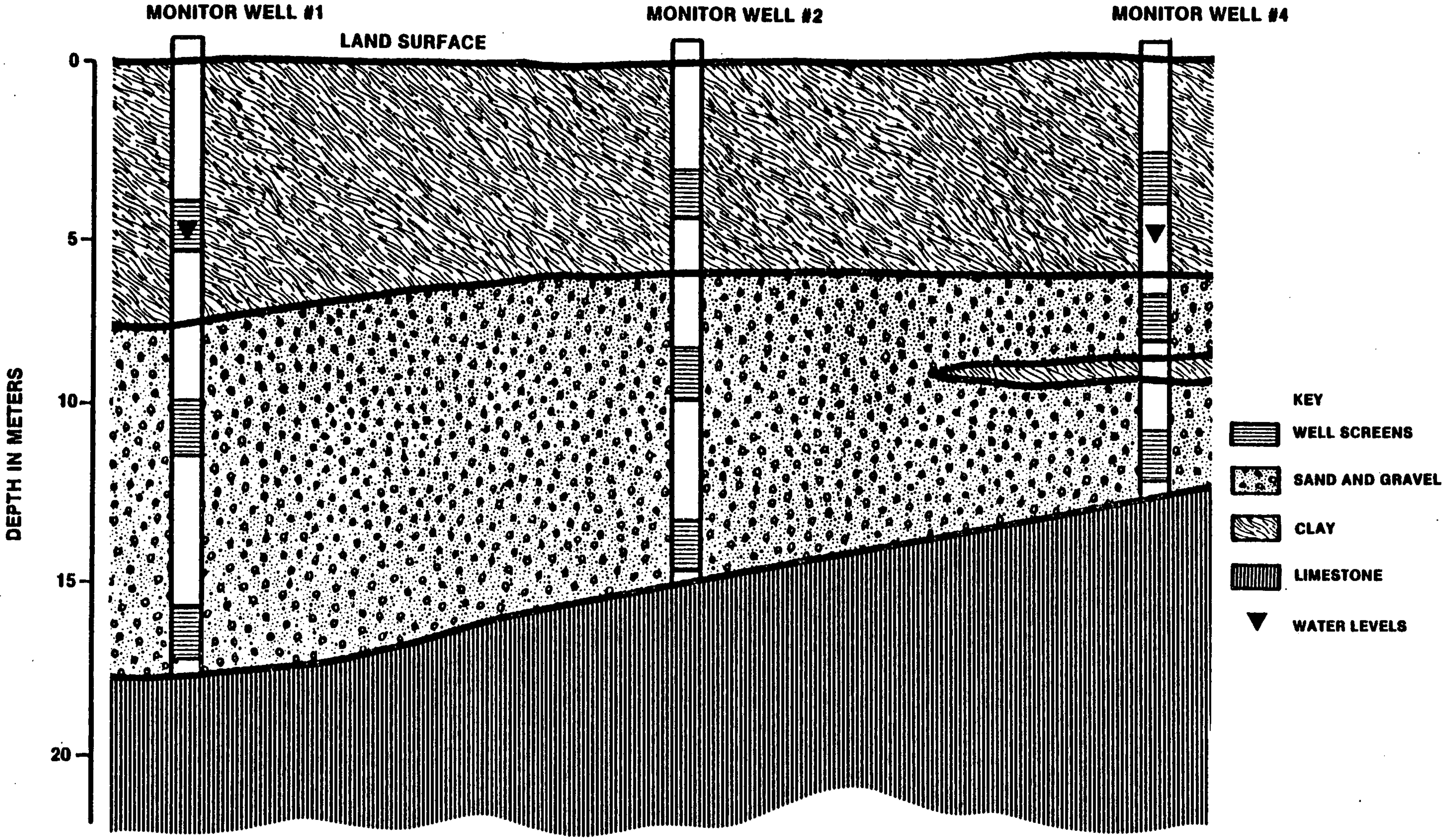
The state of Kansas closure plan for the landfill requires that a continuous 0.6-m cover be maintained on the landfill. During the onsite visit, it was noted that a proper soil cover was not being maintained. Lack of proper soil cover allows infiltration of precipitation and, thus, increases the potential for production of leachate. [Subsequent to the site visit, it was reported that a sign which prohibits the disturbance of surface soils at the closed landfill has been posted. The installation intends to place soil cover in the eroded areas of the landfill.]

Due to the permeability of the alluvial deposits, the relatively high solubility of the chlorinated solvents disposed of in the landfill, and the proximity of the Kansas River, which forms the installation boundary, a limited sampling and analysis program was undertaken by USATHAMA. The objective of the program was to provide additional data for the purpose of evaluating the need for USATHAMA to conduct a Phase II environmental contamination survey. Specifically, the program involved sampling the existing monitor wells at the landfill and analyzing the ground water samples from these wells for volatile hydrocarbons, trace metals, and petroleum hydrocarbons. Details of the sampling and analysis task, including chemical analysis rationale, sampling methodology, and laboratory procedures, are contained in the sampling and analysis plan (ESE, 1984). The following paragraphs briefly summarize monitor well construction and the analytical program.

The monitor wells range in depth from 12 to 18 m and were installed through the alluvial deposits to the top of the underlying limestone bedrock. Each well was constructed of 5-in inside diameter (ID) polyvinyl chloride (PVC) casing and screen. The screen is slotted, saw-cut casing and is spaced at three intervals in each well. These wells were installed by Strader and Co. under contract to the engineering firm of Wilson and Co. (Salina, Kans.), which developed the landfill closure plan. Fig. 3.1-2 is a cross-sectional diagram illustrating the geology in the landfill area. This cross section was constructed using the well logs from Monitor Well Nos. 1, 2, and 4 (see Fig. 3.1-1), which lie in a general northwest to southeast line across the landfill area. As shown in the cross section, the local geology consists of a surficial 5- to 7-m layer of clay material that overlies 5 to 10 m of sands and gravels. Underlying these alluvial deposits is grey limestone bedrock. Monitor Well No. 1 was installed as a topographic upgradient background well. During dry periods when the Kansas River is at low stage, surface topography may define ground water gradients; however, at high river stages, the river likely recharges the alluvial deposits, and ground water gradient reversal may occur. Therefore, it is unknown whether Monitor Well No. 1 actually represents background upgradient conditions.

The analysis for volatile hydrocarbons by gas chromatography/mass spectrometry (GC/MS) included six halogenated aliphatic hydrocarbons known to have been used as solvents for vehicle parts degreasing or cleaning (trichloromethane, tetrachloromethane, trichloroethene, tetrachloroethene, dichlorodifluoromethane, and trichlorofluoromethane), as well as other priority pollutant and nonpriority pollutant volatile hydrocarbons which may be present in POL. The list of trace metals included all the NIPDWR (EPA, 1982d) metals (except barium); iron, copper, and zinc, which are NSDWR (EPA, 1982e) metals; and nickel and vanadium. These metals are typically found at elevated levels in waste engine oil due to wear and abrasion of engine parts. Petroleum hydrocarbon analyses provide an overall estimate of contamination due to the disposal of waste POL in the landfill.

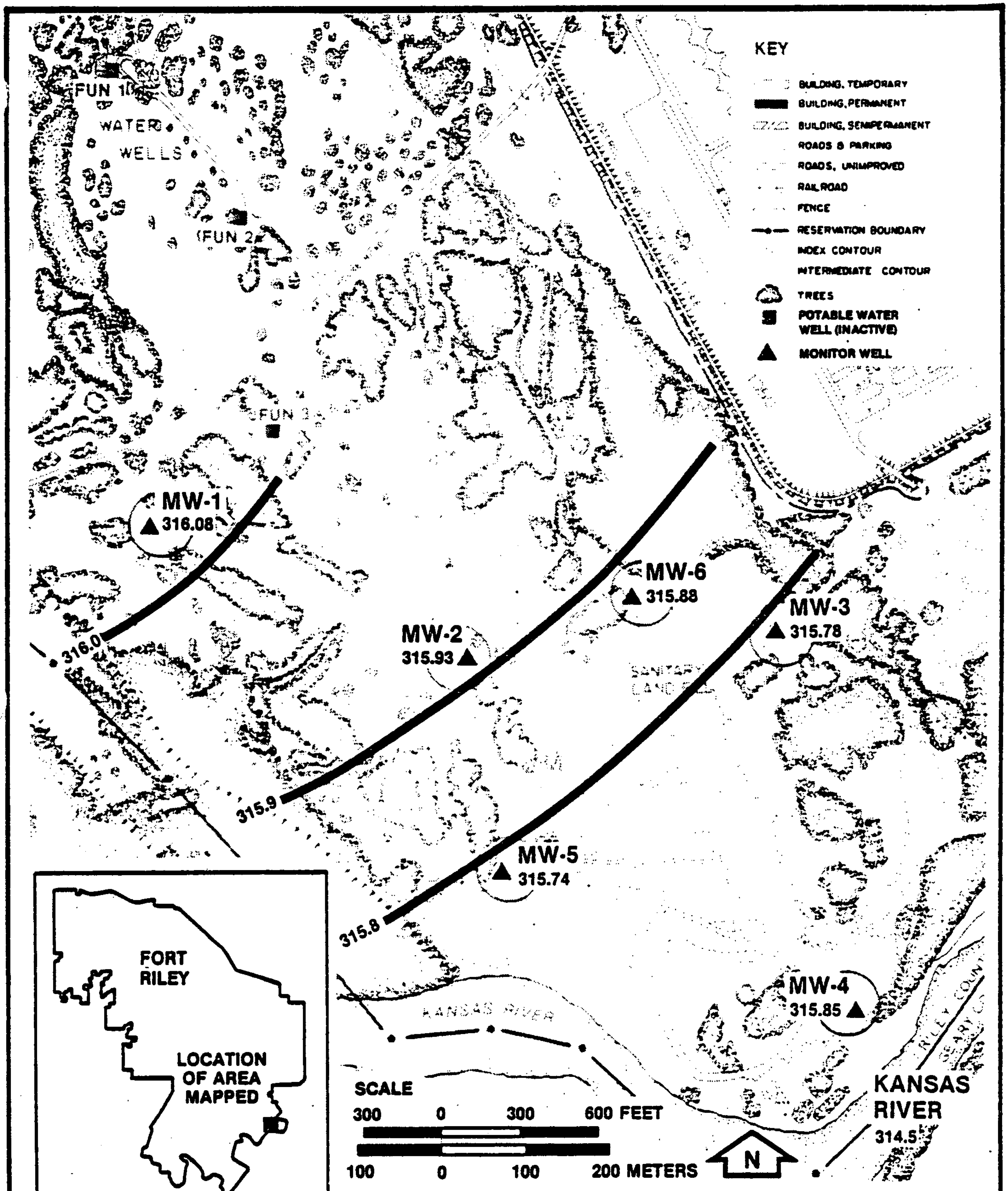
Ground water elevations at the time of sampling (Apr. 27-28, 1984) are plotted on Fig. 3.1-3. Elevations ranged from 316.08 m above MSL at Monitor Well No. 1 to 315.74 m above MSL at Monitor Well No. 5. As



SOURCE: ESE, 1984.

Figure 3.1-2
GEOLOGIC CROSS SECTION AT THE SW CAMP FUNSTON SANITARY LANDFILL

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland



SOURCES: FR, OFFICE OF THE POST ENGINEER, 1975.
ESE, 1984.

Figure 3.1-3 GROUND WATER ELEVATIONS (METERS ABOVE MEAN SEA LEVEL) AT THE TIME OF SAMPLING (4/27-4/28/84)	**Prepared for:** **U.S. Army Toxic and Hazardous Materials Agency** **Aberdeen Proving Ground, Maryland**

shown by the ground water elevation isopleths, a generally flat ground water gradient of approximately -0.6 m per km was observed toward the Kansas River located south-southeast of the landfill.

The results of chemical analysis of ground water samples obtained from the six monitor wells are summarized in Table 3.1-1. Parameters listed in Table 3.1-1 are only those for which concentrations above applicable detection limits were observed. The complete data set and listing of USATHAMA Data Management System (DMS) data file names are contained in App. K.

Samples from each monitor well were analyzed for 12 trace metals, 7 of which were observed at detectable levels (arsenic, cadmium, copper, iron, lead, nickel, and zinc). The other five metals (chromium, mercury, selenium, silver, and vanadium) were not detected in any sample. As shown by Fig. 3.1-4, arsenic, iron, and zinc were observed in samples from all six wells. The levels of arsenic and zinc were below primary and secondary drinking water MCLs and aquatic life criteria. Arsenic levels ranged from 5.1 to 17 ug/l (detection limit = 4 ug/l), which are above human health criteria at the 10^{-5} incremental risk level. It should be noted that the criteria are several orders of magnitude below analytical detection limits. Mass balance calculations indicate that the observed levels would be diluted by a factor of 6,000 upon entering the Kansas River, which would reduce the concentrations to levels less than the criteria.

All samples contained visible iron-colored, flocculant materials, and iron levels ranged from 55 to 14,900 ug/l. Samples from Monitor Well Nos. 2, 3, and 4 exhibited iron levels substantially above background, indicating the presence of leachate materials. The decay of organic materials in the subsurface environment of landfills produces highly reducing (i.e., negative redox potential) conditions that reduce ferric (+3 valence) to ferrous (+2 valence) iron. This is a very soluble form of iron and, therefore, it is mobilized in the ground water. As shown

Table 3.1-1. Summary of Ranges of Concentrations and Federal and State of Kansas Water Quality Criteria for Contaminants Observed at FR

Parameter	Observed Range of Concentrations	Background Range of Concentrations[1]	Drinking Water MCL*	Freshwater Aquatic Life Maximum Level†	Human Health at 10^{-5} Incremental Risk Level: Ingesting Water and Organisms	Human Health at 10^{-5} Incremental Risk Level: Ingesting Organisms Only
Metals						
Arsenic (ug/l)	5.1-17	<20-<30	50	44	0.022	0.175
Cadmium (ug/l)	<2.9-3.4	<1-<5	10	12	10	—
Copper (ug/l)	<5.0-6.3	<25-57	1,000	75	—	—
Iron (ug/l)	55-14,900	<100-900	300	1,000	—	—
Lead (ug/l)	<13.7-25.1	<5-21	50	836	50	—
Nickel (ug/l)	<7.0-13	ND	—	4,900	13.4	100
Zinc (ug/l)	24.2-69.0	<15-39	5,000	941	5,000	—
Volatile Halogenated Organics						
Trans-1,2-dichloroethene (ug/l)	<1-2	ND	—	—	—	—
Vinyl chloride (ug/l)	<1-5	ND	—	—	20.0	5,250
Other						
Petroleum hydrocarbons (mg/l)	2.62-11.9	ND	—	—	—	—

[1] Ranges of values are for nine onpost wells sampled during 1972-77 as part of USADWSP (see Table 2.3-2).

* EPA, 1982d and 1982e.
† EPA, 1976, 1980, and 1981b; aquatic life criteria for cadmium, copper, lead, nickel, and zinc are based on a total hardness value of 351 mg/l as calcium carbonate for the Kansas River.
— = Not applicable.
ug/l = micrograms per liter.
ND = No data.

Source: ESE, 1984.

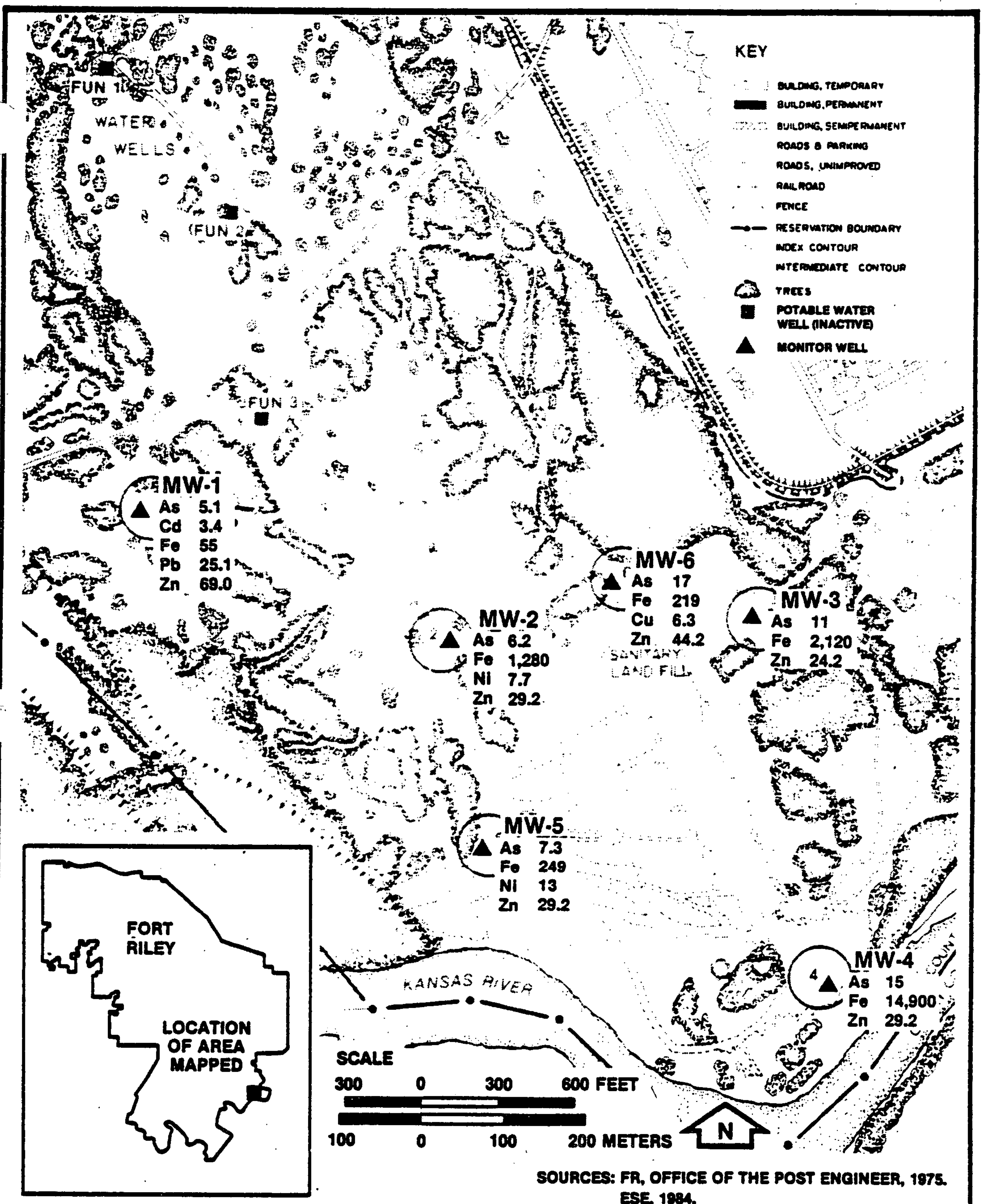


Figure 3.1-4
CONCENTRATIONS (ug/l) OF TRACE METALS ABOVE DETECTION LIMITS

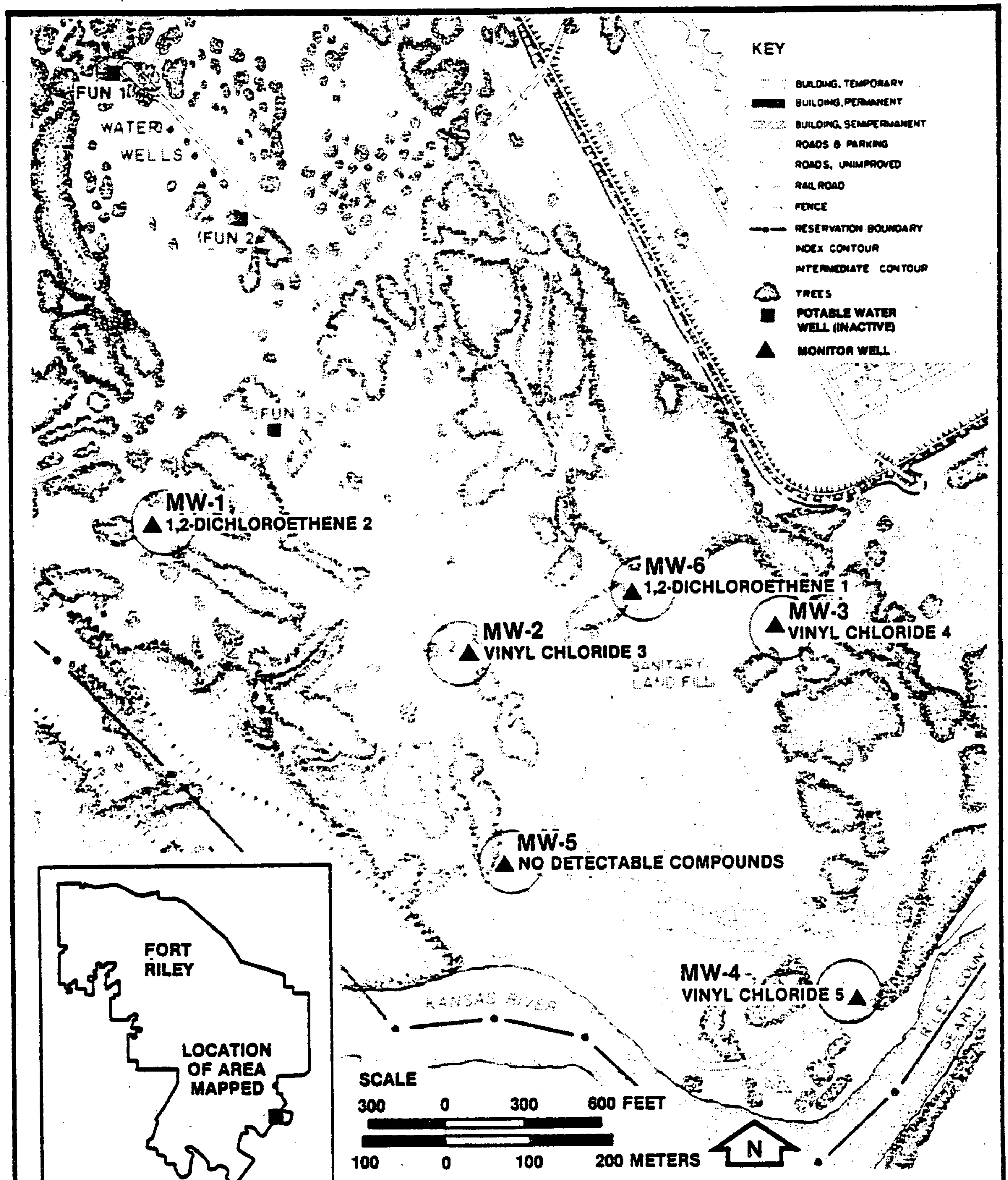
Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

in Table 3.1-1, iron concentrations in Monitor Well Nos. 2, 3, and 4 were above secondary drinking water MCLs and aquatic life criteria. It should be noted that the secondary MCLs have been developed for aesthetic purposes and are not health related; furthermore, no potable wells are located near the site. Mass balance calculations indicate that the observed iron levels in the ground water would be diluted by a factor of 6,000 upon entering the Kansas River and would, therefore, be below the aquatic life criterion.

Cadmium, copper, nickel, and lead were detected in several samples (Fig. 3.1-4) at levels slightly above the detection limits. Concentrations of all four metals were below primary and secondary drinking water MCLs, aquatic life criteria, and human health criteria at the 10^{-5} incremental risk level (Table 3.1-1). Based on existing data, the observed levels appear to represent background conditions.

The GC/MS analysis for volatile hydrocarbons included 30 compounds of which only two were observed at detectable levels. As shown by Fig. 3.1-5, vinyl chloride was detected in Monitor Well Nos. 2, 3, and 4, and trans-1,2-dichloroethene was detected in Monitor Well Nos. 1 and 6. No volatile hydrocarbons were detected in Monitor Well No. 5. The observed levels of vinyl chloride and trans-1,2-dichloroethene were slightly above analytical detection and do not exceed water quality criteria. Vinyl chloride may be an artifact due to well construction materials (e.g., PVC and PVC solvent glue).

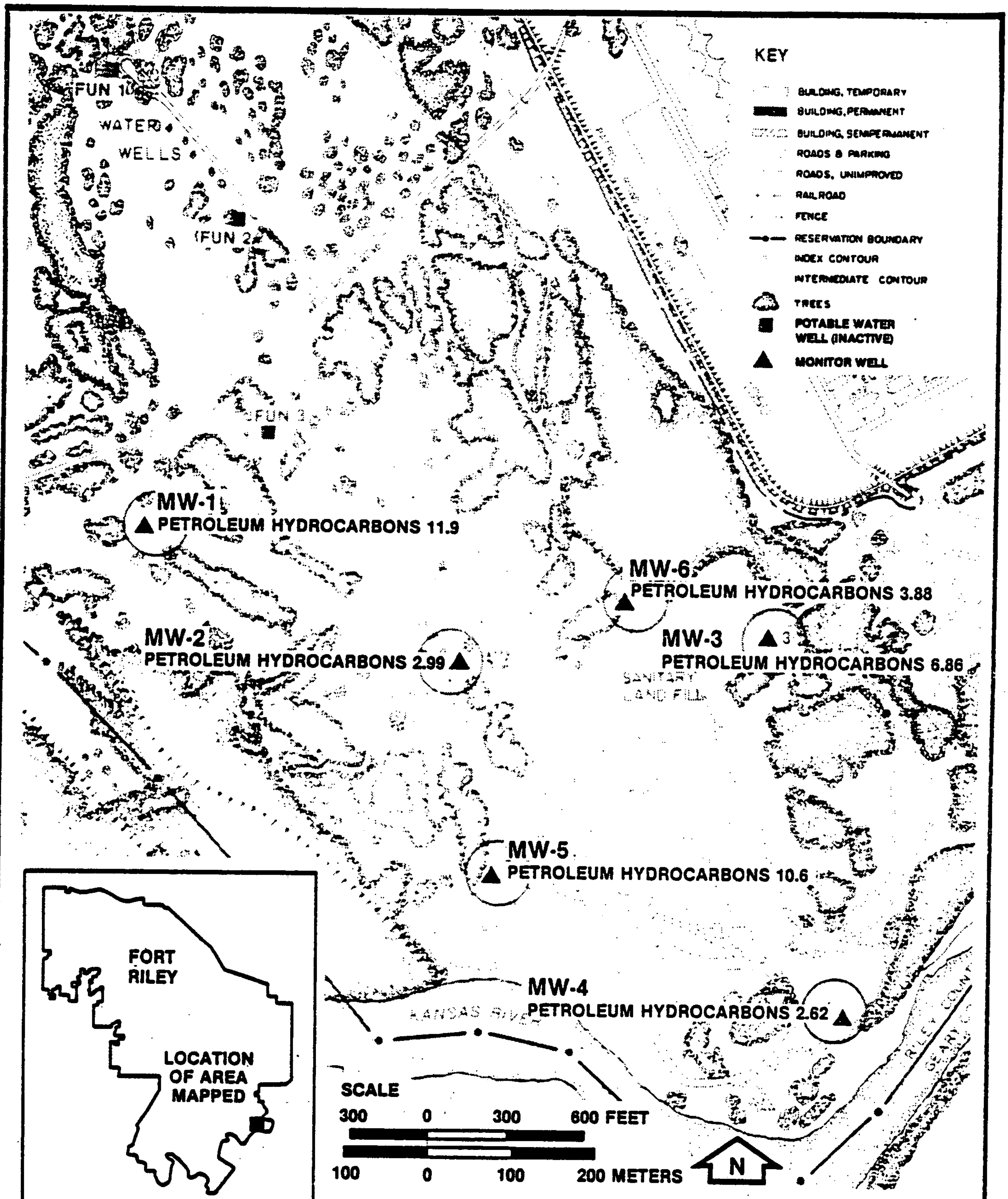
Petroleum hydrocarbons were detected at relatively low levels in samples from all six monitor wells, with concentrations ranging from 2.62 to 11.9 mg/l (Fig. 3.1-6). The detection limit for the analytical method was 1.0 mg/l. No POL materials were visible floating or suspended in any of the samples. Since the analytical method specifically excludes hydrocarbons of natural origin (i.e., biological decay or organic materials), the observed levels are likely due to waste motor oils and lubricants that were reportedly disposed of in the landfill. No potable



SOURCES: FR, OFFICE OF THE POST ENGINEER, 1975.
ESE, 1984.

Figure 3.1-5
CONCENTRATIONS (ug/l) OF VOLATILE HYDROCARBONS ABOVE DETECTION LIMITS

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland



SOURCES: FR, OFFICE OF THE POST ENGINEER, 1975.
ESE, 1984.

Figure 3.1-6 CONCENTRATIONS (mg/l) OF PETROLEUM HYDROCARBONS	**Prepared for:** **U.S. Army Toxic and Hazardous Materials Agency** **Aberdeen Proving Ground, Maryland**

wells are located near the landfill; therefore, there is no risk to potable supplies. The potential does exist, however, for migration of petroleum hydrocarbons to the Kansas River. Mass balance calculations, however, indicate that the observed levels would be diluted by a factor of 6,000 upon entering the river.

The observed levels of petroleum hydrocarbons in the ground water around the landfill are relatively low, considering the total volume of waste motor oil disposed of at the site during the period from the early 1950s to 1970 when the waste oil recycling program was implemented. The observed low levels are likely due to the fact that the waste oils were disposed of on a daily basis along with the other solid wastes (e.g., office trash, mess hall garbage, etc.) generated onpost. Therefore, the waste oils were not disposed of in large quantities in a single location, but rather were distributed throughout the landfill and mixed with the other landfilled wastes. In addition, burning of the wastes in the trenches was commonly practiced until the mid 1960s, and much of the waste oil may have been burned. Any unburned waste oil would be expected to move downward through the soil due to gravity and percolation of rainfall. As the oil moves through the soil, adsorption onto soil particles would occur due to the viscosity of the oil and its hydrophobicity. Percolating rainfall would be expected to remove soluble or diffusible components (typically the lighter oil fractions) which would then be carried to the water table [American Petroleum Institute (API), 1972]. These processes likely explain the low levels observed in the ground water during this investigation. Residual waste oil remaining in the landfill would be biodegraded with other organic wastes disposed of in the trenches.

In summary, the results of the limited sampling and analysis program indicate that significant contaminant migration from the former landfill is not occurring. As expected, localized ground water quality degradation in the vicinity of the landfill has occurred, primarily due to iron and petroleum hydrocarbons. No active potable wells, however, are located near the site.

The installation is in the process of developing and implementing a sampling and analysis program for the landfill, as required by the state of Kansas closure plan. The installation has contacted USAEHA for assistance in implementing the required sampling and analysis program. When available, analytical results from this program should be provided to USATHAMA for review and assessment. [Subsequent to the site visit, it was reported that the landfill monitor wells were sampled by a private contractor and the samples were sent to USAEHA for analysis in September 1984. The installation plans to comply with the state of Kansas request for biennial reporting of landfill ground water quality data.]

3.1.17 CONTAMINATED WASTES

The only contaminated wastes generated on the installation are infectious wastes (pathology laboratory glassware, bandages, human and animal tissue, etc.). These wastes are generated by the IAH activity and the veterinary activity. Such items are sterilized (as appropriate) prior to landfilling or are incinerated in the IAH pathological incinerator.

3.1.18 DEMOLITION AND BURNING GROUND AREAS

The demolition and destruction (demilitarization) of unserviceable ammunition and UXO at FR are conducted by the 74th EOD Detachment. Demolition and burning are conducted in the impact area in a pit approximately 5 m deep. The pit consists mostly of clay materials. This demilitarization is permitted under RCRA hazardous waste regulations as a thermal treatment facility. The waste ammunition and powder are classified as hazardous under RCRA due to the reactivity characteristic. Sampling and analysis of soils and residues in the demolition area indicate that the wastes remaining after the demolition process do not present a problem.

3.1.19 WATER QUALITY

Surface

Surface water quality data for Sevenmile Creek (which drains the FR impact area), Threemile Creek, and the Kansas River are available from a 7-day USAEHA study that evaluated any potential stream contamination associated with the use of munitions and other training activities within the FR impact area. Data include pH, dissolved oxygen, specific conductance, phosphorus, nitrate, calcium, magnesium, and 14 trace metals. Levels of all toxic metals were below EPA drinking water MCLs and aquatic life criteria; in fact, most were below analytical detection. Nutrient (phosphorus and nitrate) levels were highest in the Kansas River, presumably due to municipal domestic wastewater discharges and/or agricultural or pasture runoff. No contamination was found due to the use of munitions or training activities in the watershed of Sevenmile Creek.

Subsurface

Extensive subsurface water quality data are available from raw water analyses of nine potable water supply wells on the installation. Analyses include major ions, trace metals, and radioactivity. With the exception of iron, manganese, and TDS, the raw well water meets EPA drinking water MCLs. Trace metal concentrations were generally below analytical detection. Due to the limestone and shale sedimentary deposits, the ground water is highly mineralized, and elevated levels of iron, manganese, and TDS are common in the region.

Historical (mid-1970s) chemical data from a potable supply well (now inactive) near the former Camp Funston landfill indicated higher than background levels of iron and TDS. Specific conductance values (a gross measure of dissolved ionic constituents) also appear to be elevated above background. No toxic trace metals or radioactivity were above drinking water MCLs; in fact, most were below the analytical detection. It should be noted, however, that no trace organic analyses have been performed on the water from this well. From the mid-1950s to 1970, waste motor oils and comingled degreasing solvents were disposed of in the former landfill. This well, as well as the other two former water supply wells in this area (all within 900 m of the former landfill; see Fig. 3.1-1), are inactive. At the time of the site visit, the installation was in the process of abandoning these wells in accordance with state of Kansas procedures. [Subsequent to the site visit, it was reported that the installation plans to decommission the three former water supply wells in the vicinity of the Camp Funston landfill in Fiscal Year 1985 or 1986.]

Potable

The principal raw water supply for the installation is ground water obtained from the alluvial deposits along the Republican and Kansas Rivers. Wells are currently operated at well fields west of the Main Post and in Camp Forsyth. In addition to the cantonment area wells, several small-volume wells are located at outlying range facilities, training areas, and recreational facilities. Potable water treatment includes disinfection, fluoridation, and stabilization/conditioning. Operational chemical surveillance of the water in the distribution system is performed by DFAE personnel. Medical surveillance (chemical and biological) is performed by PVNTMED Activity personnel. NIPDWR and NSDWR analyses are conducted by USAEHA. With the exception of occasional problems with iron and manganese (which occur naturally in the region), the potable water meets NIPDWR and NSDWR criteria.

3.1.20 AIR QUALITY AND NOISE

FR is in compliance with all applicable local, state, and Federal air quality control regulations. The installation submits annual emissions inventories, as well as inspection reports, on regulated sources to KDHE.

Principal sources of noise generated on the installation include vehicles, aircraft, tank and artillery fire, and explosives detonations. Mitigative measures include limiting aircraft to designated flight corridors and height restrictions. Tank and artillery firing are accomplished at specified time schedules to minimize noise generation.

3.2 CONCLUSIONS

1. Toxic/hazardous materials generated by vehicle maintenance operations have been disposed of in the former sanitary landfill. Limited geohydrological and water quality data, however, do not indicate that contaminants are migrating at significant levels from the landfill.
2. The following practices for handling materials or for waste disposal, while not leading to offpost migration, are either not in compliance with designated regulations and/or are resulting in onpost contamination:
   a. Caustic sodium hydroxide cleaning solution generated by engine parts cleaning operations at the Directorate of Industrial Operations maintenance facility and the Directorate of Personnel and Community Activities Automotive Self-Help Shop is disposed of to the sanitary sewer system. This solution may be classified as a hazardous waste due to corrosivity (EPA, 1982b). Subsequent to the site visit, the following actions were reported by the installation: The decision to discharge caustic solution to the sanitary sewer will be based on the results of laboratory analyses for corrosivity and trace metals content. The discharge of caustic cleaning solution to the sewer system is prohibited without prior consultation with the facilities engineer.
   b. Nonhazardous waste degreasing solvents generated by the Directorate of Industrial Operations aircraft maintenance shop are disposed of by dumping into a wash rack drain that is connected to the sanitary sewer system. This disposal of waste petroleum, oils, and lubricants is not in accordance with Army regulations (U.S. Army, 1980). Subsequent to the site visit, the following actions were reported by the installation: Aircraft maintenance activities have been advised to dispose of waste degreasing solvents by transfer to the Defense Property Disposal Office.

c. Tetrachloroethylene is used as a solvent to clean paint spray equipment in the Directorate of Industrial Operations furniture shop. Wastes (residues, rags, containers) from this operation are disposed of in the post sanitary landfill, contrary to Federal Resource Conservation and Recovery Act regulations (EPA, 1982c). Subsequent to the site visit, the following actions were reported by the installation: The furniture shop has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.

d. Tetrachloroethylene is used to clean printing equipment at the Adjutant General print plant. Wastes (residues, rags, containers) are disposed of in the sanitary landfill. This disposal practice is not in accordance with Federal Resource Conservation and Recovery Act regulations (EPA, 1982c). Subsequent to the site visit, the following actions were reported by the installation: The print plant has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.

e. Still bottoms from distillation of tetrachloroethylene drycleaning solvent at the Directorate of Industrial Operations drycleaning plant have been periodically disposed of on the ground behind Bldg. 109. Tetrachloroethylene still bottoms are a designated Resource Conservation and Recovery Act hazardous waste (EPA, 1982b). Subsequent to the site visit, the following actions were reported by the installation: The soil in the vicinity of Bldg. 109 will be sampled and analyzed for tetrachloroethylene. Based on the results of these analyses, soil decontamination will be conducted, as necessary.

f. Trichloroethane and trichlorotrifluoroethane (Freon®) solvents used in the Directorate of Industrial Operations oil analysis laboratory are disposed of by comingling with nonhazardous waste motor oils that are contract sold to recycling companies through the Defense Property Disposal Office. This disposal practice is not in accordance with Federal Resource

Conservation and Recovery Act regulations (EPA, 1982c). Subsequent to the site visit, the following actions were reported by the installation: The oil analysis laboratory has been advised to dispose of waste solvents by transfer to the Defense Property Disposal Office.

g. Waste mercury generated from breakage of laboratory instruments has been disposed of in the post sanitary landfill. Since 1982, the waste mercury has been accumulated for disposal by hazardous waste contract. It may be possible to recycle/reclaim this waste mercury through supply channels. Subsequent to the site visit, the following actions were reported by the installation: The feasibility of recycling mercury wastes from breakage of laboratory instruments is being investigated.

h. Pesticides in the soil and stream sediments behind Bldg. 292 present a potential environmental hazard due to pesticide contamination (Callahan et al., 1979). Subsequent to the site visit, the following actions were reported by the installation: The soil and stream sediments in the drainageway behind Bldg. 292 will be resampled and analyzed for pesticides. Based on the results of these analyses, soil decontamination will be conducted, as necessary.

i. The Directorate of Personnel and Community Activites golf course pesticide storage facility is not weatherproof, the storage area is not curbed, and potable water sources used for obtaining mixing water are not equipped with backflow-prevention devices, contrary to U.S. Environmental Protection Agency regulations (EPA, 1982g). Subsequent to the site visit, the following actions were reported by the installation: Actions are being taken to provide the storage building with expedient weatherproofing and a backflow-prevention device. The feasibility of constructing a more satisfactory storage facility is being investigated.

j. The installation is conducting sampling and analysis of out-of-service transformers prior to turn-in to the Defense Property Disposal Office. Subsequent to the site visit, the following actions were reported by the installation: The transfer of accountability (for disposal) of four polychlorinated biphenyl items to the Defense Property Disposal Office was accomplished in August 1984. No sampling was performed due to a waiver of the requirement by the Defense Property Disposal Office. The installation intends to sample and transfer all future waste polychlorinated biphenyl items, as needed. The installation intends to temporarily store selected waste polychlorinated biphenyl items, as needed.

k. A continuous, 0.6-m soil cover is not being maintained on the former sanitary landfill, as required by the state of Kansas closure plan. Subsequent to the site visit, the following actions were reported by the installation: A sign which prohibits the disturbance of surface soils at the closed landfill has been posted. The installation intends to place soil cover in the eroded areas of the landfill.

l. The installation is in the process of developing and implementing a sampling and analysis plan for the former Camp Funston landfill in accordance with the state of Kansas closure plan for the landfill. Subsequent to the site visit, the following actions were reported by the installation: The landfill monitor wells were sampled by a private contractor, and the samples were sent to the U.S. Army Environmental Hygiene Agency for analysis in September 1984. The installation plans to comply with the state of Kansas request for biennial reporting of landfill ground water quality data.

m. The installation is in the process of abandoning three former water supply wells located near the former Camp Funston landfill. This abandonment will be conducted in accordance with state of Kansas procedures. Subsequent to the site visit, the following actions were reported by the installation: The installation plans to decommission the three former water supply wells in the vicinity of the Camp Funston landfill in Fiscal Year 1985 or 1986.

n. The installation is using a number of listed hazardous solvents for industrial operations for which there may be acceptable nonhazardous substitutes. Subsequent to the site visit, the following actions were reported by the installation: The installation has taken action to substitute nonhazardous solvents for hazardous solvents, where feasible.

3.3 RECOMMENDATIONS (KEYED TO CONCLUSIONS)

That USATHAMA should:

1. Not conduct a survey at this time.

That FR should:

2. a. Perform a pH test of the caustic cleaning solution to determine if the waste meets the Resource Conservation and Recovery Act corrosivity characteristic and take appropriate action. Subsequent to the site visit, the following actions were reported by the installation: The decision to discharge caustic solution to the sanitary sewer will be based on the results of laboratory analyses for corrosivity and trace metals content. The discharge of caustic cleaning solution to the sewer system is prohibited without prior consultation with the facilities engineer.

   b. Properly dispose of waste degreasing solvents generated by the Directorate of Industrial Operations aircraft maintenance operation. Subsequent to the site visit, the following actions were reported by the installation: Aircraft maintenance activities have been advised to dispose of waste degreasing solvents by transfer to the Defense Property Disposal Office.

   c. Properly dispose of tetrachloroethylene-contaminated wastes generated by cleaning paint spray equipment at the Directorate of Industrial Operations furniture shop. Subsequent to the site visit, the following actions were reported by the installation: The furniture shop has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.

   d. Properly dispose of tetrachloroethylene-contaminated wastes generated by cleaning operations at the Adjutant General print plant. Subsequent to the site visit, the following actions were reported by the installation: The print plant has been advised to dispose of tetrachloroethylene wastes by transfer to the Defense Property Disposal Office.

e. Conduct sampling and analysis of tetrachloroethylene-contaminated soil behind Bldg. 109 and take appropriate action, including removal and proper disposal of contaminated materials. Institute procedures to ensure proper disposal of the tetrachloroethylene still bottoms in the future. Subsequent to the site visit, the following actions were reported by the installation: The soil in the vicinity of Bldg. 109 will be sampled and analyzed for tetrachloroethylene. Based on the results of these analyses, soil decontamination will be conducted, as necessary.

f. Properly dispose of waste trichloroethane and trichlorotrifluoroethane solvents generated by the Directorate of Industrial Operations oil analysis laboratory. Subsequent to the site visit, the following actions were reported by the installation: The oil analysis laboratory has been advised to dispose of waste solvents by transfer to the Defense Property Disposal Office.

g. Investigate the feasibility of recycling/reclaiming waste mercury through supply channels. Subsequent to the site visit, the following actions were reported by the installation: The feasibility of recycling mercury wastes from breakage of laboratory instruments is being investigated.

h. Perform sampling and analysis of soils and sediments in the stream behind Bldg. 292 to determine the extent of pesticide contamination and take appropriate action. Subsequent to the site visit, the following actions were reported by the installation: The soil and stream sediments in the drainageway behind Bldg. 292 will be resampled and analyzed for pesticides. Based on the results of these analyses, soil decontamination will be conducted, as necessary.

i. Bring the Directorate of Personnel and Community Activities golf course pesticide storage facility into compliance with U.S. Environmental Protection Agency regulations. Use backflow-prevention devices on potable water sources that are used for pesticide mixing or equipment rinsing. Subsequent to the site visit, the following actions were reported by the installation: Actions are being taken to provide the storage building with expedient weatherproofing and a backflow-prevention device. The feasibility of constructing a more satisfactory storage facility is being investigated.

j. Continue with the program to sample and analyze transformer fluids and turn these items in to the Defense Property Disposal Office. Subsequent to the site visit, the following actions were reported by the installation: The transfer of accountability (for disposal) of four polychlorinated biphenyl items to the Defense Property Disposal Office was accomplished in August 1984. No sampling was performed due to a waiver of the requirement by the Defense Property Disposal Office. The installation intends to sample and transfer all future waste polychlorinated biphenyl items, as needed. The installation intends to temporarily store selected waste polychlorinated biphenyl items, as needed.

k. Maintain proper soil cover on the former sanitary landfill. Subsequent to the site visit, the following actions were reported by the installation: A sign which prohibits the disturbance of surface soils at the closed landfill has been posted. The installation intends to place soil cover in the eroded areas of the landfill.

l. Continue with the program to develop and implement a sampling and analysis program for the monitor wells around the Camp Funston landfill. Provide water quality data from this program to USATHAMA for review and assessment.

Subsequent to the site visit, the following actions were reported by the installation: The landfill monitor wells were sampled by a private contractor, and the samples were sent to the U.S. Army Environmental Hygiene Agency for analysis in September 1984. The installation plans to comply with the state of Kansas request for biennial reporting of landfill ground water quality data.

m. Continue with the program to abandon the three former water supply wells near the former Camp Funston landfill. Subsequent to the site visit, the following actions were reported by the installation: The installation plans to decommission the three former water supply wells in the vicinity of the Camp Funston landfill in Fiscal Year 1985 or 1986.

n. Institute a program to substitute hazardous solvents with nonhazardous counterparts. Subsequent to the site visit, the following actions were reported by the installation: The installation has taken action to substitute nonhazardous solvents for hazardous solvents, where feasible.

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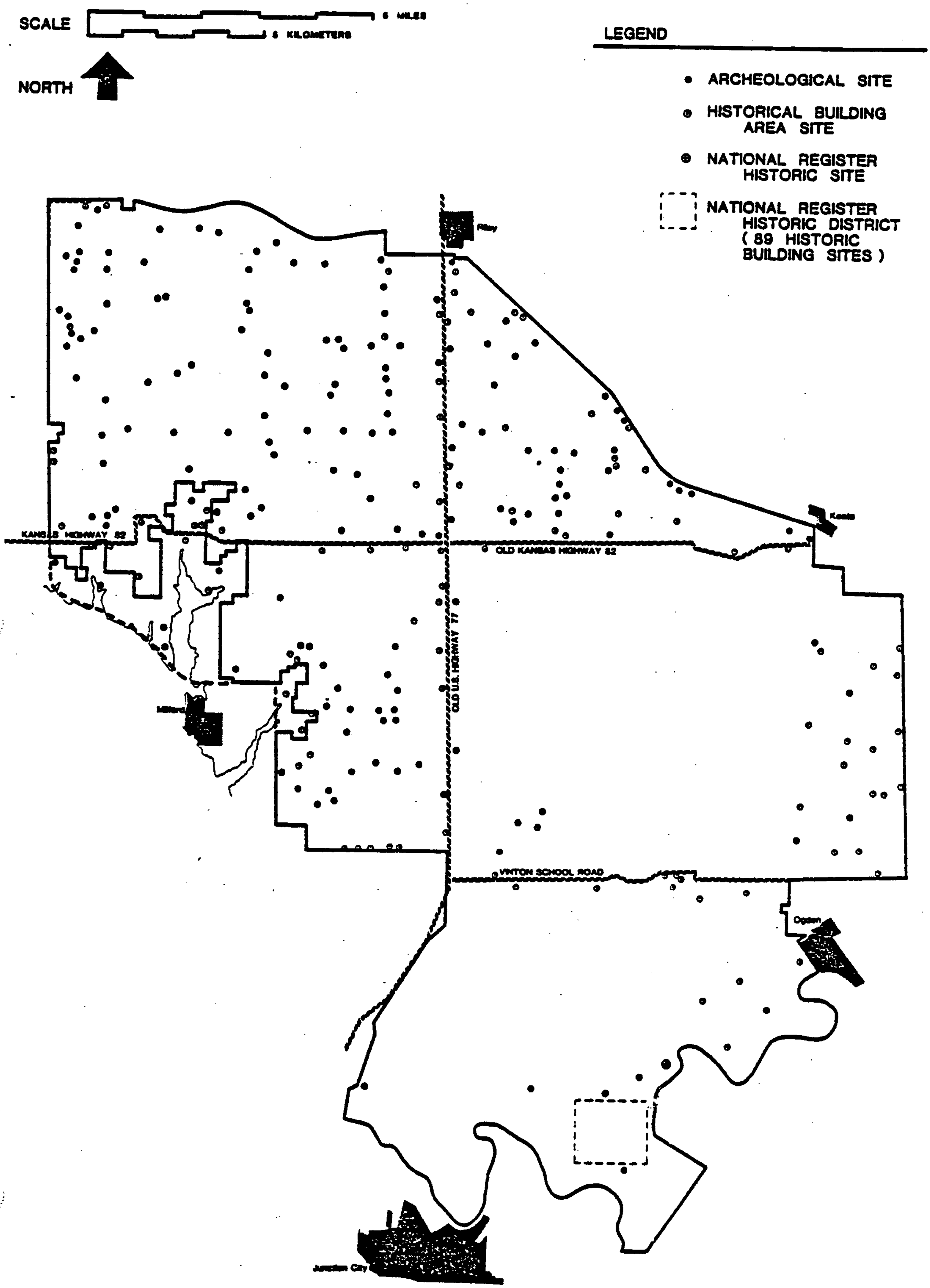
APPENDIX A

HISTORICAL AND ARCHAEOLOGICAL SITES ON FR

Source: Department of the Army, Headquarters, Forces Command, 1981.

ARCHEOLOGICAL & HISTORICAL SITE MAP



APPENDIX B

COOPERATIVE AGREEMENT FOR THE MANAGEMENT OF FISH AND WILDLIFE RESOURCES ON FR

Source: FR *et al.*, n.d.

COOPERATIVE AGREEMENT

For the Conservation and Development of Fish and Wildlife Resources on the Fort Riley Military Reservation Fort Riley, Kansas

I. In accordance with the authority contained in Title 10, U.S. Code, Section 2671; Title 16, U.S. Code, Section 670; and in Public Law 86-797, approved September 15, 1960, the Department of Defense, the Department of Interior, and the State of Kansas, through their duly designated representatives whose signatures appear below, approved the following cooperative plan for the protection, development and management of fish and wildlife resources on the Fort Riley Military Reservation.

II. Purpose and Objectives:

A. Purpose: The purpose of this agreement is to establish a cooperative effort for the proper protection, development, and management of fish and wildlife resources on the Fort Riley Military Reservation.

B. Objectives:

1. Provide a general inventory of fish and wildlife resources to include:

a. The potential of existing water areas on the Installation to meet current and future needs for adequate fishing facilities including the specific determination of:

(1) Principal water areas of the Installation, to include location, physical characteristics, and acreage.

(2) Principal game fish species present in such water areas and observations as to the quality of the aquatic habitat.

(3) Determination of fish population "balance" within lakes and streams.

(4) The need for new fishing areas, to include recommendations regarding the type and number of water areas to be constructed.

(5) Description of restricted areas and of areas available for public access. Areas to be utilized will be commensurate with Installation objectives.

b. The population status of principal game species of wildlife on the Installation and the condition of their range.

2. Determination of the adequacy of current habitat development programs for providing the best possible approach toward the management of

se species with the complement of equipment and manpower available.

3. Describe restricted areas and areas available for public access. Areas to be utilized by the public will be commensurate with the Installation objectives.

4. Develop a program of research and further development and management of fish and wildlife resources to include the following:

a. Development and improvement of habitats.

b. Need for and means of accomplishing restoration or restocking of desired species.

c. Need for and means of accomplishing control of plant and animal species.

d. Plan for the protection of endangered and threatened fish and wildlife resources.

5. Areas of the Installation available for the purpose of this program shall be managed so as to protect and preserve the watersheds, the soil, the beneficial forest and timber growth, and vegetative cover, as vital elements of this fish and wildlife program consistent with the military needs of the Installation.

. To achieve the objectives of this agreement, the three participating agencies agree as follows:

A. Army (Fort Riley Military Installation):

1. Will carry out the provisions of the Five-Year Fish and Wildlife Program (See TAB B) insofar as is possible, with available manpower, equipment, and funds. The plan places primary emphasis on:

a. The maintenance of emergency food and cover for the principal game species of wildlife on the Reservation. This is to be accomplished by the planting of trees, shrubs, and compatible food plots for wildlife in those areas where adequate winter food and cover are lacking.

b. The maintenance of lakes and ponds with the physical characteristics that will sustain a harvestable fish population over a number of years.

c. The conducting of annual surveys and census of Installation fish and wildlife.

2. Keep the other two parties to this Agreement fully informed as to the status and progress of the fish and game management activities being carried out on the Installation in the form of an annual written report to these parties

be submitted prior to 1 February of each year.

3. Provide for the enforcement of Installation, State, and Federal fish and game regulations in cooperation with State and Federal enforcement agents after negotiations are completed providing for the access of these agents.

B. The Kansas Fish and Game Commission within the limit of available personnel and funds will:

1. Prepare, with the cooperation of the U.S. Fish and Wildlife, Department of Interior, and submit to the Installation's Fish and Wildlife Section Office, suggestions and recommendations for the improvement of the long range fish and game management now in effect.

2. Furnish technical assistance, when requested, on the implementation of the Installation's Five-Year Plan for Fish and Wildlife Management, particularly as to:

a. Continually reviewing techniques being employed in the wildlife habitat development and fish management portions of the plan in order to offer the Fish and Wildlife Conservation Office constructive suggestions on how these techniques can be improved for the most efficient and effective management.

b. Assist Installation personnel, when requested, in the enforcement . State and Federal fish and game regulations on the Installation, after negotiations have been completed for the access of State agents to the Installation.

3. The Kansas Fish and Game Commission will provide technical advice and assistance when requested to assist in the development practices for new species intended to increase recreational opportunities.

C. The Department of the Interior, U.S. Fish and Wildlife, will within the limit of available funds and personnel:

1. Prepare, with the cooperation of the Kansas Fish and Game Commission, and submit to the Installation Fish and Wildlife Conservation Office suggestions and recommendations for the improvement of the long range fish and wildlife management plans now in effect.

2. Provide technical assistance in matters relative to lake and pond rehabilitation and construction when requested.

3. Furnish fish for stocking in new lakes that are constructed or existing ponds and lakes that are rehabilitated on the Installation. Restocking will be accomplished in accordance with needs as determined by fishery biologists of the participating fish and wildlife agencies. Such creel census information as will be needed by the fishery biologists will be collected by the Installation.

The stocking requirement will be subject to the continued appropriation of funds and the availability of hatchery fish.

IV. Hunting and Fishing on the Installation:

A. Hunting and fishing are considered valuable recreational uses of existing fish and wildlife resources on the Fort Riley Military Reservation. Hunting and fishing on the Installation will be in accordance with State and Federal Laws governing same, and in accordance with further indicated need for protection of any given species as determined by the Fish and Wildlife Conservation Office and the Kansas Fish and Game Commission.

B. Licenses, permits, and fees for hunting and fishing shall be required in accordance with applicable State and Federal laws and military regulation . The possession of a special permit for hunting migratory game birds shall not relieve the permittee of the requirements of the Migratory Bird Hunting Stamp Act as amended. In addition to the above, all military and civilian personnel will be required to have in their possession both a fees-paid Fort Riley Hunting and/or Fishing Permit, and a non-fee daily permit. All fees collected will be utilized appropriated funds in direct support of the Post Fish and Wildlife Conservation Program as recommended by the Fish and Wildlife Conservation Section and approved by the Commanding General.

C. The Cooperative Agreement recognizes the primary mission of the Fort Riley Military Installation to be its military function. The public will be allowed to participate in the harvest of fish and game on the Installation equally with military personnel except where such public participation must be necessarily limited because of military objectives and safety as determined by the Commander of the Installation. Large portions of the Installation acreage is artillery impact area; therefore, it is necessary for civilian personnel to be accompanied by military representatives who will act as their sponsor and be responsible for their actions. Public access to the Installation for the purpose of hunting and fishing will be granted and controlled by the Fish and Wildlife Conservation Section.

V. Use of Off-Road Vehicles:

The use of off-road vehicles in the conduct of management requirements will be authorized when the following type management practices are being performed: surveys, habitat improvement, stocking of lakes and ponds, and when weather and terrain require for hunter control.

VI. This Cooperative Agreement will be in full force and effect upon its adoption; adoption will be indicated by signature below of duly authorized representatives of the three agencies first above named; will remain in full force and effect as long as permitted by the cited authorities under which it is entered. This Agreement may be amended or revised by agreement between all three parties hereto. Any proposed amendment of this plan may originate with any of the participating agencies.

VII. Scope of Assets and Potential: (See TAB A).

VIII. Five-Year Managment Summary: (See TAB B).

APPROVAL AUTHORITY

Deputy Post Commander
Fort Riley, Kansas

Director, Kansas Fish & Game Commission

Regional Director, U.S. Fish & Wildlife Service

SCOPE OF ASSETS AND POTENTIAL - FISH

The fishing potential of existing water areas:

Inventory of fish resources 1979

a. Manageable lakes within the "Old Reservation"

(1)	Beaver Lake	1.7 acres
(2)	Vinton School Lake	1.0 acres
(3)	Break Neck Lake	1.8 acres
(4)	Moon Lake	8.3 acres
(5)	Rimrock Lake	0.8 acres
(6)	Cameron Springs (w/imp)	0.4 acres (1 to 2)

b. Old River Bed Lakes that are manageable

(1)	Marshall	40.0 acres
(2)	Funston	40.0 acres
(3)	Whitside	10.0 acres

c. Farm ponds within the "New Reservation"

(1)	Census count number 157	Surface area varies from 1/10 to 3¼ acres. 73 ponds are less than ½ acre in size; 84 are larger than ½ acre in size.

(2) Manageable farm ponds included in the census count

(a) Cargill Pond

(b) G. W. Pond

(c) Miller Pond

(d) Rushcreek Pond

(e) Williams Pond

(f) Donaho Pond

(g) Foster Pond

(h) Blue Pond

(i) Avery Pond

(j) Stone Pond

(k) Sinn Pond

(l) Sharp Pond

(m) Dahlgren Pond

(n) Roblyer Pond

(o) Jahnke Pond

(p) Beck Pond

d. Rivers/streams of fishing interest (Miles of stream)

(1)	Kansas River (flows through Reservation)	7.0
(2)	Smoky Hill River (borders Reservation)	.8
(3)	Republican River (borders Reservation)	0.5
(4)	Wildcat Creek (flows into and out of Reservation at northeast corner).	6.0 (straight line from point of entry to exit, stream meanders greatly).

e. Milford Reservoir. The Army has control of approximately 6 miles of Milford Reservoir shore line. This includes Madison Creek Cove which is one of the largest coves on the Reservoir.

(1) Principal Game Fish Species

(a) Channel Catfish (Ictaluras punctatus). These fish are well adapted to all types of water on Fort Riley including farm ponds, larger lakes, old river beds and streams.

(b) White Crappie (Pomoxis annularis). White Crappie are found in the Beck Pond, Moon Lake, Funston Lake, and Break Neck Lake. These species will be stocked only as recommended by State of Kansas and Federal Fisheries Biologists. It is anticipated that Milford Reservoir will furnish good White Crappie fishing in the future.

(c) Bluegill (Lepomis macrochirus). These fish are adapted only to ponds and lakes that have relatively clear water. Many of the farm ponds have muddy water and are not suitable habitat for Bluegill. The stocking of Bluegill is normally recommended only in waters suitable for Largemouth Bass; at Fort Riley, this will limit their use to only the larger ponds.

(d) Largemouth Bass (Micropterus salmoides). A good population of Largemouth Bass is present in all the manageable ponds on the "Old Reservation", except Cameron Springs which is being considered for Trout. Several farm ponds on the "New Reservation" have a fair population of Largemouth Bass.

(e) Northern Pike (Esox lucius). Moon Lake contains a fair population of Northern Pike. The Northern Pike present are doing very well.

(f) Bullhead Catfish (Pylodictis olivaris). Most farm ponds on the "New Reservation" contain Bullhead Catfish.

SCOPE OF ASSETS AND POTENTIAL - GAME

1. Inventory of Upland Game Habitat

   a. Total Land Acreage — 101,000 acres

   b. Total Unimproved and Semi-improved — 93,000 acres

      (1) Impact areas and training grounds that cannot be managed for wildlife. — 15,000 acres

      (2) Land available for wildlife conservation and development. — 86,000 acres

2. Population Status of Principal Game Species

   a. Bobwhite Quail (Colinus uriginianus). The Bobwhite Quail population, which normally is at a relatively high level, was severely reduced by the extremely hard winter of 78 and 79. At present, there is no data available from whistle counts or brood surveys to determine status of breeding population.

   b. Ringneck Pheasant (Phasianus colchicus). 1979 hunter success indicates a stable breeding population. Data is not available to determine population density.

   c. Mourning Dove (Zenaidura macroura). The population appears to be very high.

   d. Greater Prairie Chicken (Tympanuchus cupido). A five-fold increase in the number of Greater Prairie Chicken harvested indicates an expanding population. However, as tall grass prairie habitat is lost, prairie chicken numbers are expected to decrease. The Fish and Wildlife Conservation Section intends to re-establish the intensive controlled range burning program to maintain the disclimax of tall grass habitat required by the Greater Prairie Chicken.

   e. Cottontail Rabbits (Sylvilagus floridanus). The habitat continues to support a good huntable population. Actual numbers are not known.

   f. East Fox Squirrel (Sciurus niger). The hunter harvest reports indicate a continued stable Eastern Fox Squirrel population.

   g. Whitetail Deer (Odocoileus uriginianus). The total number is estimated to be between 1000 to 1500. Two years of extensive deer research has shown the Fort Riley deer herd to be extremely healthy.

3. Water Fowl (Migratory). The close proximity of Milford Reservoir and Tuttle Creek Reservoir has aided in the increase of the migratory water fowl

population of the Fort Riley Military Reservation to high levels during the fall of the year. The planting of Japmilet around the farm ponds on the "New Reservation" is planned to hold the water fowl for longer periods. The following species have been sighted on the farm ponds: mallard, pintail, blue-winged teal, green-winged teal.

4. Non-Game. The abundance of diversified habitat on the Fort Riley Military Reservation supports large numbers of non-game species. A species list is being prepared by the Fish and Wildlife Conservation Section.

APPENDIX C

LOG OF FR ACTIVE OUTGRANTS

Source: FR, 1983b.

NO# 2 386.0 RENTAL# $10,345.19

LOG OF ACTIVE OUTGRANTS

170350

INSTALLATION AND LOCATION	DISTRICT	INSPECTION DATE
RILEY FORT KAN	K.C.	30 SEP 1983

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	PER	ACTION REC'MD YES	ACTION REC'MD NO	
LEASE	DACA41-1-81-559	BERGMEIER-SCHURLE LU 23	AGRICULTURE-UNRESTRIC 2,931.0 ACRES	05/15/81	03/31/86	$7,171.50	A			I4
LEASE	DACA41-1-83-567	BUNSER V LU 9	AGRICULTURE-UNRESTRIC 2,750.0 ACRES	06/15/83	03/31/86	$1,500.00	A			I4
LEASE	DACA41-1-83-565	CHAMP E LU 2,2A,3,3A	AGRICULTURE-UNRESTRIC 6,352.0 ACRES	06/15/83	03/31/86	$3,287.00	A			I4
LEASE	DACA41-1-81-566	CHESTNUT H LU F-4,F-4A,F-4B,F-4C, ETC	AGRICULTURE-UNRESTRIC 211.0 ACRES	05/15/81	03/31/86	$4,627.00	A			I1,4
LEASE	DACA41-1-81-567	CHESTNUT H LU F-6,F-6A,F-6B,F-6C, ETC	AGRICULTURE-UNRESTRIC 232.0 ACRES	05/15/81	03/31/86	$4,320.00	A			I1,4
LEASE	DACA41-1-81-568	CHESTNUT H LU F-7,F-7A,F-7B	AGRICULTURE-UNRESTRIC 111.0 ACRES	05/15/81	03/31/86	$1,357.00	A			I1,4
LEASE	DACA41-1-83-566	CHESTNUT H LU F-9,F-9A,F-9B,F-9C	AGRICULTURE-UNRESTRIC 84.0 ACRES	06/15/83	03/31/86	$507.00	A			I4
LEASE	DACA41-1-82-569	CHRONISTER P O LU 7,7B,15	AGRICULTURE-UNRESTRIC 4,778.0 ACRES	05/15/82	03/31/86	$1,600.00	A			I4
LEASE	DACA41-1-83-568	CHRONISTER P O LU 4,4A,4B	AGRICULTURE-UNRESTRIC 4,335.0 ACRES	06/15/83	03/31/86	$1,480.00	A			I4
LEASE	DACA41-1-81-571	EBERT T L LU 17	AGRICULTURE-UNRESTRIC 1,265.0 ACRES	05/15/81	03/31/86	$1,850.00	A			I4
LEASE	DACA41-1-81-572	EBERT T L LU 18	AGRICULTURE-UNRESTRIC 1,910.0 ACRES	05/15/81	03/31/86	$6,850.00	A			I4
LEASE	DACA41-1-81-573	ELKINS R S JR LU F-5,F-5A,F-5B,F-5C, ETC	AGRICULTURE-UNRESTRIC 167.0 ACRES	05/15/81	03/31/86	$2,204.00	A			I1,4

The outgrants listed above have been visually inspected and noted particularly as to maintenance, repair, condition of property, utilization, additions or alterations, and for any unauthorized use, transfer or assignment of interest. The grantees are complying with the terms of the respective instruments in all cases which show no corrective action recommended (cases shown as recommending corrective action, indicate non-compliance in some respects, and a separate report on ENG Form 3131 is attached).

REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
R. F. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

LOG OF ACTIVE OUTGRANTS

170350	INSTALLAT[illegible]D LOCATION: RILEY FORT KAN	DISTRICT: K.C.	INSPECTION DATE: 30 SEP 1983

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	PER	ACTION REC MD YES	ACTION REC MD NO	
LEASE	DACA41-1-81-574	HALL R LU 12,12B,12C	AGRICULTURE-UNRESTRIC 4,396.0 ACRES	05/15/81	03/31/86	$877.00	A			I4
LEASE	DACA41-1-83-576	HALL R C LU 11,11A	AGRICULTURE-UNRESTRIC 1,863.0 ACRES	06/15/83	03/31/86	$305.00	A			I4
LEASE	DACA41-1-83-577	HEIKES D LU 27	AGRICULTURE-UNRESTRIC 1,650.0 ACRES	06/15/83	03/31/86	$752.00	A			I4
LEASE	DACA41-1-81-593	HOLLE R LU F-3,F-3A,F-3B,F-3C,ETC	AGRICULTURE-UNRESTRIC 215.0 ACRES	05/15/81	03/31/86	$4,896.00	A			I1,4
LEASE	DACA41-1-81-575	HULTGREN J LU 1,1A,1B	AGRICULTURE-UNRESTRIC 880.0 ACRES	05/15/81	03/31/86	$8,531.00	A			I1,4
LEASE	DACA41-1-81-578	KUNZE H J LU 26	AGRICULTURE-UNRESTRIC 1,910.0 ACRES	05/15/81	03/31/86	$3,710.00	A			I4
LEASE	DACA41-1-83-569	KUNZE H J LU 14,14A	AGRICULTURE-UNRESTRIC 3,850.0 ACRES	06/15/83	03/31/86	$6,800.00	A			I4
LEASE	DACA41-1-83-578	LARSON V D LU 29	AGRICULTURE-UNRESTRIC 1,360.0 ACRES	06/15/83	03/31/86	$2,610.00	A			I4
LEASE	DACA41-1-82-570	LUTTMAN G LU 31	AGRICULTURE-UNRESTRIC 2,605.0 ACRES	05/15/82	03/31/86	$1,300.00	A			I4
LEASE	DACA41-1-81-579	LYNE L E LU 13,13A	AGRICULTURE-UNRESTRIC 3,600.0 ACRES	05/15/81	03/31/86	$5,050.00	A			I1,4
LEASE	DACA41-1-83-579	LYNE L E LU 24,25	AGRICULTURE-UNRESTRIC 6,020.0 ACRES	06/15/83	03/31/86	$4,200.00	A			I4
LEASE	DACA41-1-81-580	MELLIES D L LU 22	AGRICULTURE-UNRESTRIC 1,040.0 ACRES	05/15/81	03/31/86	$1,585.00	A			I4

The outgrants listed above have been visually inspected and noted particularly as to maintenance, repair, condition of property, utilization, additions or alterations, and for any unauthorized use, transfer or assignment of interest. The grantees are complying with the terms of the respective instruments in all cases which show no corrective action recommended (cases shown as recommending corrective action, indicate noncompliance in some respects, and a separate report on ENG Form 3131 is attached).

REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
B. E. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

LOG OF ACTIVE OUTGRANTS

170350

INSTALLATION AND LOCATION		DISTRICT	INSPECTION DATE
RILEY FORT	KAN	K.C.	30 SEP 1983

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	PER	ACTION REC MD YES	NO	
LEASE	DACA41-1-81-581	MORLAND E L LU 28	AGRICULTURE-UNRESTRIC 1,750.0 ACRES	05/15/81	03/31/86	$2,510.00	A			11,4
LEASE	DACA41-1-81-582	PUETT G D JR LU F-1,F-1A,F-1B,F-1C,F-1D	AGRICULTURE-UNRESTRIC 183.0 ACRES	05/15/81	03/31/86	$3,129.61	A			11,4
LEASE	DACA41-1-81-583	PUETT G D JR LU 5,5A,5B,5C	AGRICULTURE-UNRESTRIC 2,200.0 ACRES	05/15/81	03/31/86	$2,777.62	A			14
LEASE	DACA41-1-83-580	REED L LU 19,20	AGRICULTURE-UNRESTRIC 2,495.0 ACRES	06/15/83	03/31/86	$1,000.00	A			
LEASE	DACA41-1-81-588	SCHURLE D LU 30	AGRICULTURE-UNRESTRIC 1,000.0 ACRES	05/15/81	03/31/86	$1,951.00	A			14
LEASE	DACA41-1-81-560	SCHURLE S LU F-2,F-2A,F-2B,F-2C,F-2D	AGRICULTURE-UNRESTRIC 203.0 ACRES	05/15/81	03/31/86	$3,326.01	A			11,4
LEASE	DACA41-1-81-589	SHEPARD L E LU 8	AGRICULTURE-UNRESTRIC 1,812.0 ACRES	05/15/81	03/31/86	$1,311.00	A			14
LEASE	DACA41-1-81-590	SUMP T A LU 6	AGRICULTURE-UNRESTRIC 2,503.0 ACRES	05/15/81	03/31/86	$1,774.00	A			14
LEASE	DACA41-1-81-592	THOMAS J LU 21	AGRICULTURE-UNRESTRIC 1,261.0 ACRES	05/15/81	03/31/86	$2,261.00	A			14
LEASE	DACA41-1-81-594	WITT J G LU 10	AGRICULTURE-UNRESTRIC 1,260.0 ACRES	05/15/81	03/31/86	$1,320.00	A			14

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REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
R. E. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

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LOG OF ACTIVE OUTGRANTS

INSTALLATION AND LOCATION		DISTRICT	INSPECTION DATE
170350 RILEY FORT	KAN	K.C.	30 SEP 1983

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	PER	ACTION REC'MD YES	ACTION REC'MD NO	
LICENSE	DACA41-3-82-575	AMERICAN RED CROSS OPER+MNTN ADMIN BLDG	OTHER	06/18/82	06/17/87	$1.00	T			13
LEASE	DA-23-028-ENG-3308	ARMY-CAPEHART ARMED SERV HSG PROJ-C-1	HOUSING 82.0 ACRES	10/03/57	10/02/12	$1,000.00	T			13
LEASE	DA-23-028-ENG-4555	ARMY-CAPEHART ARMED SERV HSG PROJ-C-2	HOUSING 21.8 ACRES	03/09/61	03/08/16	$1,000.00	T			13
LEASE	DA-23-028-ENG-4556	ARMY-CAPEHART ARMED SERV HSG PROJ-C-3	HOUSING 30.2 ACRES	03/09/61	03/08/16	$1,000.00	T			13
LEASE	DA-23-028-ENG-4557	ARMY-CAPEHART ARMED SERV HSG PROJ-C-4	HOUSING 35.8 ACRES	03/09/61	03/08/16	$1,000.00	T			13
LEASE	DA-23-028-ENG-4558	ARMY-CAPEHART ARMED SERV HSG PROJ-C-5	HOUSING 40.3 ACRES	03/09/61	03/08/16	$1,000.00	T			13
LEASE	DA-23-028-ENG-4774	ARMY-CAPEHART ARMED SERV HSG PROJ-C-6	HOUSING 32.8 ACRES	03/09/61	03/08/16	$1,000.00	T			13
LEASE	DA-23-028-ENG-4775	ARMY-CAPEHART ARMED SERV HSG PROJ-C-7	HOUSING 32.2 ACRES	03/09/61	03/08/16	$1,000.00	T			13
LEASE	DA-23-028-ENG-4776	ARMY-CAPEHART ARMED SERV HSG PROJ-C-8	HOUSING 30.1 ACRES	03/09/61	03/08/16	$1,000.00	T			13
EASEMENT	DACA41-2-80-639	COMMUNICATIONS SERV R-O-W 18 IN-PLACE POLES	RIGHT OF WAY 0.9 ACRE	11/23/80	11/22/85	$275.00	T			13
LEASE	DACA41-1-80-640	COMMUNICATIONS SERV USE OF 216 GOVT POLES	RIGHT OF WAY	11/23/80	11/22/85	$650.00	A			13
PERMIT	DACA41-4-81-509	DEPT OF EDUCATION USE SCHOOL PURPOSES	EDUCATION 16.1 ACRES	04/14/81	04/13/06					13

The outgrants listed above have been visually inspected and noted particularly as to maintenance, repair, condition of property, utilization, additions or alterations, and for any unauthorized use, transfer or assignment of interest. The grantees are complying with the terms of the respective instruments in all cases which show no corrective action recommended (cases shown as recommending corrective action, indicate noncompliance in some respects, and a separate report on ENG Form 3131 is attached).

REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
H. E. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

ENG FORM 1520

LOG OF ACTIVE OUTGRANTS

INSTALLATION AND LOCATION		DISTRICT	INSPECTION DATE
170350 RILEY FORT	KAN	K.C.	30 SEP 1983

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	RENTAL PER	ACTION REC'MD YES	ACTION REC'MD NO	
PERMIT	DACA41-4-79-665	DEPT OF TRANS INSTL OUTER MKR, BURIED CBL	OTHER	07/26/79	07/25/84					13
PERMIT	DACA41-4-80-635	DOT REMOTE CTR AIR-GROUND FAC	OTHER	11/19/79	11/18/84					13
PERMIT	084-20	EDUC US COMM OF USE LAND FOR SCHOOL PURPOSE	OTHER 11.3 ACRES	12/10/51	INDEF					13
PERMIT	DA-23-028-ENG-3972	EDUCATION COMM HE-W USE LAND FOR SCHOOL PURPOSE	OTHER 11.1 ACRES	09/04/59	INDEF					13
PERMIT	DACA41-4-83-506	FBI USE BLDG 7516 WTR TANK 7515	OTHER	12/26/82	12/25/87					13
LEASE	DA-23-028-ENG-9112	FT RILEY NATL BK CONSTRUCT BANK	OTHER 1.3 ACRES	03/01/67	02/28/03R	$1,560.00	A			13
LEASE	DACA41-1-81-610	FT RILEY NATL BK INSTALL TELLER MACHINE	BANKING	07/10/81	07/09/86	$250.00	T			13
LEASE	DACA41-1-83-502	FT RILEY NATL BK AUTOMATIC TELLER MACHINE	BANKING	03/09/83	03/08/88	$250.00	T			
LICENSE	084-18	GEARY COUNTY COMM CHANGE CHANNEL REPUB RIVER	OTHER	08/24/35	INDEF					13
EASEMENT	084-31	GEARY COUNTY OF R/W CONSTRUCT BRIDGE	RIGHT OF WAY 4.8 ACRES	06/06/58	INDEF					13
EASEMENT	DACA41-2-71-509	GEARY COUNTY OF R/W FOR ROAD OR STREET	RIGHT OF WAY 2.7 ACRES	11/25/70	INDEF					13
PERMIT	084-28	HEALTH EDUC WELFARE USE LAND FOR SCHOOL PURPOSE	OTHER 10.4 ACRES	11/30/56	INDEF					13

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REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
H. E. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

ENG Form 1560

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LOG OF ACTIVE OUTGRANTS

INSTALLATION AND LOCATION	DISTRICT	INSPECTION DATE
170350 RILEY FORT KAN	K.C.	30 SEP 1983

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	RENTAL PER	ACTION REC'MD YES	ACTION REC'MD NO	
LEASE	DACA41-1-81-599	SCHURLE D M USE WATER WELL	OTHER	10/01/81	09/30/86	$100.00	A			13
LICENSE	DACA41-3-81-600	SCHURLE D M OPER+MNTN WATER+ELEC LINE	RIGHT OF WAY	10/01/81	09/30/86	$100.00	A			13
LEASE	DACA41-1-82-572	SOUTHWESTERN BELL USE 14 GOVT POLES	OTHER	06/27/82	06/26/84	$14.00	A			13
EASEMENT	DA-23-028-ENG-5944	SOWESTERN BELL TEL R/W BURIED COMMUN CABLE	RIGHT OF WAY 0.2 ACRE	11/05/62	11/04/12	$52.66	T			13
EASEMENT	DACA41-2-80-638	STWN BELL TELE CO R-O-W 306 IN-PLACE POLES	RIGHT OF WAY 14.3 ACRES	06/27/79	06/26/04	$920.00	A			13
LEASE	DACA41-1-81-500	TELENATL COM INC LEASE OFFICE SPACE	OTHER	11/24/80	11/23/85					13
EASEMENT	DACA41-2-80-586	TELENATL COMM INC CONST,OP + MAINT OVHD CABLE	RIGHT OF WAY	07/01/80	11/23/90					13
LICENSE	D84-7	UNION PACIFIC RR EXTEND 2 TRACKS	RIGHT OF WAY	08/25/02	INDEF					13
EASEMENT	D84-8	UNION PACIFIC RR R/W ACROSS RESERVATION	RIGHT OF WAY	07/26/66	INDEF					13
LICENSE	D84-2	UNION PACIFIC RR CO MAINTAIN SPUR TRACKS	RIGHT OF WAY	11/21/03	INDEF					13
EASEMENT	DACA41-2-80-540	UNITED TEL CO OF KS ROW UNDERGROUND COMMS CABLE	RIGHT OF WAY	06/20/80	06/19/05	$1.00	T			13
EASEMENT	DACA41-2-76-531	UNITED TELCO BURIED+AERIAL CABLE LINE	RIGHT OF WAY 6.7 ACRES	09/19/75	09/18/20	$3,792.00	T			13

The outgrants listed above have been visually inspected and noted particularly as to maintenance, repair, condition of property, utilization, additions or alterations, and for any unauthorized use, transfer or assignment of interest. The grantees are complying with the terms of the respective instruments in all cases which show no corrective action recommended (cases shown as recommending corrective action, indicate non-compliance in some respects, and a separate report on ENG Form 3131 is attached).

REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
H. F. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

LOG OF ACTIVE OUTGRANTS

170350	INSTALLATION AND LOCATION: RILEY FORT	KAN	DISTRICT: K.C.	INSPECTION DATE: 30 SEP 198[illegible]

TYPE INSTRUMENT	CONTRACT NUMBER	GRANTEE	PURPOSE	TERM FROM	TERM TO	RENTAL AMOUNT	RENTAL PER	ACTION REC'MD YES	ACTION REC'MD NO	
LEASE	DACA41-1-76-658	UNITED TELCO OF KS TELEPHONE EXCHANGE BUILDING	OTHER 0.9 ACRE	07/01/76	06/30/26	$1,600.00	A			13
EASEMENT	DACA41-2-81-601	UNITED TELE OF KS INSTALL+USE+MNTN TELE CABLE	RIGHT OF WAY	07/16/81	07/15/06	$1,000.00	T			13
LICENSE	DACA41-3-82-571	UNITED TELEPHONE INSTL+OPER+MNTN PAY TELE	OTHER	06/24/82	06/23/87					13
LICENSE	DA-49-040-ENG-5	WESTERN UNION TELE BLANKET LICENSE - TELE SRVC	OTHER	07/01/62	INDEF					13

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The outgrants listed above have been visually inspected and noted particularly as to maintenance, repair, condition of property, utilization, additions or alterations, and for any unauthorized use, transfer or assignment of interest. The grantees are complying with the terms of the respective instruments in all cases which show no corrective action recommended (cases shown as recommending corrective action, indicate noncompliance in some respects, and a separate report on ENG Form 3131 is attached).

REPORT APPROVED	SIGNATURE OF INSPECTOR	INSPECTED WITH (IF APPLICABLE) NAME	TITLE	TELEPHONE NO
H. E. UPSCHULTE CHIEF, REAL ESTATE DIVISION				

APPENDIX D

INVENTORY OF PESTICIDES STORED ON FR

Table D-1. DFAE Land Management Branch Pesticide Inventory (December 1983)--Bldg. 292

Pesticide	Registration No.	Quantity
Balan	EPA 1471-62-AC	281 kg
Hyvar-X "Bromacil"	EPA 352-287-AA	272 kg
Casoron	EPA 148-614	57 kg
Chemweed-265	EPA 1769-122-AA	26 l
Dacthal W-75	EPA 677-166-AA	45 kg
Dalapon 85	EPA 677-358-ZA	41 kg
2,4-D "Amine"	EPA 39511-64-34704	946 l
2,4-D "Amine"	EPA 2217-633-AA	568 l
2,4-D "Amine" DMA-4	EPA 464-196	8 l
2,4,5-TP "Silvex"	EPA 264-289	53 l
Disodium Methanearsonate 63%	EPA 677-289-AA	45 kg
Embark-25	EPA 7182-7-AA	155 l
Ronstar G	EPA 359-659	907 kg
Round-Up Glyphosate	EPA 524-308-AA	34 l
Simazine 80W	EPA 2749-163-34704	23 kg
Verton-2-D	*	19 l
MH 30T "Malichydrazide"	*	227 l
Bordeaux "Fungicide"	*	4 kg
BP 300 Pyrethins	EPA 4540-1	2 kg
Sevin "Carbaryl" 80%	EPA 264-318	694 kg
Chlordane 72%	EPA 876-63-AA	11 l
Chlordane 46%	EPA 7122-3	4 kg
Chlorobenzilate	Cont. No. 89545 601-403-1	9 l
Diazinon-D-Tox-4E	EPA 551-220	42 l
Diazinon 2% "Powder Form"	EPA 6830-19	175 kg
Dursban 10CR	EPA 464-517	68 kg
Gopher Bait "Mild-Maize"	EPA 8612-97	7 kg
Fungicide Manzate "D"	U.S. Reg. 352-291	5 kg
Methoxychlor 25% E	USDA 5602-86	20 l
Malathion 57%	EPA 551-131	208 l
"Fumigant" Phostoxin	EPA 5857-1	630 tablets
PT-140 Resmethrin	EPA 499-166-AA	82 kg
PT-10 Resmethrin	EPA 499-160-AA	79 kg
Pro-Noxfish "Rotenone"	USDA 432-171	7 kg
Wasp Freeze PT-515	EPA 499-153-ZB	36 kg
Copper Sulfate	*	23 kg
Ferrous Sulfate	*	69 kg
Warfarin Rodenticide Bait	EPA 6830-25	3 kg
Daconil 2787	EPA 677-315-2A	76 l
I.O. Teen Detergent Disinfectant	EPA 267-152	19 l

2,4,5-TP = 2,4,5-trichlorophenoxy propionic acid.
USDA = U.S. Department of Agriculture.

* Label torn or illegible

Sources: FR DFAE, 1983a.
ESE, 1984.

Table D-2. DPCA Golf Course Activity Pesticide Inventory (December 1983)--Bldg. 6424

Pesticide	Registration No.	Quantity
Broad Spectrum Fungicide	EPA 538-27	142 kg
Fungicide II	EPA 538-103	52 kg
Weed Preventitive	EPA 538-26	100 kg
Insecticide III	EPA 538-11	64 kg
Systemic Fungicide	EPA 538-88	45 kg
Algecide	EPA 8959-10	30 l
Tersan-SP	EPA 352-344AA	33 kg
Tersan-LSR	EPA 352-343	4 kg
Dacthal W75 Herbicide	EPA 667-166	18 kg
Tersan 1991	EPA 352-357AA	0.5 kg
Trimec-Liquid	EPA 2217-52926	30 l

Source: FR DPCA, 1983.
ESE, 1984.

APPENDIX E

INVENTORY OF PCB ITEMS STORED ON FR

Table E-1. In-Service PCB-Containing Electrical Equipment Stored on FR

Item	Location	No.	Size	Total Volume PCB Fluid (1)
A. Capacitors	Bldg. 144	3	100 KVAR	11
	Bldg. 153	3	100 KVAR	11
	Bldg. 337	3	100 KVAR	11
	Bldg. 480	9	25 KVAR	15
	MAAF	3	25 KVAR	6
	Parkers Camp Rd.	6	15 KVAR	6
	Bldg. 1691	9	15 KVAR	11
	Bldg. 1904	9	15 KVAR	11
	Bldg. 2488	6	15 KVAR	6
	Bldg. 3039	6	25 KVAR	11
	Bldg. 3201	6	25 KVAR	11
	Bldg. 4020	3	100 KVAR	11
	Bldg. 4660	3	100 KVAR	11
	Bldg. 4845	6	25 KVAR	11
	Bldg. 5712	3	100 KVAR	11
	Bldg. 6577	3	100 KVAR	11
	Bldg. 7086	3	100 KVAR	11
	Bldg. 7175	3	100 KVAR	11
	Bldg. 7520	3	100 KVAR	11
	Bldg. 7602	3	100 KVAR	11
	Bldg. 7612	3	100 KVAR	11
	Bldg. 7780	3	100 KVAR	11
	Bldg. 7808	3	100 KVAR	11
	Bldg. 7848	3	100 KVAR	11
	Bldg. 8130	6	25 KVAR	11
B. Transformers	Bldg. 7404	1	225 KVA	538
	Bldg. 7424	1	225 KVA	538
	Bldg. 7285	1	150 KVA	477
	Bldg. 37	3	100 KVA	386
	Bldg. 485 (3d floor)	1	1,000 KVA	628
	Bldg. 485 (basement)	1	1,500 KVA	795
	Bldg. 485 (basement)	2	750 KVA	3,596
	Bldg. 486	1	1,500 KVA	795

Sources: FR DFAE, 1983e.
ESE, 1984.

Table E-2. Out-of-Service PCB-Containing Electrical Equipment Stored on FR

Item	Quantity	Total Volume of PCB Fluid (1)	PCB Concentration
Capacitors			
100 KVAR	10	38	*
25 KVAR	3	6	*
15 KVAR	1	2	*
Transformers			
25 KVA	1	58	*
Bulk Fluid	3 55-gal drums	625	*

* Concentration believed to be greater than 50 ppm PCBs.

ppm = parts per million.

Sources: FR DFAE, 1983f.
ESE, 1984.

APPENDIX F

INSTRUCTIONS FOR THE DISPOSAL OF FR LOW-LEVEL RADIOACTIVE WASTES

Sources: FR RPO, 1983a.
Headquarters, ARRCOM, 1983.

DEPARTMENT OF THE ARMY Mr. Biela/vlz/AUTOVON
HEADQUARTERS, US ARMY ARMAMENT MATERIEL READINESS COMMAND 793-3980
ROCK ISLAND, ILLINOIS 61299

REPLY TO ATTENTION OF:

DRSMC-DSM (R)

07 NOV 1983

SUBJECT: Disposition Instructions for Radioactive Materiel

Commander
1st Infantry Division (Mech) and Fort Riley
ATTN: AFZN-DPT-C
Fort Riley, KS 66442

1. Reference letter, AFZN-DPT-C, 1st Infantry Division and Fort Riley, 5 Jul 83, subject: Low Level Radioactive Waste Disposal (encl 1).

2. HQ, AMCCOM Control No. 132-83 is assigned to this request. This number <u>must</u> be annotated on <u>all</u> correspondence, forms, and shipping documents.

3. HQ, AMCCOM, has reviewed your request for disposal of low level radioactive waste. The following discrepancies have been found and should be changed:

a. IM174 Dial ... 1.0 microcuries each.

b. Electron tubes ... stock no. 5970-00-801-6865 should be "5960-00-801-6365."

c. Electron tubes ... should be 0.25 microcuries each, not 250mCi. Note: "mCi" is abbreviation for millicuries, and "uCi" is abbreviation for microcuries.

d. AN/PDR27 source ... should be 5 millicuries.

4. The unwanted materiel identified in your request contains sufficient activity to require shipment in one or more "TYPE A" containers. Metal drums such as NSN 8110-00-030-7779 (30 gal) or NSN 8110-00-823-8121 (55 gal) or some other container meeting DOT 7A specifications must be used to package the materiel. Be sure to include sufficient packing materiel to preclude shifting of the contents during transport.

5. Recent changes in DOT Title 49 regulations for shipping radioactive materiel authorize the following limits for "TYPE A" containers. Please observe these limits when packaging your items in one or more "TYPE A" containers.

a. ^{3}H 100 curies

b. ^{226}Ra 50 millicuries

c. ^{60}Co 7 curies

d. ^{147}Pm 20 curies

e. ^{85}Kr 5 curies

6. Carefully monitor each container with a beta-gamma survey meter to obtain the highest reading on the outer surface. Obtain another reading at 1 meter from this point (Transport Index - Round up to nearest tenth of millirem). Separate the containers while taking the measurements to eliminate any possible background errors. Apply a Radioactive Yellow - II label on two opposite sides of each container where the surface readings are above 0.5 millirem per hour or the Transport Index exceeds 1.0 millirem per hour. Apply Radioactive White - I labels on two opposite sides if the surface readings are less than 0.5 millirem per hour and the Transport Index is less than 1.0 millirem per hour. Fill in the required information on the labels concerning contents, no. of curies, and Transport Index. Contact this office (AUTOVON 793-3980 or 793-3383) if further assistance is required.

7. Securely tighten the retainer ring bolt and nut to compress the gasket on each drum. Seal the drum with a security seal to the bolt sufficient to indicate any opening of the drum lid. Mark the exterior of each drum with waterproof grease pencil or stenciled letters on one side with letters at least 1/2-inch high as follows:

a. "TYPE A"

b. "No. _____ OF _____"

c. "WEIGHT = _______ LBS." (If over 110 lbs.)

d. NAME/ADDRESS/PHONE NO. OF CONSIGNEE

e. PROPER SHIPPING NAME (As per Title 49)

8. A copy of the radioactive shipment form attached at enclosure 2 is to be completed. A Bill of Lading and/or DD Form 1348 must also be prepared and contain at least the information described in the guidelines furnished at enclosure 3. Completed copies of these forms must be forwarded with the shipment, and to this office when the shipment is made. Ship the containers to:

Southwest Nuclear Company
7066-A Commerce Circle
Pleasanton, CA 94566

07 ... 1983

DRSMC-DSM (R)
SUBJECT: Disposition Instructions for Radioactive Materiel

The shipment should be made by commercial motor carrier or UPS to comply with NRC/DOT Federal regulations.

9. If the preceding instructions and guidelines are not understood, or cannot be followed explicitly, contact the HQ, AMCCOM Healtn Physicist, Mr. Byron Morris, AUTOVON 793-3383, FTS 367-3383, (309) 794-3383; or the Radioactive Waste Disposal Administrator, Mr. Robert Biela, AUTOVON 793-3980, FTS 367-3980, (309) 794-3980 for assistance. Do not ship extra materiel without a verbal authorization.

FOR THE COMMANDER:

ORIGINAL SIGNED

HERMAN M. BAREN
Chief, Defense Ammo Maint Division

3 Encl
as

CF:
Southwest Nuclear Co., w/encl 1
Pleasanton, CA 94566

3

RILEY-89
RAD

DEPARTMENT OF THE ARMY

HEADQUARTERS 1ST INFANTRY DIVISION (MECH) AND FORT RILEY
FORT RILEY KANSAS 66442

AFZN-DPT-C

5 July 1983

SUBJECT: Low Level Radioactive Waste Disposal

Control Number
132-83

Commander
ARRCOM
ATTN: DARSAR-MAD-AC
Rock Island, Ill 61299

AV 793-
MR BIFLE

1. Request shipping isntructions for disposal of low level radioactive waste.

2. The following is a list of items, source activity, and quantity planned for shipment.

NOMENCLATURE	NSN	SOURCE	ACTIVITY	QUANTITY
COMPASS LENSATIC	6605-00-846-7618	H3	50mCi	15
COMPASS LENSATIC	6605-00-846-7618	H3	75mCi	121
COMPASS LENSATIC	6605-00-846-7618	H3	120mCi	7
COMPASS LENSATIC	6605-00-846-7618	H3	190mCi	160
COMPASS MAG	UNKNOWN	RA226	15uCi	73
IM 174 DIAL	UNKNOWN	RA226	.17uCi	5
ELECTRON TUBES	5970-00-801-6864	Co60	250mCi	23
TUBE	UNKNOWN	Co60	.84mCi	2
TUBE	UNKNOWN	Co60	.250mCi	3
FRONT SIGHT	1005-00-145-6370	PM-147	1mCi	80
LAW SIGHT	Part #9234-291	PM-147	3mCi	800
AN/PDR 27 SOURCE SAMPLE	UNKNOWN	KR85	5uCi	1

3. POC this headquarters is MAJ Beisner, G3/DPT, NBC Divsion, AV 856-2225/2424.

James W Beisner
JAMES W. BEISNER
MAJ, IN
Installation RPO

APPENDIX G

USADWSP DATA FOR FR WELLS

Sources: USAEHA, 1976b, 1978b.

Source No.	Source I.D.
RW 1	Keats Well
TW 1	Main Post Dist System
RW 2	Tank Gunnery Well
TW 2	Funston Dist System
RW 3	Range Control Well
TW 3	Forsyth Dist System
RW 4	Forsyth Well 1
TW 4	Custer Hill Dist System
RW 5	Main Post Well 1
TW 5	Keats Well Dist System
RW 6	Main Post Well 3
TW 6	Range Control Dist System
RW 7	Main Post Well 4
TW 7	Milford Area Dist System
RW 8	Main Post Well 5
RW 9	Main Post Well 6
RW 10	Main Post Well 7
TW 10	Ice Plant, Junction City
RW 11	Forsyth Well 2
RW 12	Funston Well 1 (Inactive)
RW 13	Funston Well 2 (Reserve Only)
RW 14	Funston Well 3 (Inactive)
RW 15	Milford Recreational Area Well

RW = Raw water.

TW = Treated water.

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SOURCE RW01

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.2	< .010	< .0004	.5	.000	< .010	7.7
MEAN	.020	.30	.001	.025	.2	.010	.0004	.5	.000	.010	7.7
MAX	< .020	< .30	< .001	< .025	.2	< .010	< .0004	.5	.000	< .010	7.7
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	1.6	1.9	.0004	.00	.00	.16	< .025	< .1	17.4	< .03	.075
MEAN	1.6	1.9	.0004	.00	.00	.16	.025	.1	17.4	.03	.075
MAX	1.6	1.9	.0004	.00	.00	.16	< .025	< .1	17.4	< .03	.075
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	310.0	7.9	323.0	620.	94.7	.80	24.1	372.0	5.5	18.8
MEAN	5.0	310.0	7.9	323.0	620.	94.7	.80	24.1	372.0	5.5	18.8
MAX	5.0	310.0	7.9	323.0	620.	94.7	.80	24.1	372.0	5.5	18.8
NR OBS	1	1	1	1	1	1	1	1	1	1	1

SOURCE RW02

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	.36	< .001	< .025	.3	.040	< .0004	3.3	.000	< .010	24.6
MEAN	.020	.36	.001	.025	.3	.040	.0004	3.3	.000	.010	24.6
MAX	< .020	.36	< .001	< .025	.3	.040	< .0004	3.3	.000	< .010	24.6
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	2.5	2.7	.0004	.00	.00	.30	< .025	.3	43.6	< .03	1.710
MEAN	2.5	2.7	.0004	.00	.00	.30	.025	.3	43.6	.03	1.710
MAX	2.5	2.7	.0004	.00	.00	.30	< .025	.3	43.6	< .03	1.710
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	329.0	8.6	359.0	730.	81.0	1.50	17.9	449.0	14.9	43.0
MEAN	5.0	329.0	8.6	359.0	730.	81.0	1.50	17.9	449.0	14.9	43.0
MAX	5.0	329.0	8.6	359.0	730.	81.0	1.50	17.9	449.0	14.9	43.0
NR OBS	1	1	1	1	1	1	1	1	1	1	1

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SOURCE RW03

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	.31	< .001	< .025	.2	< .010	< .0004	1.6	.000	< .010	20.1
MEAN	.020	.31	.001	.025	.2	.010	.0004	1.6	.000	.010	20.1
MAX	< .020	.31	< .001	< .025	.2	< .010	< .0004	1.6	.000	< .010	20.1
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	1.4	1.6	.0003	.00	.00	.24	< .025	< .1	32.0	< .03	.552
MEAN	1.4	1.6	.0003	.00	.00	.24	.025	.1	32.0	.03	.552
MAX	1.4	1.6	.0003	.00	.00	.24	< .025	< .1	32.0	< .03	.552
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	356.0	7.9	341.0	680.	82.7	1.10	19.1	395.0	5.2	12.4
MEAN	5.0	356.0	7.9	341.0	680.	82.7	1.10	19.1	395.0	5.2	12.4
MAX	5.0	356.0	7.9	341.0	680.	82.7	1.10	19.1	395.0	5.2	12.4
NR OBS	1	1	1	1	1	1	1	1	1	1	1

SOURCE RW04

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.4	< .005	< .0002	.2	.000	< .010	11.3
MEAN	.025	.31	.001	.025	.4	.021	.0005	.3	.000	.015	15.1
MAX	< .030	.33	< .001	< .025	.4	.049	.0009	.3	.000	< .025	17.1
NR OBS	2	3	3	3	2	3	3	2	0	3	3

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	8.5	.0005	1.40	.70	.15	< .025	< .1	27.1	< .03	< .010
MEAN	7.2	9.8	.0339	1.40	.70	.19	.057	.2	28.1	.03	.015
MAX	13.0	11.0	< .1000	1.40	.70	.22	.120	.3	28.8	< .03	< .020
NR OBS	3	3	3	1	1	2	3	3	3	3	3

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	376.0	7.2	386.0	765.	104.0	4.60	37.4	458.0	5.9	36.[illegible]
MEAN	5.0	377.0	7.5	388.5	770.	108.3	5.27	38.0	476.5	6.1	37.[illegible]
MAX	5.0	378.0	7.9	391.0	775.	113.0	5.70	38.7	495.0	6.4	38.[illegible]
NR OBS	2	2	2	2	2	3	3	2	2	2	2

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SOURCE RW05

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.4	< .005	< .0002	< .0	.000	< .010	16.1
MEAN	.027	.32	.002	.025	.5	.008	.0003	.1	.000	.017	26.1
MAX	< .030	.40	< .005	< .025	.5	< .010	.0004	.1	.000	< .025	33.3
NR OBS	3	4	4	4	3	4	4	3	0	4	4

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	6 .8	< .0003	.00	.00	.12	< .025	< .1	20.5	.15	< .015
MEAN	1.9	6.3	.0503	.00	.00	.21	.025	.1	21.3	.30	.017
MAX	5.4	9.1	< .1000	.00	.00	.28	< .025	< .1	22.0	.59	.020
NR OBS	4	4	4	0	0	3	4	4	4	4	4

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	243.0	7.3	292.0	701.	83.6	2.06	22.5	420.0	21.2	38.7
MEAN	5.0	255.3	7.5	309.7	709.	87.0	5.24	23.5	436.3	25.0	66.8
MAX	5.0	262.0	7.7	328.0	715.	94.0	6.80	25.0	463.0	27.6	81.2
NR OBS	3	3	3	3	3	4	4	3	3	3	3

SOURCE RW06

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.4	< .005	< .0002	< .0	.000	< .010	23.0
MEAN	.020	.30	.002	.025	.5	.007	.0003	.0	.000	.020	37.7
MAX	< .020	< .30	< .005	< .025	.5	< .010	< .0004	< .0	.000	< .025	47.1
NR OBS	2	3	3	3	2	3	3	2	0	3	3

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	11.3	.0005	1.20	.00	< .04	< .025	< .1	15.0	.50	< .015
MEAN	1.8	12.7	.0338	1.70	.00	.11	.025	.1	15.8	.68	.039
MAX	2.6	15.0	< .1000	2.30	.00	.18	< .025	< .1	16.5	.79	.074
NR OBS	3	3	3	3	0	2	3	3	3	3	3

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	185.0	7.6	252.0	684.	61.6	8.70	18.0	415.0	42.0	102.0
MEAN	6.0	188.0	7.8	253.0	697.	66.0	9.50	18.5	430.0	43.2	104.5
MAX	7.0	191.0	8.0	254.0	710.	73.9	11.00	18.9	445.0	44.4	107.0
NR OBS	2	2	2	2	2	3	3	2	2	2	2

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SOURCE RW07

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	< .1	< .005	< .0002	< .0	.000	< .010	20.7
MEAN	.027	.36	1.251	.025	.4	.008	.0003	.1	.000	.017	31.6
MAX	< .030	.50	<5.000	< .025	.6	< .010	.0006	.1	.000	< .025	39.2
NR OBS	3	4	4	4	4	4	4	4	0	4	4

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	9.1	.0003	1.20	.00	.19	< .025	< .1	12.9	.68	< .015
MEAN	3.0	11.1	.0503	1.30	.00	.28	.025	.7	14.7	.87	.017
MAX	5.5	12.1	< .1000	1.40	.00	.50	< .025	2.4	16.3	1.01	< .020
NR OBS	4	4	4	2	0	4	4	4	4	4	4

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	217.0	7.4	260.0	685.	77.9	8.10	16.0	365.0	31.5	76.0
MEAN	11.5	222.2	7.5	275.2	690.	80.6	9.50	24.9	430.7	36.3	80.4
MAX	25.0	228.0	7.6	296.0	700.	86.0	10.70	28.8	479.0	41.7	84.0
NR OBS	4	4	3	4	3	4	4	4	4	4	4

SOURCE RW08

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	< .1	< .005	< .0002	< .0	.000	< .010	43.2
MEAN	.020	.30	.002	.025	.3	.007	.0006	.1	.000	.020	46.7
MAX	< .020	< .30	< .005	< .025	.5	< .010	.0011	.1	.000	< .025	53.0
NR OBS	2	3	3	3	3	3	3	3	0	3	3

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	9.5	.0007	1.20	.00	< .04	< .025	< .1	14.7	.46	< .015
MEAN	2.1	11.4	.0339	1.40	.00	.16	.025	.1	16.2	.60	.017
MAX	4.3	13.5	< .1000	1.60	.00	.30	< .025	< .1	17.9	.70	< .020
NR OBS	3	3	3	2	0	3	3	3	3	3	3

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	190.0	7.7	247.0	676.	68.3	7.60	18.5	429.0	40.8	70.0
MEAN	5.7	206.3	7.8	252.0	678.	73.6	8.97	19.9	453.3	44.7	91.3
MAX	7.0	228.0	7.9	255.0	680.	82.0	10.10	21.8	494.0	49.2	107.0
NR OBS	3	3	2	3	2	3	3	3	3	3	3

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SOURCE RW09

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	< .1	< .005	< .0002	< .0	.000	< .010	16.9
MEAN	.027	.32	.002	.025	.3	.008	.0005	.5	.000	.017	28.3
MAX	< .030	.40	< .005	< .025	.4	< .010	.0011	.8	.000	< .025	37.0
NR OBS	3	4	4	4	4	4	4	4	0	4	4

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	6.7	< .0003	.00	.00	.20	< .025	< .1	21.7	< .03	< .010
MEAN	2.4	7.9	.0504	.00	.00	.22	.025	.1	23.6	.03	.016
MAX	4.0	8.7	< .1000	.00	.00	.26	< .025	< .1	25.7	< .03	< .020
NR OBS	4	4	4	0	0	4	4	4	4	4	4

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	272.0	7.3	324.0	750.	92.4	4.20	17.5	453.0	3.7	53.5
MEAN	6.3	301.2	7.4	361.5	757.	95.6	5.72	23.9	483.2	15.7	69.5
MAX	10.0	324.0	7.5	420.0	771.	97.4	7.00	28.7	529.0	25.2	80.5
NR OBS	4	4	3	4	3	4	4	4	4	4	4

SOURCE RW10

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	< .1	< .005	< .0004	< .0	.000	< .010	17.2
MEAN	.020	.34	.002	.025	.3	.007	.0006	.3	.000	.020	20.4
MAX	<·.020	.36	< .005	< .025	.4	< .010	.0009	.4	.000	< .025	25.0
NR OBS	2	3	3	3	3	3	3	3	0	3	3

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	7.7	.0007	.00	.60	< .04	< .025	< .1	26.2	.04	< .015
MEAN	2.6	8.2	.0338	.00	.60	.15	.025	.1	26.8	.07	.017
MAX	5.4	8.9	< .1000	.00	.60	.22	<'.025	< .1	28.0	.08	< .020
NR OBS	3	3	3	0	1	3	3	3	3	3	3

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	3.0	197.0	7.5	232.0	493.	109.0	5.30	18.5	295.0	11.0	46.0
MEAN	6.0	314.0	7.7	353.7	646.	117.8	6.27	28.7	436.7	11.6	47.7
MAX	10.0	389.0	7.9	450.0	800.	130.5	7.30	33.8	531.0	12.5	49.0
NR OBS	3	3	2	3	2	3	3	3	3	3	3

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SOURCE RW11

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .33	< .001	< .025	.3	< .005	< .0002	.8	.000	< .010	15.1
MEAN	.020	.33	.003	.025	.3	.008	.0003	.8	.000	.017	16.2
MAX	< .020	.34	< .005	< .025	.3	< .010	< .0004	.9	.000	< .025	17.3
NR OBS	2	2	2	2	2	2	2	2	0	2	2

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	1.4	5.1	.0007	.00	.00	< .04	< .025	< .1	31.0	< .03	< .015
MEAN	2.8	5.5	.0010	.00	.00	.12	.025	.1	31.1	.03	.017
MAX	4.3	5.9	.0014	.00	.00	.20	< .025	< .1	31.2	< .03	< .020
NR OBS	2	2	2	0	0	2	2	2	2	2	2

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	.0	300.0	7.4	288.0	567.	106.0	3.47	31.5	337.0	6.1	30.0
MEAN	2.5	343.0	7.6	341.5	671.	179.2	3.73	31 8	405.0	6.5	31.7
MAX	5.0	386.0	7.9	395.0	775.	252.5	4.00	32.2	473.0	6.9	33.3
NR OBS	2	2	2	2	2	2	2	2	2	2	2

SOURCE RW12

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .030	< .30	< .005	< .025	.5	< .005	< .0002	.4	.000	< .025	19 7
MEAN	.030	.30	.005	.025	.5	.005	.0002	.4	.000	.025	19 7
MAX	< .030	< .30	< .005	< .025	.5	< .005	< .0002	.4	.000	< .025	19 7
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	4.6	< .1000	.00	.00	.33	< .025	.9	32.6	.06	.0 8
MEAN	.5	4.6	.1000	.00	.00	.33	.025	.9	32.6	.06	.0 8
MAX	< .5	4.6	< .1000	.00	.00	.33	< .025	.9	32.6	.06	.0 8
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	10.0	353.0	7.2	463.0	942.	101.0	2.60	21.4	584.0	27.8	95.
MEAN	10.0	353.0	7.2	463.0	942.	101.0	2.60	21.4	584.0	27.8	95.
MAX	10.0	353.0	7.2	463.0	942.	101.0	2.60	21.4	584.0	27.8	95.
NR OBS	1	1	1	1	1	1	1	1	1	1	1

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SOURCE RW15

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	.40	< .001	< .025	.2	< .010	< .0004	.4	.000	< .010	33.0
MEAN	.020	.44	.001	.025	.6	.010	.0004	.8	.000	.010	33.3
MAX	< .020	.49	< .001	< .025	1.0	< .010	< .0004	1.3	.000	< .010	33.6
NR OBS	2	2	2	2	2	2	2	2	0	2	2

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	3.2	2.3	< .0003	.00	.00	.16	< .025	< .1	19.1	< .03	.080
MEAN	3.8	5.1	.0003	00	.00	.18	.077	.1	22.5	.07	.765
MAX	4.3	8.0	.0004	.00	.00	.20	.130	< .1	26.0	.11	1.450
NR OBS	2	2	2	0	0	2	2	2	2	2	2

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	247.0	7.6	306.0	688.	78.6	2.00	23.1	425.0	8.9	19.6
MEAN	5.0	301.0	7.6	307.5	706.	83.3	5.45	26.2	452.5	20.7	50.8
MAX	5.0	355.0	7.6	309.0	725.	88.0	8.90	29.3	480.0	32.6	82.0
NR OBS	2	2	2	2	2	2	2	2	2	2	2

SOURCE RW16

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.4	< .010	< .0004	.2	.000	< .010	20.0
MEAN	.020	.30	.001	.025	.4	.010	.0004	.2	.000	.010	20.0
MAX	< .020	< .30	< .001	< .025	.4	< .010	< .0004	.2	.000	< .010	20.0
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .9	1.4	.0003	.00	.00	.21	< .025	< .1	38.9	< .03	.097
MEAN	.9	1.4	.0003	.00	.00	.21	.025	.1	38.9	.03	.097
MAX	< .9	1.4	.0003	.00	.00	.21	< .025	< .1	38.9	< .03	.097
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	336.0	7.6	385.0	785.	91.2	1.70	20.4	503.0	8.4	86.5
MEAN	5.0	336.0	7.6	385.0	785.	91.2	1.70	20.4	503.0	8.4	86.5
MAX	5.0	336.0	7.6	385.0	785.	91.2	1.70	20.4	503.0	8.4	86.5
NR OBS	1	1	1	1	1	1	1	1	1	1	1

420736 FORT RILEY, KANSAS

SOURCE TW01

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.7	< .005	< .0002	< .0	.000	< .010	13.3
MEAN	.023	.30	.003	.025	.8	.006	.0002	.3	.000	.021	23.4
MAX	< .030	< .30	< .005	< .025	1.2	< .010	< .0004	.5	.000	< .025	32.3
NR OBS	3	4	4	4	3	4	4	3	0	4	4

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	1.6	8.1	.0005	1.60	.00	< .04	< .025	< .1	19.5	.03	< .015
MEAN	1.9	9.4	.0503	1.70	.00	.17	.027	.1	21.5	.09	.050
MAX	2.6	10.8	< .1000	1.80	.00	.24	.032	< .1	23.3	.17	.075
NR OBS	4	4	4	2	0	3	4	4	4	4	4

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	3.0	257.0	7.3	308.0	712.	85.8	5.40	26.0	436.0	19.7	60.4
MEAN	4.3	275.7	7.9	326.0	745.	93.3	7.35	26.6	452.0	26.9	70.8
MAX	5.0	289.0	8.6	343.0	780.	96.6	8.40	27.7	479.0	34.0	80.0
NR OBS	3	3	3	3	3	4	4	3	3	3	3

SOURCE TW02

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.7	< .005	< .0002	< .0	.000	< .010	17.5
MEAN	.023	.30	.003	.025	.9	.006	.0002	.1	.000	.022	25.6
MAX	< .030	< .30	< .005	< .025	1.3	< .010	< .0004	.2	.000	.029	30.0
NR OBS	3	4	4	4	3	4	4	3	0	4	4

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .9	6.9	.0004	1.20	.00	< .04	< .025	< .1	17.5	< .03	.015
MEAN	2.5	8.6	.0503	1.20	.00	.16	.025	.1	20.1	.04	.057
MAX	4.3	10.8	< .1000	1.20	.00	.26	< .025	.2	21.3	.06	.181
NR OBS	4	4	4	1	0	3	4	4	4	4	4

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	3.0	247.0	7.3	305.0	687.	83.7	6.40	25.9	427.0	27.0	66.0
MEAN	4.3	267.3	7.8	315.3	717.	89.8	7.62	26.3	446.0	27.7	68.3
MAX	5.0	282.0	8.6	325.0	740.	96.0	8.70	26.9	462.0	29.1	71.0
NR OBS	3	3	3	3	3	4	4	3	3	3	3

420736 FORT RILEY, KANSAS

SOURCE TW03

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.4	< .005	< .0002	.3	.000	< .010	9.7
MEAN	.027	.35	.002	.025	.5	.008	.0003	.4	.000	.017	15.3
MAX	< .030	.50	< .005	< .025	.5	< .010	.0005	.7	.000	< .025	22.1
NR OBS	3	4	4	4	3	4	4	3	0	4	4

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< 1.3	4.9	.0006	1.20	.00	.20	< .025	< .1	12.6	< .03	.038
MEAN	3.2	9.3	.1754	1.20	.00	.26	.025	.1	24.9	.04	.051
MAX	5.1	13.8	< .6000	1.20	.00	.30	< .025	< .1	31.2	.09	.070
NR OBS	4	4	4	1	0	3	4	4	4	4	4

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	346.0	7.3	364.0	747.	87.0	3.80	32.8	462.0	5.5	37.5
MEAN	5.0	362.7	7.4	384.3	770.	102.5	4.62	33.5	476.0	8.1	45.3
MAX	5.0	382.0	7.5	402.0	787.	112.0	6.40	34.5	500.0	12.6	57.0
NR OBS	3	3	3	3	3	4	4	3	3	3	3

SOURCE TW04

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.7	< .010	< .0004	.4	.000	< .010	29.7
MEAN	.020	.30	.001	.025	.7	.010	.0004	.4	.000	.010	29.7
MAX	< .020	< .30	< .001	< .025	.7	< .010	< .0004	.4	.000	< .010	29.7
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	2.2	9.0	< .0003	.00	.00	.20	< .025	< .1	21.6	.04	.039
MEAN	2.2	9.0	.0003	.00	.00	.20	.025	.1	21.6	.04	.039
MAX	2.2	9.0	< .0003	.00	.00	.20	< .025	< .1	21.6	.04	.039
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	277.0	7.9	321.0	745.	92.3	7.90	26.2	469.0	28.1	75.5
MEAN	5.0	277.0	7.9	321.0	745.	92.3	7.90	26.2	469.0	28.1	75.5
MAX	5.0	277.0	7.9	321.0	745.	92.3	7.90	26.2	469.0	28.1	75.5
NR OBS	1	1	1	1	1	1	1	1	1	1	1

420736 FORT RILEY, KANSAS

SOURCE TW06

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	.34	< .001	< .025	.2	< .010	< .0004	1.6	.000	< .010	20.6
MEAN	.020	.34	.001	.025	.2	.010	.0004	1.6	.000	.010	20.6
MAX	< .020	.34	< .001	< .025	.2	< .010	< .0004	1.6	.000	< .010	20.6
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	1.1	< .8	.0004	.00	.00	.20	< .025	< .1	31.8	< .03	.552
MEAN	1.1	.8	.0004	.00	.00	.20	.025	.1	31.8	.03	.552
MAX	1.1	< .8	.0004	.00	.00	.20	< .025	< .1	31.8	< .03	.552
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	357.0	8.6	339.0	688.	85.6	1.10	20.1	404.0	4.6	15.5
MEAN	5.0	357.0	8.6	339.0	688.	85.6	1.10	20.1	404.0	4.6	15.5
MAX	5.0	357.0	8.6	339.0	688.	85.6	1.10	20.1	404.0	4.6	15.5
NR OBS	1	1	1	1	1	1	1	1	1	1	1

SOURCE TW07

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.4	< .010	< .0004	.4	.000	< .010	19.
MEAN	.020	.30	.001	.025	.4	.010	.0004	.4	.000	.010	19.
MAX	< .020	< .30	< .001	< .025	.4	< .010	< .0004	.4	.000	< .010	19.
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	1.1	2.3	< .0003	.00	.00	.19	< .025	< .1	38.7	< .03	.04
MEAN	1.1	2.3	.0003	.00	.00	.19	.025	.1	38.7	.03	.04
MAX	1.1	2.3	< .0003	.00	.00	.19	< .025	< .1	38.7	< .03	.040
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	300.0	8.5	395.0	800.	93.1	1.80	19.1	512.0	6.3	99.0
MEAN	5.0	300.0	8.5	395.0	800.	93.1	1.80	19.1	512.0	6.3	99.0
MAX	5.0	300.0	8.5	395.0	800.	93.1	1.80	19.1	512.0	6.3	99.0
NR OBS	1	1	1	1	1	1	1	1	1	1	1

420736 FORT RILEY, KANSAS

SOURCE TW10

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .020	< .30	< .001	< .025	.8	< .010	< .0002	1.2	.000	< .010	37.9
MEAN	.025	.30	.001	.025	1.0	.010	.0003	1.4	.000	.010	39.7
MAX	< .030	< .30	< .001	< .025	1.2	< .010	< .0004	1.6	.000	< .010	41.5
NR OBS	2	2	2	2	2	2	2	2	0	2	2

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .8	7.4	.0003	.00	.00	.18	< .025	< .1	10.9	< .03	< .020
MEAN	.8	7.4	.0005	.00	.00	.20	.025	.1	11.9	.03	.020
MAX	< .9	7.5	.0007	.00	.00	.21	< .025	< .1	12.9	< .03	< .020
NR OBS	2	2	2	0	0	2	2	2	2	2	2

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	43.5	8.3	106.0	462.	21.3	8.50	15.2	267.0	44.1	77.5
MEAN	5.0	51.4	8.6	113.5	471.	23.9	9.15	15.9	274.0	45.1	87.5
MAX	5.0	59.4	8.9	121.0	480.	26.6	9.80	16.6	281.0	46.1	97.5
NR OBS	1	2	2	2	2	2	2	2	2	2	2

SOURCE TW15

	AS	BA	CD	CR	F	PB	HG	NO3	SE	AG	NA
MIN	< .030	< .30	< .005	< .025	.5	< .005	< .0002	.3	.000	< .025	15.3
MEAN	.030	.30	.005	.025	.5	.005	.0002	.3	.000	.025	15.3
MAX	< .030	< .30	< .005	< .025	.5	< .005	< .0002	.3	.000	< .025	15.3
NR OBS	1	1	1	1	1	1	1	1	0	1	1

	ALPHA	BETA	TRITIUM	90SR	226RA	B	CU	FE	MG	MN	ZN
MIN	< .5	6.6	< .1000	.00	.00	.25	< .025	< .1	29.0	< .03	< .015
MEAN	.5	6.6	.1000	.00	.00	.25	.025	.1	29.0	.03	.015
MAX	< .5	6.6	< .1000	.00	.00	.25	< .025	< .1	29.0	< .03	< .015
NR OBS	1	1	1	0	0	1	1	1	1	1	1

	COLOR	ALK	PH	HARD	SP C	CA	K	SI	TDS	CL	SO4
MIN	5.0	359.0	7.3	385.0	766.	1.2	5.30	32.1	464.0	11.2	39.4
MEAN	5.0	359.0	7.3	385.0	766.	1.2	5.30	32.1	464.0	11.2	39.4
MAX	5.0	359.0	7.3	385.0	766.	1.2	5.30	32.1	464.0	11.2	39.4
NR OBS	1	1	1	1	1	1	1	1	1	1	1

APPENDIX H

PERMIT RENEWAL FOR OPEN BURNING AT FR

Source: KDHE, 1982b.

State of Kansas . . . John Carlin, Governor
DEPARTMENT OF HEALTH AND ENVIRONMENT
Joseph F. Harkins, Secretary
Forbes Field
Topeka, Kansas 66620
913-862-9360

RENEWAL OF OPEN BURNING EXEMPTION
FOR TREES AND BRUSH, 1983

December 27, 1982

Department of the Army
Facilities Engineering
Building 187
Fort Riley, Kansas 66442

Permit No. 385

Gentlemen:

The Department of the Army is hereby granted an extension of the open burning exemption at the permitted landfill.

This exemption is being granted on the basis of recent satisfactory investigation of the site by members of our staff and your past certification that such burning is in the overall public interest (required by Air Quality Regulation 28-19-27(C)).

Open burning is subject to the following conditions:

1. The exemption shall be granted until January 1, 1984.
2. All burning shall be confined to the area designated on the landfill permit.
3. All burning operations shall be carried out under the open burning guidelines Air Pollution Control Regulation 28-19-47(E) (copy attached).
4. That the public's safety and welfare shall not be endangered.
5. This exemption shall be revocable upon thirty (30) days notice at the department's option.
6. Representatives from the department will make frequent inspections of the site to determine the extent of compliance with the guidelines.

It is mutually understood all burning will be initiated at the discretion of and conducted under the direct control of the Department of the Army. In granting this exemption, the Department of Health and Environment or its representatives assume no liability for personal injury or property damage resulting from such burning.

If you have any questions about this letter, please contact our office.

Sincerely yours,

James F. Aiken, Jr.

James F. Aiken, Jr. P.E.
Director of Environment

mw

C Air Quality
District Office

State of Kansas . . . John Carlin, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

Joseph F. Harkins, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360

OPEN BURNING GUIDELINES

a. Nature of Material to be Burned: The burning of heavy smoke producing materials such as heavy oils, tires, tarpaper, etc. is prohibited. The material to be burned should be stockpiled and dried to the extent possible before it is burned. It is also required to be kept free of excess dirt, or other extraneous matter that will inhibit good combustion.

b. Meteorological Conditions: Burning operations shall not be initiated until at least one hour after sunrise. Addition of material to the fire shall be limited to periods at least two hours prior to sunset. Burning shall not be carried out during inclement or foggy conditions or on very cloudy days. Cloudy days will be defined as overcast days (more than 0.7 cloud cover) with a ceiling of less than 2000 feet.

In addition, burning shall be restricted to periods when surface wind speed is more than 5 mph and less than 15 mph, and from a direction which will not carry the smoke over any occupied dwellings or public roadways or any airports within two miles of the burning site.

c. Location: The burning shall be carried out at least 1000 feet from any occupied dwelling or public roadway and at least one mile from any airport.

Conditions of burning within 1000 feet of a roadway which provide potential traffic safety hazards or any other safety hazards must be avoided by appropriate notifications of the Highway Patrol, Sheriff's office or other appropriate authorities.

d. Firebreaks: The burning of vegetation in providing a firebreak in pasture or other crop management may be allowed where necessary during evening or early morning hours in order to take advantage of calm wind conditions.

e. Safety: Burning shall be supervised until the fire is extinguished and must not be in violation of the requirements of any local fire authority having jurisdiction in the area.

(Authorized by K.S.A. 1970 Supp. 65-3005, 65-3006, 65-3007, 65-3010; Effective January 1, 1971; Amended December 27, 1972)

(28-19-47 through 28-19-49 Reserved for future use)

APPENDIX I
ANNUAL KDHE INSPECTION OF FR AIR EMISSION SOURCES

Source: FR DFAE, 1981.

Kansas Air Quality
Annual Emissions
Inventory

Firm Name 1st Inf Div (M) and Fort Riley, Kansas

Mailing Address Director of Facilities Engineering, Building 187

City Fort Riley State Kansas Zip Code 66442

Firm-Plant Location Main Post

City Fort Riley County Geary State Kansas

Normal Operating Schedule: 8 hrs./day; 5 da./wk.; 52 wk./yr.

If we need additional detailed information regarding your operations, who should we contact?

Name Richard D. Carlisle Title Lieutenant Colonel, EN

Location Fort Riley (Building 187) Telephone No. (913) 239-3906

Person completing this form:

Name Charles Harris Title Environ. Protec. Spec Date Jan 26, 1983

Fully complete this questionnaire for the 1982 calendar year and return by February 1, 1983, to:

Bureau of Air Quality
Kansas Department of Health and Environment
Building 740, Forbes Field
Topeka, Kansas 66620

Incineration

Seasonal Operating Percentages:

Jan.-Mar. _____%; Apr.-June _____%; July-Sept. _____%; Oct.-Dec. _____%

Incinerator Information[a]:

Municipal Refuse: Not applicable

Tons of refuse incinerated ______________

Fuel: __________________ million cubic feet (Natural Gas)

__________________ thousand gallons (fuel oil)

__________________ thousand gallons (propane)

Sewage Sludge Incineration: Not applicable

Tons of sludge dried ______________

Fuel: __________________ million cubic feet (Natural Gas)

__________________ thousand gallons (fuel oil)

__________________ thousand gallons (propane)

[a]Complete incinerator method applicable to your operation.

Surface Coating

asonal Operating Percentages:

Jan.-Mar. 20 % Apr.-June 30 % July-Sept. 30 % Oct.-Dec. 20 %

Painting Operations:

Coating Type	Oil-Based Tons/yr. Usage	Water-Based Tons/yr. Usage
Enamel	7.2	
Lacquer	6.	
Primer	0.1	1.1
Varnish/Shellac	0.3	
Paint (General)	14.8	1.2

Thinner (cleaning only) ____________ tons/yr.

Paint Ovens: Not applicable

Fuel: Natural Gas ____________ million cubic feet.

Propane ____________ thousand gallons

Fuel Oil ____________ thousand gallons

Grade of Fuel Oil ________

Sulfur Content of Fuel Oil ________ %

NOTE: The quantity of surface coating reported above is that quantity applied by soldiers and civil servants in the work force at Fort Riley. The quantity of surface coating applied by commercial contract (painting of interiors and exteriors of buildings) has been deleted from this report based on information given by Mr. Terry Denker, KDHE, Jan 25, 1983.

Seasonal Operating Percentages: (see table below)
Ja[illegible] Mar. ____% Apr. - June ____% July - Sept ____% Oct.- Dec. ____%

Fuel Data:

Unit ID	Maximum Heat Input BTU/hr.	Annual Fuel Consumption			
		Natural Gas[a]	Fuel Oil ___[b]	Propane[c]	Coal[d]
CUSTER HILL BOILERS (BUILDING 8073)					
7428	14,700,000		285.5		
7429	14,700,000		285.5		
CAMP WHITSIDE BOILERS (BUILDING 909)					
1	7,205,500	5.7			
2	7,205,500	5.7			
3	7,205,500	5.7			
4	7,205,500	5.7			
MAIN POST (BUILDING 239)					
54481	14,645,000	15.6			
54482	14,645,000	15.6			
IRWIN ARMY HOSPITAL (BUILDING 486)					
19312	69,952,000	111.6	11		

SEASONAL OPERATING PERCENTAGES

BUILDING	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
8073	35%	15%	35%	15%
909	50%	0	0	50%
239	30%	25%	20%	25%
486	35%	15%	35%	15%

Sulfer Content (of Oil) 0.33 % Sulfur Content (of Coal) NA % Ash Content (of Coal) NA %

a Indicate as million cubic feet of natural gas.
b Indicate fuel grade of fuel oil and indicate as thousand gallons of fuel.
c Indicate as thousand gallons of propane.
d Indicate as tons of coal.

APPENDIX J

KDHE COMPLIANCE INSPECTION OF FR AIR EMISSION SOURCES

Source: KDHE, 1982a.

State of Kansas . . . John Carlin, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

Joseph F. Harkins, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360

December 16, 1982

Mr. Jim Day
Facilities Engineering
Bldg. 187
Fort Riley
Fort Riley, Kansas 66442

Dear Mr. Day:

On December 6, 1982, a representative of the Kansas Department of Health and Environment conducted an annual inspection of your military installation, located at Fort Riley, Kansas, to observe whether the facilities were continuing to be operated in compliance with the Kansas air pollution emission control regulations.

The following sources were inspected:

Bldg. #8073 Unit #1 - Mohawk Boiler
Bldg. #909T Unit #2 - Kewanne Boiler
Bldg. #239 Unit #1 - Boiler
Irwin Army Hospital - incinerator (Comtro)
Bldg. #486 Unit #1 - Babcock & Wilcox Boiler
Bldg. #486 Unit #2 - Babcock & Wilcox Boiler

As a result of this inspection, the sources listed above were operating and are considered, at this time, to be in compliance with K.A.R. 28-19-50 Opacity Requirements, K.A.R. 28-19-31 Emission Limitations and K.A.R. 28-19-41 Restriction of Emissions.

During the inspection, the sources listed below were not operating and an evaluation for compliance with K.A.R. 28-19-50 Opacity Requirements, K.A.R. 28-19-31 Emission Limitations and K.A.R. 28-19-41 Restriction of Emissions, could not be made. Should emissions from these sources be observed at a later date to be in excess of the limitations specified by K.A.R. 28-19-50, K.A.R. 28-19-31 and K.A.R. 28-19-41, you will be officially notified of the violation of the regulation and required to make the appropriate correction.

Bldg. #8073 Unit #2 - Mohawk Boiler - Emergency Generator Set
Bldg. #909T Unit #1 - Kewanee Boiler
Bldg. #909T Unit #3 - Kewanee Boiler
Bldg. #909T Unit #4 - Kewanee Boiler
Bldg. #239 Unit #2 - Boiler
Bldg. #486 - Emergency Generator Set
Rock Crushing facility

We would also like to take this opportunity to remind you of other provisions of the regulations that may affect your operations. These are K.A.R. 28-19-11, 28-19-8 and 28-19-14.

A.R. 28-19-11, provides exemption from applicable regulation emission limitations when the limitations are exceeded due to equipment malfunction or scheduled maintenance. Exemption will be considered if the Department is notified in writing within 10 days of such occurrence. Should your facilities be observed in violation of applicable regulations which occurred as a result of equipment malfunction or maintenance, enforcement proceedings would be initiated unless the Department has been notified in accordance with the provisions of K.A.R. 28-19-11.

K.A.R. 28-19-8 Reporting Required and K.A.R. 28-19-14 Review of New or Altered Sources establishes the reporting requirements for the installation of new processing equipment or facility modifications by your firm. The Department is to be notified of any future construction activities 60 days prior to the initiation of such construction. If the Department is not notified prior to the commencement of such activities, enforcement proceedings could be initiated.

Should you have any questions regarding these matters, please contact Vic Montgomery, Environmental Technician at (913)-862-9360 or Gary Miller at the Topeka office (913) 862-9360.

Sincerely,

H. V. Montgomery, Jr.
Environmental Technician
Bureau of Air Quality

HVM/gm

APPENDIX K

ANALYTICAL DATA ON GROUND WATER SAMPLES FROM THE MONITOR WELLS

Table K-1. Summary of Data Files for Ft. Riley Limited Sampling and Analysis

Data File Type	USATHAMA File Name (Level 2)	Comments
Geotechnical Origin File	RYSAGOR84095	Installation location coordinates
Geotechnical Map File	RYSAGMA84138	Monitor well location coordinates
Geotechnical Field Drilling File	RYSAGFD84146	Monitor well construction details and well logs
Geotechnical Ground Water Stabilized File	RYSAGGS84161	Monitor well ground water level data
Chemical Files	RYSACGW84234 RYSACGW84230 RYSACGW84194 RYSACGW84193 RYSACGW84249	Chemical data for monitor wells

Source: ESE, 1984.

ENVIRONMENTAL SCIENCE & ENGINEERING 07/09/84

PROJECT NUMBER 81638591
FIELD GROUP: FTRI1
PARAMETERS: PART SAMPLES: ALL

PROJECT NAME FORT RILEY 1
PROJECT MANAGER: HENDRY
FIELD GROUP LEADER: HENDRY

		SAMPLE NUMBERS							
		MW1	MW1R	MW2	MW3	MW4	MW5	MW6	BLK
PARAMETERS	STORET # / METHOD #	363600	363601	363602	363603	363604	363605	363606	363680
DATE		4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	5/1/84
TIME		645	645	510	610	800	550	530	0
ARSENIC,TOTAL(UG/L)	1002 / 0	<4.0	5.1	6.2	11	15	7.3	17	<4.0
CADMIUM,TOTAL(UG/L)	1027 / 0	<2.9	3.4	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
CHROMIUM,TOTAL(UG/L)	1034 / 0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
IRON,TOTAL(UG/L)	1045 / 0	55	<30	1280	2120	14900	249	7150	<30
COPPER,TOTAL(UG/L)	1042 / 0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.3	<5.0
SILVER,TOTAL(UG/L)	1077 / 0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
MERCURY,TOTAL(UG/L)	71900 / 0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
SELENIUM,TOTAL(UG/L)	1147 / 0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
VANADIUM,T,(UG/L)	1087 / 0	<100	<100	<100	<100	<100	<100	<100	<100
ZINC,TOTAL(UG/L)	1092 / 0	69.0	49.1	29.2	24.2	29.2	29.2	44.2	<15.0
NICKEL,T,(UG/L)	1067 / 0	<7.0	<7.0	7.7	<7.0	<7.0	13	<7.0	<7.0
LEAD,TOTAL(UG/L)	1051 / 0	<13.7	25.1	<13.7	<13.7	<13.7	<13.7	<13.7	<13.7

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PARAMETERS: PART SAMPLES: ALL

PROJECT NAME FORT RILEY 1
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FIELD GROUP LEADER: HENDRY

PARAMETERS	STORET # METHOD #	MW1 363600	MW1R 363601	MW2 363602	MW3 363603	MW4 363604	MW5 363605	MW6 363606	BLK 363680
		SAMPLE NUMBERS							
DATE		4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	5/1/84
TIME		645	645	510	610	800	550	530	0
HYDROCARBONS,PETROL. (MG/L)	99376 0	11.9	5.90	2.99	6.86	2.62	10.6	3.88	
ACROLEIN (UG/L)	34210 0	<5	<5	<5	<5	<5	<5	<5	<5
ACRYLONITRILE (UG/L)	34215 0	<5	<5	<5	<5	<5	<5	<5	<5
BENZENE (UG/L)	34030 0	<1	<1	<1	<1	<1	<1	<1	<1
BROMODICHLOROMETHANE (UG/L)	32101 0	<1	<1	<1	<1	<1	<1	<1	<1
BROMOFORM (UG/L)	32104 0	<1	<1	<1	<1	<1	<1	<1	<1
BROMOMETHANE (UG/L)	34413 0	<1	<1	<1	<1	<1	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102 0	<1	<1	<1	<1	<1	<1	<1	<1
CHLOROBENZENE (UG/L)	34301 0	<5	<5	<5	<5	<5	<5	<5	<5
CHLOROETHANE (UG/L)	34311 0	<1	<1	<1	<1	<1	<1	<1	<1
2-CHL'ETH'VINYLETHER (UG/L)	34576 0	<5	<5	<5	<5	<5	<5	<5	<5
CHLOROFORM (UG/L)	32106 0	<1	<1	<1	<1	<1	<1	<1	<1
CHLOROMETHANE (UG/L)	34418 0	<1	<1	<1	<1	<1	<1	<1	<1
DIBROMOCHLOROMETHANE (UG/L)	34306 0	<1	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHANE (UG/L)	34496 0	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DICHLOROETHANE (UG/L)	34531 0	<1	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHYLENE (UG/L)	34501 0	<1	<1	<1	<1	<1	<1	<1	<1
T-1,2-DICHLOROETHENE (UG/L)	34546 0	1	2	<1	<1	<1	<1	1	<1
1,2-DICHLOROPROPANE (UG/L)	34541 0	<1	<1	<1	<1	<1	<1	<1	<1
CIS-1,3-DICH'PROPENE (UG/L)	34704 0	<1	<1	<1	<1	<1	<1	<1	<1
T-1,3-DICHL'PROPENE (UG/L)	34699 0	<1	<1	<1	<1	<1	<1	<1	<1

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		SAMPLE NUMBERS							
		MW1	MW1R	MW2	MW3	MW4	MW5	MW6	BLK
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DATE		4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	4/27/84	5/1/84
TIME		645	645	510	610	800	550	530	0
T-1,3-DICHL'PROPENE (UG/L)	34699 0	<1	<1	<1	<1	<1	<1	<1	<1
ETHYLBENZENE (UG/L)	34371 0	<5	<5	<5	<5	<5	<5	<5	<5
METHYLENE CHLORIDE (UG/L)	34423 0	2	3	2	3	2	2	3	8
1,1,2,2-TE'CH'ETHANE (UG/L)	34516 0	<5	<5	<5	<5	<5	<5	<5	<5
TETRACHLOROETHENE (UG/L)	34475 0	<5	<5	<5	<5	<5	<5	<5	<5
1,1,1-TRICHL'ETHANE (UG/L)	34506 0	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2-TRICHL'ETHANE (UG/L)	34511 0	<1	<1	<1	<1	<1	<1	<1	<1
TRICHLOROETHENE (UG/L)	39180 0	<1	<1	<1	<1	<1	<1	<1	<1
TOLUENE (UG/L)	34010 0	<1	<1	<1	<1	<1	<1	<1	<1
VINYL CHLORIDE(UG/L)	39175 0	<1	<1	3	4	5	<1	<1	<1

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