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MEMORANDUM FOR COMMANDER, XVIII Airborne Corps and Fort Bragg,

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ATTN: AFZA-PW-EE (Mr. Raheem Lawal), Public
Works Business Center, Fort Bragg, NC 28307-5000

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SUBJECT: RCRA Facility Investigation, Operable Unit 6, Work Plan No. 38-EH-8828-99,
Fort Bragg, North Carolina, March 1999.

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1. Two copies of the subject USACHPPM draft work plan and sampling and analysis plan are enclosed for your review. The Quality Assurance Project Plan will be sent under separate cover.

2. This program will await consolidated comments from your office. Please submit these and any other additional concerns to Ms. Bridgett Lyons, Project Manager, at DSN 584-7846 or (410) 436-7846.

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FOR THE COMMANDER:

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Encl

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JOHN W. BAUER

Program Manager
Ground Water and Solid Waste

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RCRA FACILITY INVESTIGATION OPERABLE UNIT 6
WORK PLAN No. 38-EH-8828-99
FORT BRAGG, NORTH CAROLINA
MARCH 1999

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CONTENTS

Paragraph		Page
I.	REFERENCES	1
II.	AUTHORITY	1
III.	INTRODUCTIONS	1
IV.	PURPOSE	1
V.	RCRA CORRECTIVE ACTION PROCESS	1
VI.	FACILITY DESCRIPTION AND HISTORY	2
	A. Mission and Location	2
	B. Land Use	6
	C. Demography	6
	D. Climate	6
	E. Physiography and Topography	6
	F. Soils	8
	G. Surface Water	8
	H. Regional Geology	8
	I. Regional Hydrogeology	10
VII.	DESCRIPTION OF PREVIOUS INVESTIGATIONS AND CURRENT CONDITIONS AT OPERABLE UNIT 6	12
	A. SWMU 16 – Abandoned Landfill 16	12
	B. SWMU 86 – 659 th Vehicle Maintenance Battery Neutralization Tank	21
	C. SWMU 88 – 659 th Vehicle Maintenance Used Oil Pit	25
	D. AOC C	30
	E. AOC D	32
VIII.	PROJECT MANAGEMENT	32
	A. Project Organization and Responsibilities	32
	B. Project Communications and Report	34
	C. Project Schedule and Deliverables	34
	D. Work Plan Summary	34

Paragraph titles
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subpara-
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Appendices

A - REFERENCES	A-1
B - PLAN LABORATORY DATA SHEETS FOR SWMU 86 AND SWMU 88	B-1
C - SAMPLING AND ANALYSIS PLAN	C-1
D - QUALITY ASSURANCE PROJECT PLAN	D-1

Page numbering – lowercase Roman numerals
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Running header

RCRA Facility Investigation Operable Unit 6 Work Plan No. 38-EH-8828-99, Feb 99

Initial Caps

Figures		Page
1.	SWMUs and AOCs Location Map.....	3
2.	RCRA Decision-Making Process.....	4
3.	Installation Location Map.....	5
4.	Physiographic Location Map.....	7
5.	Drainage Divide Location.....	9
6.	SWMU 16 Location.....	13
7.	Tree Age Delineation Map.....	15
8.	Geophysical Survey Locations.....	18
9.	SWMU 16 Ground-Water Sampling Locations.....	20
10.	SWMU 86 and SWMU 88 Location Map.....	22
11.	SWMU 86 and SWMU 88 Sample Collection Locations.....	23
12.	Photograph of SWMU 88.....	26
13.	Ground-Water Sample Locations SWMU 88.....	28
14.	AOC C Location.....	31
15.	AOC D Location.....	33
C-1.	SWMU 16 Location.....	C-4
C-2.	SWMU 86 and 88.....	C-5
C-3.	Boring /Monitoring Well Installation Log.....	C-6

ALL CAPS

Tables		
1.	SUMMARY OF SAMPLE ANALYSES AT SWUM 16.....	19
2.	GROUND WATER SAMPLES ANALYTICAL RESULTS.....	24
3.	SUMMARY OF SAMPLE ANALYSES AT SWUM 88.....	29
4.	SUMMARY OF SOIL SAMPLE ANALYSES AT SWUM 88.....	30
C-1.	SUMMARY OF FIELD ACTIVITIES.....	C-3

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RCRA FACILITY INVESTIGATION OPERABLE UNIT 6
WORK PLAN No. 38-EH-8828-99
FORT BRAGG, NORTH CAROLINA
MARCH 1999

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- I. **REFERENCES.** See Appendix A for a list of references.
- II. **AUTHORITY.** Telephone conversation between Ms. Joanne Williams, IRP Manager, XVIII Airborne Corps and Fort Bragg and Mr. Wayne Fox, Acting Program Manager, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), 2 September 1998.
- III. **INTRODUCTION.** Fort Bragg, North Carolina, is evaluating past hazardous waste management practices in accordance with the regulations set forth by the Hazardous and Solid Waste Amendments (HSWA) of the Resource Conservation Recovery Act (RCRA). In October 1998, the USACHPPM was contracted by Fort Bragg to prepare and implement this RCRA Facility Investigation (RFI) Work Plan for Operable Unit (OU) 6. OU 6 is comprised of three solid waste management units (SWMUs) and two areas of concern (AOCs). The SWMUs and AOCs are: SWMU 16 (Abandoned Landfill 16), SWMU 86 (659th Vehicle Maintenance Battery Neutralization Tank), SWMU 88 (659th Vehicle Maintenance Used Oil Pit), AOC C (Underground Storage Tank (UST) Fuel Spill), and AOC D (UST Fuel Stain).
- IV. **PURPOSE.** The purpose of this RFI is to confirm the presence or absence of contamination at OU 6 where releases may have occurred. If contamination is present future work will be designed in another Work Plan to determine the extent and degree of contamination at OU 6; to identify and characterize the sources of contamination for OU 6; to assess the potential for contaminant migration to surrounding environments; and to identify public health and environmental risks of any identified contaminants.
- V. **RCRA CORRECTIVE ACTION PROCESS.**
 - A. The RCRA Corrective Action Process consists primarily of the following four steps: the RCRA Facility Assessment (RFA), the RFI, the Corrective Measures Study (CMS), and the Corrective Measures Implementation (CMI). An RFA identifies releases or potential releases of hazardous wastes or constituents. An RFI verifies release(s) and characterizes the nature and extent of contaminant migration. A CMS determines appropriate corrective measures and a CMI designs, constructs, operates, maintains, and monitors the proposed corrective measures.

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RCRA Facility Investigation Operable Unit 6 Work Plan No. 38-EH-8828-99, Feb 99

Tab

B. In 1988, an RFA was completed by A.T. Kearney, Inc., and DPRA, Inc. at Fort Bragg. The RFA identified 31 SWMUs and 7 AOCs at Fort Bragg. Figure 1 provides the locations of the SWMUs and AOCs. A Hazardous Waste Storage Permit in accordance with Section 3004(u) of RCRA, as amended by the HSWA of 1984, was issued to Fort Bragg by Region IV of the U.S. Environmental Protection Agency (EPA) and the North Carolina Department of Environment, Health, and Natural Resources (DEHNR). The permit requires Fort Bragg to conduct RFIs that address the 31 SWMUs and 7 AOCs in accordance with the RCRA corrective action guidelines (reference 1). In April 1998, the U.S. Geological Survey (USGS), North Carolina District, submitted a Draft Work Plan for OU 6 and a Phase 2 Draft Work Plan for Additional Work at OU 6 to Fort Bragg. This Work Plan, if approved, will replace the plans written by the USGS.

C. The USACHPPM will perform data gathering tasks to supplement data collected during the RFA and subsequent investigations in OU 6 to confirm the presence or absence of contamination. USACHPPM tasks will include drilling soil borings, installing monitoring wells, collecting environmental samples, and analyzing the samples. As appropriate, USACHPPM will recommend further investigations or interim corrective measures during RFI activities. Regulatory agencies, the EPA Region IV and DEHNR, in conjunction with Fort Bragg will determine whether further investigations or interim corrective measures are necessary. The decision will be based on the data collected and on established health and environmental assessment criteria. Both the regulatory agencies and Fort Bragg have a responsibility to identify and respond to priority situations that warrant interim corrective measures. Figure 2 illustrates the recommended phased RCRA decision making approach to be followed.

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VI. FACILITY DESCRIPTION AND HISTORY. A more detailed facility description and history of Fort Bragg is contained in the Preliminary Site Inspection for Fort Bragg Military Reservation, Site Inspection Report No. 91040 written by Advanced Sciences, Inc. (reference 3), and the final RFI report for SWMUs 4 and 18, Fort Bragg, North Carolina, November 1998 written by the USGS, North Carolina District (reference 1).

A. Mission and Location. Fort Bragg was established in 1918 as the Army's major logistical, training, and mobilization deployment center for the XVIII Airborne Corps. Fort Bragg is located in south central North Carolina approximately 50 miles southeast of Raleigh in northern Hoke and northwestern Cumberland Counties (see Figure 3). Fayetteville and other towns neighboring the reservation include Southern Pines, Aberdeen, Raeford, and Spring Lake. Pope Air Force base borders Fort Bragg along a portion of its northeastern boundary.

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Figure 1
SWMU and AOC Locations



Figures must appear on the page following the 1st time they are referenced in the report.

3. The Cape Fear Formation consists of pale- to medium-gray clays and sandy clays with some sand units; the lower part contains beds of greenish-gray clays, some of which have red mottling. The uppermost part of the Cape Fear Formation consists of clay and sandy clay ranging in thickness from 10 to 15 feet. The Cape Fear is more clayey, and individual quartz-sand beds are generally thinner and finer-grained than in the Middendorf Formation (reference 1).

4. The Middendorf Formation is exposed at land surface throughout the Fort Bragg area except in areas where it has been eroded. This formation unconformably overlies the Cape Fear Formation. The Middendorf is thickest beneath the upland areas of Fort Bragg and is composed of tan, cross-bedded, medium- and fine-grained, micaceous quartz sand and clayey-sand interbedded with clay or sandy-clay lenses or layers. In areas to the north and west, a basal gravel unit has been described within the Middendorf; however, drilling logs from wells installed throughout the cantonment area indicate a basal sand layer is present at Fort Bragg. Rounded quartzite pebbles as large as 0.5 inch in diameter were present in a clay matrix at several intervals. Layers of hematite-cemented sandstone and thin layers of hard kaolin and kaolin-cemented sandstone occur locally throughout the Middendorf. These units are generally friable or plastic below the water table. In places, the Middendorf Formation is a mottled orange, gray, and tan color with streaks and laminae of red and purple hematite and manganese oxide stains (reference 1).

5. The contact between the Cape Fear and Middendorf Formation in the Fort Bragg area was identified by the USGS. The base of the Middendorf Formation consists of 10-30 feet of coarse- to fine-grained sand and clayey sand. The clayey sand and sandy-clay beds in the upper part of the Middendorf and throughout most of the Cape Fear Formation are thinner and finer grained than the sand unit at the base of the Middendorf Formation. Below the sand unit at the base of the Middendorf is a 5-10 feet thick clay and sandy clay unit that forms the uppermost bed of the Cape Fear Formation. This unit is distinguished from the clays of the lower Middendorf by its compactness. The contact is the sand unit at the base of Middendorf and the thick clay and sandy clay unit at the top of the Cape Fear (reference 1).

I. Regional Hydrogeology.

1. The Fort Bragg area is underlain by three aquifers: the saprolite-basement, the Cape Fear, and the Middendorf aquifers. The North Carolina Department of Natural Resources and Community Development conducted a ground-water study west of Fort Bragg in southern Moore County, in which the Middendorf Formation and Tertiary strata were referred to as the Sand Hills aquifer. In a regional aquifer study of the North Carolina Coastal Plain and in a study of the Southern Pines area, the water-bearing strata of the Middendorf Formation were considered part of the Black Creek aquifer. The major water-bearing strata

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RCRA Facility Investigation Operable Unit 6 Work Plan No. 38-EH-8828-99, Feb 99

associated with this aquifer at Fort Bragg are part of the Middendorf Formation, and for purposes of reports prepared by the USGS for Fort Bragg are referred to as the Middendorf aquifer. For consistency, USACHPPM will use the same nomenclature as the USGS.

2. The saprolite-basement aquifer is composed of saprolite underlying the Cape Fear Formation and fracture zones in the uppermost part of the basement formation. The depth to basement rock ranges from 140 feet below ground surface (bgs) in low-lying parts of the cantonment area to 300 feet bgs or greater in the central and western parts of Fort Bragg. The saprolite-basement aquifer is generally assumed to yield little water, and no supply wells in this area are known to solely tap this aquifer (reference 3).

3. The Cape Fear aquifer is confined and composed of the Cape Fear Formation, primarily clay interbedded with silt and silty sand. The uppermost 5-10 feet of the Cape Fear Formation in the Fort Bragg area is composed of clay and sandy clay and forms the Cape Fear confining unit. This confining unit restricts vertical movement of water between the overlying sediments and the silty-sand units of the Cape Fear aquifer. Because of the thickness of the clay units within the Cape Fear Formation, sandy clay units within the Formation may act as hydraulically isolated systems within the lower part of the Cape Fear aquifer. In counties east of Fort Bragg, the Cape Fear aquifer is used for public and industrial supplies (reference 1).

4. The Middendorf aquifer primarily consists of coarse- to fine-grained silty or clayey sands with interbedded light-gray to tan clays. In the Sand Hills area, some of the interbedded and discontinuous clay layers in the Middendorf Formation support local perched water zones. At Fort Bragg perched water zones are generally within 20 feet of land surface, unconfined, and typically only a few feet thick. Many of the perched water zones dry out during the growing season.

5. Ground water in the lower part of the Middendorf aquifer commonly is under confined or semiconfined conditions, as determined by interbedded clay layers; whereas, ground water in the upper part of the Middendorf aquifer is under unconfined conditions. Although the potentiometric surface in the lower part of the aquifer is as much as 80 feet bgs in upland areas of Fort Bragg, it is near ground surface along perennial streams, which are discharge areas for the Middendorf aquifer.

6. The sandy soils of Fort Bragg and the Sand Hills hydrologic area are leached beds of the Middendorf Formation. These sands are highly permeable and allow rapid infiltration of precipitation. Precipitation is the primary source of ground-water recharge (reference 1).

5. Recommendation of Work at SWMU 16.

a. The USGS determined the location but not the extent of the construction/demolition debris disposal area. This was done through interviews, a tree dating study, and field observations. Interviews between an employee of Fort Bragg and USACHPPM personnel also indicate that construction debris was placed in a borrow pit area on a one-time basis at SWUM 16 (reference 13). Based on the information collected to date, there is no reason to suspect that hazardous waste was disposed of in the SWMU 16 area.

b. Additional interviews with individuals, who have a knowledge of the landfilling activities at the SWMU, should also be conducted to verify SWMU 16 was used only for the disposal of demolition (building) debris for a limited time.

c. Determining the extent of the debris is not recommended unless a release to the environment is confirmed.

d. Ground-water quality data has not been collected at SWMU 16. To verify there has not been a release to the environment at SWMU 16, USACHPPM recommends that ground water samples be collected. The samples will be analyzed for parameters that the North Carolina DEHNR, Division of Waste Management requires for construction and demolition landfills and closed sanitary landfills. The parameters are total metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and volatile organic compounds (VOCs). Five wells should be installed in the uppermost aquifer at SWMU 16. Four wells will be sampled, one upgradient and three downgradient. The fifth well (Well MW2 on Figure 9) will be installed to obtain ground-water elevation data only. Well installation and sample collection and handling procedures are described in the Sampling Plan included as Appendix C. Quality assurance/quality control (QA/QC) samples will also be collected. Table 1 is a summary of samples to be collected.

TABLE 1. SUMMARY OF SAMPLE ANALYSES AT SWUM 16.

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Sample Type	Quantity	Volatiles Method 8260	Total Metals
Upgradient	1	X	X
Downgradient	3	X	X
Replicate	1	X	X
Trip blank	1	X	--
Field blank	1	X	X
Equipment Rinse Blank	1	X	X

X Analysis will be performed.

-- Analysis will not be performed.

APPENDIX A

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REFERENCES

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1. RCRA Facility Investigation at Solid Waste Management Units 4 and 18, Fort Bragg Installation Restoration Program, Fort Bragg, North Carolina, Volume 1, Final Report, November 1998.
2. Internet Site WWW.hqda.army.mil/acsim/99-gcd/bragg.htm. Fort Bragg, XL Airborne Corps & Fort Bragg, maintained by Fort Bragg, North Carolina Garrison Commander.
3. Preliminary Site Inspection for Fort Bragg Military Reservation, Site Inspection Report No. 91040 Final, prepared for U.S. Army Corps of Engineers Toxics and Hazardous Materials Agency, Contract No. DAAA15-90-D-0001, Task 9, prepared by Advanced Sciences, Inc., June 1992.
4. Draft Work Plan for the Field Investigation for the Corrective Measures Study and Remedial Design for Operable Unit 3: SWMU 8, SWMU 9, and SWMUs 2 and 14 at Fort Bragg, North Carolina, Contract Number DACA21-95-D-0022, U.S. Army Corps of Engineers, Savannah District, prepared by SAIC Engineering of North Carolina, Inc., October 1998.
5. Internet Site www.census.gov/population/estimates. Population Estimates Program, Population Division, U.S. Bureau of the Census, Washington, D.C.
6. Soil Survey of Cumberland and Hoke Counties North Carolina, U.S. Department of Agriculture, Soil Conservation Survey, October 1984.
7. Fort Bragg – 1998 Installation Action Plan, March 1998.
8. Draft Work Plan for Operable Unit 6, RFI Fort Bragg, North Carolina, U.S. Geological Survey, North Carolina District, April 1998.
9. Memorandum, USAEHA, HSHB-ME-SG, 15 March 1988, subject: Geohydrologic Study No. 38-26-0840-88, Fort Bragg, North Carolina, U.S. Army Environmental Hygiene Agency, 24 August - 1 September and 5-7 October 1987.
10. Attachment 1 to Data Transmittal for Operable Unit 6, from USGS, North Carolina District to XVIII Airborne Corps and Fort Bragg, 14 October 1998.

A-1

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APPENDIX C

FIELD METHODOLOGY
SAMPLING AND ANALYSIS PLAN

I. Introduction. In 1998, the U.S. Army Center for Health Promotion and Preventive Medicine was contracted by Fort Bragg to complete a RCRA Facility Investigation (RFI) at Operable Unit (OU) 6. Three solid waste management units (SWMUs) and two areas of concern (AOCs) are included in OU 6. Based on data collected from various sources, the RFI Work Plan for OU 6 recommended further work at two SWMUs only; SWMU 16 and SWMU 88.

II. Purpose. The proposed work at SWMU 16 and SWMU 88 is discussed in the following sections and summarized in Table C-1. The total of fieldwork proposed for the SWMUs is subject to the limits established in the Work Plan. If work other than that listed in the Work Plan is required, this Sampling Plan will be amended. Five ground-water monitoring wells will be installed at SWMU 16 and four monitoring wells will be installed at SWMU 88. The approximate well locations for SWMU 16 and SWMU 88 are shown on Figure C-1 and Figure C-2, respectively.

III. Sampling Procedures/Methodologies. This section discusses sampling procedures and methodologies. The methods that will be utilized in conducting the RFI effort include soil borings, constructing monitoring wells, ground-water sampling, and aquifer testing. Decontamination procedures and measurements of other physical site characteristics are also discussed, as well as sample handling and chain-of-custody procedures.

A. Soil Boring and Monitoring Well Installation.

1. Soil Borings (Hollow Stem Auger Method).

a. Soil borings will be advanced using continuous flight, 4-1/4 inch inside diameter (ID), or 6-1/4 inch ID hollow-stem augers. Soil samples will be collected on 5-foot centers for lithologic description using a stainless steel split-spoon sampler. Select samples from SWMU 88 will be collected for chemical analysis. A lithologic log will be prepared for each boring using the Unified Soil Classification System (USCS) as a guideline for consistent soil descriptions. Soils will be classified with respect to type, grain size, mineralogy (when pertinent), color, etc. Moisture content will be documented in terms of dry, damp, moist, or saturated. An example of the type of field boring log that will be used to record lithologic and other data is shown on Figure C-3. Air monitoring will be performed during drilling and readings will be documented. Air monitoring information is provided in the Site Health and Safety Plan. Cuttings will be placed on plastic near each drilling location for disposal by Fort Bragg. The back of the drill rig will be decontaminated between SWMUs.