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Site Name (Subject):	USA RESERVE XVIII AIRBORNE CORPS
Site ID (Document ID):	NC5210022906
Document Name (DocType):	Preliminary Assessment/Site Inspection (PA/SI)
Report Segment:	
Description:	Preliminary Assessment II (PA II)
Date of Document:	6/28/2006
Date Received:	
Box: *Enter SF and # with no spaces*	SF10,639
Access Level:	PUBLIC
Division:	WASTE MANAGEMENT
Section:	SUPERFUND
Program (Document Group):	SERB (SERB)
Document Category:	FACILITY

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NCDENR

North Carolina Department of Environment and Natural Resources

Dexter R. Matthews, Director | Division of Waste Management | Michael F. Easley, Governor
William G. Ross Jr., Secretary

June 28, 2006

Ms. Donna Webster
Superfund Site Evaluation Section
US EPA Region IV Waste Division
61 Forsyth Street SW, 11th Floor
Atlanta, GA 30303

Subject: Preliminary Assessment II (PA II)
USA Reserve XVIII Airborne Corps.-Morehead City
Morehead City, Carteret County, NC
US EPA ID: NC5 210 022 906

Dear Ms. Wendel:

Enclosed is the Preliminary Assessment II (PA II), completed by the North Carolina Department of Environment and Natural Resources (NCDENR), Superfund Section for the USA Reserve XVIII Airborne Corps Site located just east of downtown Morehead City alongside Calico Creek, Carteret County, NC. The NC Superfund Section recommends that this site be assigned a No Further Remedial Action Planned status under CERCLIS.

Under the authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the North Carolina Superfund Section conducted this PA II to evaluate updated data regarding environmental conditions at the site in order to determine the need for any further CERCLA action. Information about the site was obtained through the review of available file documents and interviews with US Army personnel and contractors who manage the site.

The USA Reserve XVIII Airborne Corps Site in Morehead City, NC is located on 405 Fisher Street, Morehead City, NC 28557. This location is at the eastern end of the peninsula that contains Morehead City and is east of the central business district of downtown Morehead City. The site is on the north side of Fisher Street inside the northeast intersection with 5th Street (Ref. 2). The northern and eastern edge of the site borders Calico Creek. Corresponding geographic coordinates for the facility are 34.72276 north latitude and 76.70668 west longitude (Ref. 1).

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This site consists of a 5-acre parcel with an approximate 16,000 square foot training and assembly building, and a 13,000 square foot maintenance shop that have been constructed in early nineties (Refs. 2;3). The site's storm water detention pond is located between 4th Street and Calico Creek (Ref. 2). The surrounding area to the west and south is a predominantly residential property. Calico Creek borders its northern and eastern perimeter. A marina lies beyond the southeastern end of the site (Ref. 1).

This property has been associated with industrial activities for the past 150 years. Reportedly, this property supported a saw mill operation during the Civil War. At a later period, it served as a shipbuilding operation. Since at least 1940, it has supported a ship refurbishing/sandblasting operation (Ref. 4). This center houses and maintains the 824th Heavy Boat Transportation Company whose mission is to transport personnel and cargo from offshore discharge operations. These landing crafts range from about 140 to 170 feet long (Ref. 3).

Over the years there has been considerable fill material added to expand the site towards Calico Creek and to elevate its grade (Ref. 5). The spent sand from sandblasting operations and channel dredge sediments were also part of this added fill. Sawdust and sand comprise the lower portion of the fill zone. Creosote timbers and construction debris consisting of brick and concrete fragments and sand comprise the mid to upper portion of fill material. The site's eastern two thirds of its area has a one foot thick layer of black sand presumed to originate from sand blasting material (Ref. 6). The fill sand from sandblasting operations has contaminated the site with heavy metals such as arsenic, lead, mercury and chromium. Poor handling of craft fuel (Fuel Oil #2) presumably led to several spills since the site has many areas of diesel range petroleum contamination. This fuel oil is blended with creosote when used as a wood preservative. Thus, the elevated total petroleum hydrocarbons (TPH) levels may also be associated with buried creosote timbers that had been used for the old seawall and to reinforce other building structures (Ref. 6).

No known major spills were reported for this center. This center uses city water and city sewers (Ref. 7). A Preliminary Assessment was completed in August of 1990 (Ref. 8). A request for updated information was submitted by EPA in order to complete the revised Hazard Ranking System in August of 1991 (Ref. 9). This PA II is intended to serve as the response to that request.

Documents regarding the site's regulatory history were found dating back to about 1985. This center is classified as a conditionally exempt small quantity generator by the NC Hazardous Waste Section. All spent petroleum products are temporarily stored on the premises and are removed by a commercial contractor and transported off-site for reclamation. This center is periodically inspected by a contractor of the Department of the Army to insure compliance with the military's Environmental Regulation regarding the storage and proper disposal of hazardous waste (Ref. 7).

Two 550-gallon heating oil underground storage tanks were removed in 1993. They were located on the south side of Fisher Street. No soil or groundwater contamination was detected from these two tanks (Ref. 4,p. 2). A Notice of Violation was issued by the NC Department of Environment and Natural Resources in October of 1994 based on an observation of sheen seen on the storm water detention pond. Samples were obtained in December 1994 from the pond's excavated soil and from around the construction of the current buildings. Only lead at levels over 100 ppm and Oil and Grease up to 3,000 ppm were detected (Ref. 10). This led to a series of sampling events (starting June 1995) that resulted in the preparation of a Corrective Action Plan of March 1997 (Ref. 6). This plan utilized natural attenuation and mandated the quarterly monitoring of groundwater which terminated in 2004 following consistent absence of any detected constituents (Ref. 11).

Soil Evaluation

About 105 soil borings that covered the entire site were collected in January of 1996 following the excavation of creosote timbers and soils (Ref. 2). Twenty shallow temporary monitoring wells were also sampled. This resulted in five soil stockpiles and two 100-foot long excavated trenches. Elevated soil lead levels were detected throughout the site, while elevated chromium, arsenic, and mercury were more sporadic (Refs. 2:10). Elevated oil and grease (O&G) levels (25-31,000 ppm) and TPH levels (diesel range) ranging from 12 to 11,000 ppm were found in soils along the old seawall and throughout three quarters of the site. Most of the TPH levels ranged below 100 ppm. (Ref. 10) Many of the O&G levels ranged from 200 to 300 ppm. These areas from which soil borings were obtained are presumed to be still intact today. There are construction plans for future expansion of the wharves that will result in removal of some of this soil (Ref. 2).

The four tables displayed below show the residual metals in soils from the 1996 sampling event. Since on-site soil metal background locations could not confidently be located, backgrounds from two nearby sites (NC Maritime Museum Site and the Buxton Landfill Site) were used (Ref. 12). The average NC stream-sediment geochemical data from the National Uranium Resource Evaluation were also used for metal backgrounds (Ref. 13).

Table 1. Residual Lead from Soil Boring Samples of 1996 (mg/Kg=PPM)

Sample ID	B1-F12 J20-K9	F14, G13, G17, I17, J16, K11, L18, M19	G11 I15 J14	J10	M21	Federal Region 9 PRGs+	NC SRG **	Detection Limit	Presumed Background
Lead Levels	30-100	100-300	300-390	667	**1760**	800	400	1.0	11
Depth Interval (feet)	0-4.6 0-7.1	0-7.5 0-10	0-5.6	0.5-1.0	3-6.7				

Bold values indicated levels above remediation guidelines. + =Region 9 Preliminary Remediation Goals for Industrial Soil. **= NC Inactive Hazardous Sites Soil Remediation Goal. ca= Cancer-based PRG. n or nc=Noncancer-based PRG.

Table 2. Residuals Mercury from Soil borings Samples of 1996 (mg/Kg=PPM)

Sample ID	D10, F14, H12, N16, K19 L22	G11, M17 L18	F10B	Federal Region 9 PRGs+	NC SRG**	Detection Limit	Presumed Background
Mercury	0.6-1.0	2.0-3.6	4.4	310nc	4.6n	0.113	0.2-0.3
Depth Interval (feet)	0-8.5	0-10	4-5				

Bold values indicated levels above remediation guidelines. + =Region 9 Preliminary Remediation Goals for Industrial Soil. **= NC Inactive Hazardous Sites Soil Remediation Goal. ca= Cancer-based PRG. n or nc=Noncancer-based PRG.

Table 3. Residuals Chromium from Soil borings Samples of 1996 (mg/Kg=PPM)

Sample ID	K11, L18-L20, N2	O3	L22	J10	Federal Region 9 PRGs+	NC SRG**	Detection Limit	Presumed Background
Chromium	30-40	65	78	398	450ca	24,000	1.0	12
Depth Interval (feet)	0-4.5 0-10	0-5.5	0.6-6.0	0.5-1.0				

Bold values indicated levels above remediation guidelines. + =Region 9 Preliminary Remediation Goals for Industrial Soil. **= NC Inactive Hazardous Sites Soil Remediation Goal. ca= Cancer-based PRG. n or nc=Noncancer-based PRG.

Table 4. Residuals Arsenic from Soil borings Samples of 1996 (mg/Kg=PPM)

Sample ID	D12, D18 F14-16, G17, I17-19	M21 N18	F6b	J12	K21	Federal Region 9 PRGs+	NC SRG**	Detect-ion Limit	Presumed Background
Arsenic	**7-10**	**10-11**	**12.8**	**23**	**49**	1.6ca	4.4 nc	1.16	2 - 4
Depth Interval (feet)	0-6.2 0-8	0.3-2.0	8-11	0-5	0-8.8				

Bold values indicated levels above remediation guidelines. + =Region 9 Preliminary Remediation Goals for Industrial Soil. **= NC Inactive Hazardous Sites Soil Remediation Goal. ca= Cancer-based PRG. n or nc=Noncancer-based PRG.

As Tables 1 and 4 illustrate, one lead location and several arsenic locations have metals that are above the remediation guidelines. Naturally occurring background arsenic levels in NC can vary from 4 to 50 ppm depending on the geology. Therefore, the guidelines may often be exceeded by the natural background levels. At this site, these borings may have elevated arsenic due to the paint chip residue. TCLP testing for all these metals indicated that any minor leaching was far below regulatory levels (Ref. 6, Table 4; Ref. 10,p. 25).

Volatile and semi-volatile organic compounds were found in only 8 soil borings (D12, F18, I15D, I19, L22, M15, O17 and P20). Seven of these borings contained varying mixtures of polycyclic aromatic hydrocarbons (PAHs) that ranged from 1 to 15 ppm (phenanthrene) (Ref. 10,Table 2, p. 69). PAHs are related to diesel fuels and creosote. Two borings had low levels (<180 ppb) of butylbenzene and propylbenzene (related to petroleum compounds). One boring had dichlorobenzene and chlorobenzene (both < 30ppb) that are non-petroleum constituents (Ref. 10,p. 13). No pentachlorophenol was found in soil.

Of the 3,000 cubic yards of soil that were excavated, 13,000 tons were transported off site. The non-contaminated soil was used to backfill the two excavated areas (Ref. 4). There are plans in the future to add additional wharves and to dredge the sediments near the bulkhead to accommodate more ships. Soil will be excavated from both sides of the center wharf and stockpiled to await off-site disposal (Ref. 2).

Groundwater Evaluation

Because the site's proximity to Calico Creek, the tidally-influenced water table is about 2 feet below land surface (bls). Initially, groundwater samples collected from 20 temporary wells installed throughout the site revealed elevated levels of all the four metals that were previously detected in the soils. Elevated PAHs occurred in eight of these temporary wells (notably in samples M19, N20, and M21) (Ref. 6). The maximum metal levels ranged up to about 50 ppb for arsenic and chromium, while lead ranged to 490 ppb and mercury to 6 ppb. Elevated PAHs ranged from 10-40 ppb. Isopropyltoluene and propylbenzene values were less than 190 ppb. Pentachlorophenol was found only in sample J16 at 160 ppb (Ref. 10).

It was suspected that the temporary wells yielded elevated levels of metals and PAHs due to sampling-induced turbidity (Ref. 6,p. 10). Therefore four additional shallow permanent monitoring wells (MW-3 to MW-6) were installed in December of 1996 (Ref. 2;Ref. 6,p. 7). MW 1 and 2 had been installed in 1995 adjacent to the northern perimeter of the storm water detention pond (Ref. 2). AAll of these six monitoring wells were screened from about 1.5 to 11 feet below grade (Ref. 6,p. 19). Analytical results from these wells initially (in 1996 and 1997) revealed elevated lead and arsenic (in MW-1) and some volatiles (mostly in MW-4). Tables 5 through 10 below summarize the analytes detected. However, periodic monitoring over the subsequent years indicated that any detectable analytes were following a declining trend. When two sampling events failed to detect an analyte, subsequent testing for that analyte was abandoned. The final sampling event for these six monitoring wells was in April of 2004. The analytical results for volatiles and semi-volatiles failed to detect any of these compounds in all six wells (Ref. 11). Analyzing for metals had ceased by November of 2000. Based on these results, a No Further Action status was granted in June 2004 by the NC Aquifer Protection Section (Ref. 14).

Table 5
Monitoring Well #1 Contaminant Levels from 1996 thru 2004. Units = ug/liter (ppb)

Analyte	Dec. 1996	Jan. 1997	Nov 2000	April 2004	Federal Region 9 PRGs+	NC 2L Standards++
Arsenic	12	15	NA	NA	0.045 ca	50
Lead	**16.5**	<3.0	32	NA	NS	15
Mercury	<0.2	<0.2	NA	NA	110	1.05
Bis(2-ethylhexyl)phthalate	<10	61	<10	<11	4.8 ca	2.5
Carbon Disulfied	220	59	<5.0	NA	1000 nc	700

+= Region 9 Preliminary Remediation Goals (Tap Water). ca = Cancer-based PRG. nc = Noncancer-based PRG. NA= Not analyzed. NS = No standard.++ = NC Aquifer Protection Section 2L Standards. Bold values indicate data exceeding the guidelines.

Table 6
Monitoring Well #2 Contaminant Levels from 1996 thru 2004. Units = ug/liter (ppb)

Analyte	Dec. 1996	Jan. 1997	Nov 2000**	April 2004	Federal Region 9 PRGs+	NC 2L Standards++
Arsenic	<10	<10	**	NA	0.045 ca	50
Lead	< 3.0	<3.0	**	NA	NS	15
Mercury	<0.2	<0.2	**	NA	110	1.05
Carbon Disulfied	87	80	**	NA	1000nc	700

+= Region 9 Preliminary Remediation Goals (Tap Water). ca = Cancer-based PRG. nc = Noncancer-based PRG. NA= Not analyzed. NS = No standard.++ = NC Aquifer Protection Section 2L Standards. ** Monitoring Well #2 was not sampled in 2000.

Table 7
Monitoring Well #3 Contaminant Levels from 1996 thru 2004. Units = ug/liter (ppb)

Analyte	Dec. 1996	Jan. 1997	Nov 2000	April 2004	Federal Region 9 PRGs+	NC 2L Standards++
Arsenic	15.2	20	NA	NA	0.045 ca	50
Lead	<3.0	<3.0	<15	NA	NS	15
Mercury	<0.2	<0.2	NA	NA	110	1.05
Isopropyltoluene	14	35	<5.0	NA	NS	NS

+= Region 9 Preliminary Remediation Goals (Tap Water). ca = Cancer-based PRG. nc = Noncancer-based PRG. NA= Not analyzed. NS = No standard.++ = NC Aquifer Protection Section 2L Standards.

Table 8
Monitoring Well #4 Contaminant Levels from 1996 thru 2004. Units = ug/liter (ppb)

Analyte	Dec. 1996	Jan. 1997	Nov 2000	April 2004	Federal Region 9 PRGs+	NC 2L Standards++
Arsenic	10	<10	NA	NA	0.045 ca	50
Lead	<3.0	<3.0	<15	NA	NS	15
Mercury	<0.2	<0.2	NA	NA	110	1.05
Butylbenzene	20	15	<5	NA	240nc	70
Carbon disulfied	<5.0----	NA	NA	NA	1000nc	700
Ethylbenzene	22	14	<5	<1.0	1300	550
Isopropyl benzene	41	23	<5	NA	660nc	70
isopropyltoluene	13	9	<5.0	NA	NS	NS
Naphthalene	**22**	**25**	<5.0	<11	6.2	21
Propyl benzene	56	32	<5	NA	240	NS
Trimethlybenzene	120	90	<5	NA	12	350
Xylene	47	32	<5	<1.0	210	530
Bis (2-ethylhexyl)phthalate	<200	<200	<10	<11.0	4.8ca	2.5
Pentachlorophenol	1200	590	<50	<11.0	0.56ca	0.29

+= Region 9 Preliminary Remediation Goals (Tap Water). ca = Cancer-based PRG. nc = Noncancer-based PRG. NA= Not analyzed. NS = No standard.++ = NC Aquifer Protection Section 2L Standards. Bold values indicate data exceeding the guidelines.

Table 9
Monitoring Well #5 Contaminant Levels from 1996 thru 2004. Units = ug/liter (ppb)

Analyte	Dec. 1996	Jan. 1997	Nov 2000	April 2004	Federal Region 9 PRGs+	NC 2L Standards++
Arsenic	<10	<10	Damaged	Damaged	0.045 ca	50
Lead	<3.0	<3.0	Well	Well	NS	15
Mercury	<0.2	<0.2	No samples Collected.	No samples Collected.	110	1.05
Naphthalene	**34**	6			6.2 nc	21

+= Region 9 Preliminary Remediation Goals (Tap Water). ca = Cancer-based PRG. nc = Noncancer-based PRG. NA= Not analyzed. NS = No standard.++ = NC Aquifer Protection Section 2L Standards. Bold values indicate data exceeding the guidelines.

Table 10
Monitoring Well #6 Contaminant Levels from 1996 thru 2004. Units = ug/liter (ppb)

Analyte	Dec. 1996	Jan. 1997	Nov 2000**	April 2004	Federal Region 9 PRGs+	NC 2L Standards++
Arsenic	10	<10	NA	NA	0.045 ca	50
Lead	<3.0	3.45	<15	NA	NS	15
Mercury	<0.2	<0.2	NA	NA	110	1.05

+= Region 9 Preliminary Remediation Goals (Tap Water). ca = Cancer-based PRG. nc = Noncancer-based PRG. NA= Not analyzed. NS = No standard.++ = NC Aquifer Protection Section 2L Standards.

Surface Water Sampling

To insure that no contaminants were discharging into Calico Creek, a surface water sample was collected in November 2000 at the intersection of the bulkhead and the concrete boat ramp. No volatile or semi-volatile compounds were detected (Refs. 2;4).

Current information indicates that the site's operations have been limited to the generation of paint-chip contaminated sand from sandblasting operations, presumed diesel fuel spills, and/or creosote leachate released from buried posts that were used to reinforce the wharves and buildings. There may still be residual levels (below guidelines and health benchmark standards) of metals and semi-volatile organic compounds in the soils as indicated in the 1996 sampling event (Ref. 10,Table 1). The site has guarded entry and will only allow access to site-related personnel. TCLP tests of site soils demonstrated that arsenic, lead, mercury and chromium leachate are below regulatory levels (Ref 6,p. 52). Furthermore, eight years of groundwater monitoring indicate that the metals, volatiles, and semivolatiles (PAHs from diesel fuels and creosote) are not leaching into the groundwater. The entire one-mile radius area around the site is served by city water. Based on these known facts, the NC Superfund Section recommends that this site be assigned a No Further Remedial Action Planned status under CERCLIS. If you have any questions about this PA II, please call Serafino Franch at (919) 508-8455, or by email at serafino.franch@ncmail.net.

Sincerely,

Serafino Franch
Environmental Chemist
NC Superfund Section

Jim Bateson, Head
Site Evaluation and Removal Branch
NC Superfund Section

cc: File
Charlotte Jesneck (letter only)

Attachments: APA Checklist
NCDENR GIS Topo Map Viewer: Address Locator (1998 aerial) (Reference 1)
Site Map of Sampling Locations for Soil Borings (with Lead Levels of 1996), Monitoring Wells, & Surface Water Sample (Reference 2)
Excerpts from the military's Environmental Assessment and Findings of No Significant Impact (May 2004) (Reference 3)
Excerpts from Natural Attenuation Monitoring Report for November 2000 (Ref. 4)
Site Map with Overlay of Structures from 1960 to 1978 (Reference 5)
Excerpts from Corrective Action Plan of March 1997 (Reference 6)
Memorandum dated May 16, 2005 (Reference 7)
Letter dated August 11, 1990 (Reference 8)
Letter dated August 27, 1991 (Reference 9)
Excerpts from Site Assessment and Work Plan for Corrective Action of August 1996 (Reference 10)
Excerpts from Natural Attenuation Monitoring Report for April 2004 (Reference 11)
Memorandum dated June 16, 2006 (Reference 12)
Excerpts from A Geochemical Atlas of NC of 1993 (Reference 13)
Letter dated June 4, 2004 from NC DWQ (NFA letter) (Reference 14)

ABBREVIATED PRELIMINARY ASSESSMENT CHECKLIST

This checklist can be used to help the site investigator determine if an Abbreviated Preliminary Assessment (APA) is warranted. This checklist should document the rationale for the decision on whether further steps in the site investigation process are required under CERCLA. Use additional sheets, if necessary.

Checklist Preparer:	**Serafino Franch, Environmental Chemist**	**June 26, 2006**
	Name/Title	Date
	NCDENR-Superfund Section	**919-508-8455**
	Address	Phone
	serafino.franch@ncmail.net	
	E-mail Address	

Site Name:	**USA-Reserve XVIII Airborne Corps-Morehead City**		
Previous Names (if any):			
EPA ID #	**NC5 210 022 906**		
Site Location:	**405 Fisher Street, Morehead City, Carteret County, NC**		
Latitude:	**34.72276° N**	**Longitude:**	**76.70668° W**

Describe the release (or potential release) and its probable nature: Lead and Arsenic are contaminants in site soils thought to originate from deposition of fill from sandblasting operations (refurbishing of docked ships). PAHs and diesel-range petroleum contaminants were deposited on site either from suspected fuel spills or from buried creosote treated pilings that were used to reinforce building structures and also used for bulkhead wall.

Part 1 - Superfund Eligibility Evaluation

If all answers are no, go on to Part 2, otherwise proceed to Part 3.	**YES**	**NO**
1. Is the site currently in CERCLIS or an alias of another site?	X	
2. Is the site being addressed by some other remedial program (Federal, State, or Tribal)?		X
3. Are the hazardous substances potentially released at the site regulated under a statutory exclusion (e.g., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?		X
4. Are the hazardous substances potentially released at the site excluded by policy considerations (i.e., deferred to RCRA corrective action)?		X
5. Is there sufficient documentation to demonstrate that no potential for a release that could cause adverse environmental or human health impacts exists (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, previous HRS score determined, or an EPA approved risk assessment completed)?		X

Please explain all yes answers.

1. **The site was added to CERCLIS based on a potential for accidental spills of petroleum-based hazardous substances and the potential to impact nearby human and environmental targets.**

3. **Even though petroleum-related contamination exists in the soil, there is no known source such as a leaking tank. The site was under the oversight of the NC Aquifer Protection Section for remediation of the groundwater. However, eight years of groundwater monitoring for volatiles and semi-volatiles indicated that there is no residual groundwater**

contamination (from at least November 2000-2004).

Part 2 - Initial Site Evaluation

Use Exhibit 1 of the APA fact sheet to make site assessment decisions based on the answers below:	YES	NO
1. Does documentation indicate that a target (e.g., drinking water wells, drinking surface water intakes, etc.) has been exposed to a hazardous substance released from the site?		X
2. Is there an apparent release at the site with no documentation of exposed targets, but there are targets on site or immediately adjacent to the site?	X	
3. Is there an apparent release and no documented on-site targets or targets immediately adjacent to the site, but there are nearby targets (e.g., targets within 1 mile)?		X
4. Is there no indication of a hazardous substance release, and there are uncontained sources containing CERCLA hazardous substances, but there is a potential to release with targets present on site or in proximity to the site?		X
5. Does the site lack documented on-site, adjacent, or nearby targets?		X
6. Does the site lack releases or potential to release?		X
7. Does the site lack uncontained sources containing CERCLA eligible substances are present on site?		X

Please explain all yes answer(s).

2. The PAHs, lead, and arsenic are in site soils. Only employees of the Reserve Center are potential receptors. The site has restricted and guarded entry.

4. & 7. Documented on-site sub-surface contamination consisting PAHs, lead, and arsenic (based on 1996 data). Only one or two borings have levels that exceed health-based guidelines. Future planned construction of expanded wharves and excavations for slips will result in removal (for off-site disposal) of about half of this contaminated soil.

Part 3 - State Site Assessment Recommendation

Check the box that applies based on the conclusions of the APA:

- [X] NFRAP
- [ ] Higher Priority SI
- [ ] Lower Priority SI
- [ ] Defer to RCRA Subtitle C
- [ ] Defer to NRC
- [ ] Refer to Removal Program - further site assessment needed
- [ ] Refer to Removal Program – NFRAP
- [ ] Site is being addressed as part of another CERCLIS site
- [ ] Other:

State Reviewer: **Serafino Franch** S. Franch — **06/26/06**

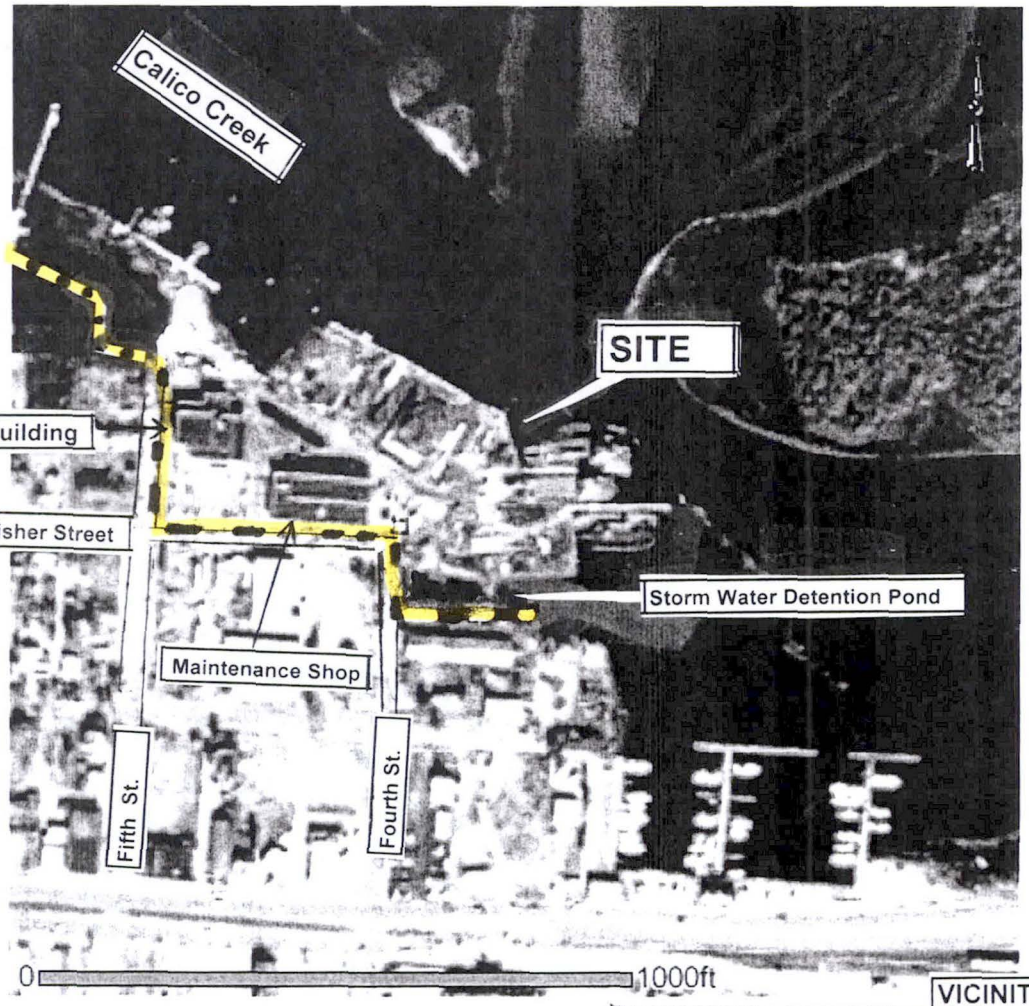
Print Name/Signature — Date

REFERENCE 1

USA Reserve XVIII Airborne Corps-Morehead City
NC5 210 022 906

Map for 405 Fisher St 28557

Location of 405 Fisher St 28557



1:4,000

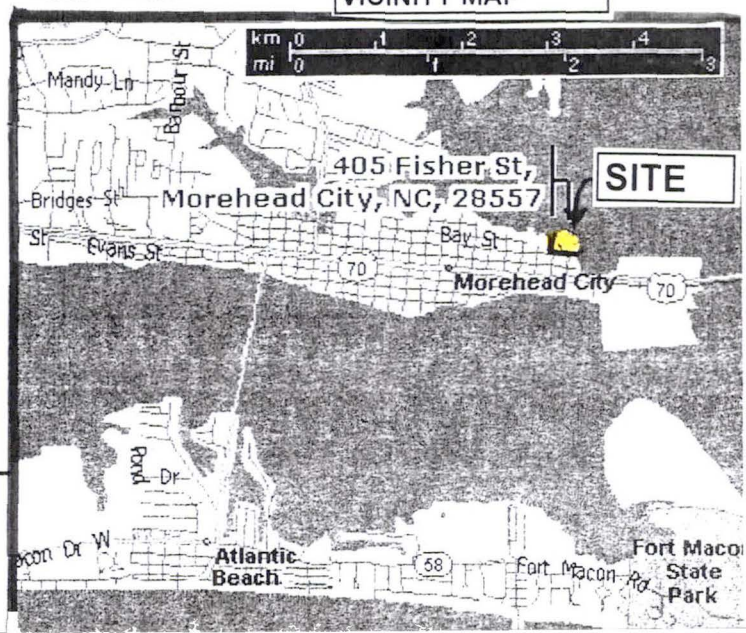
1998 AERIAL

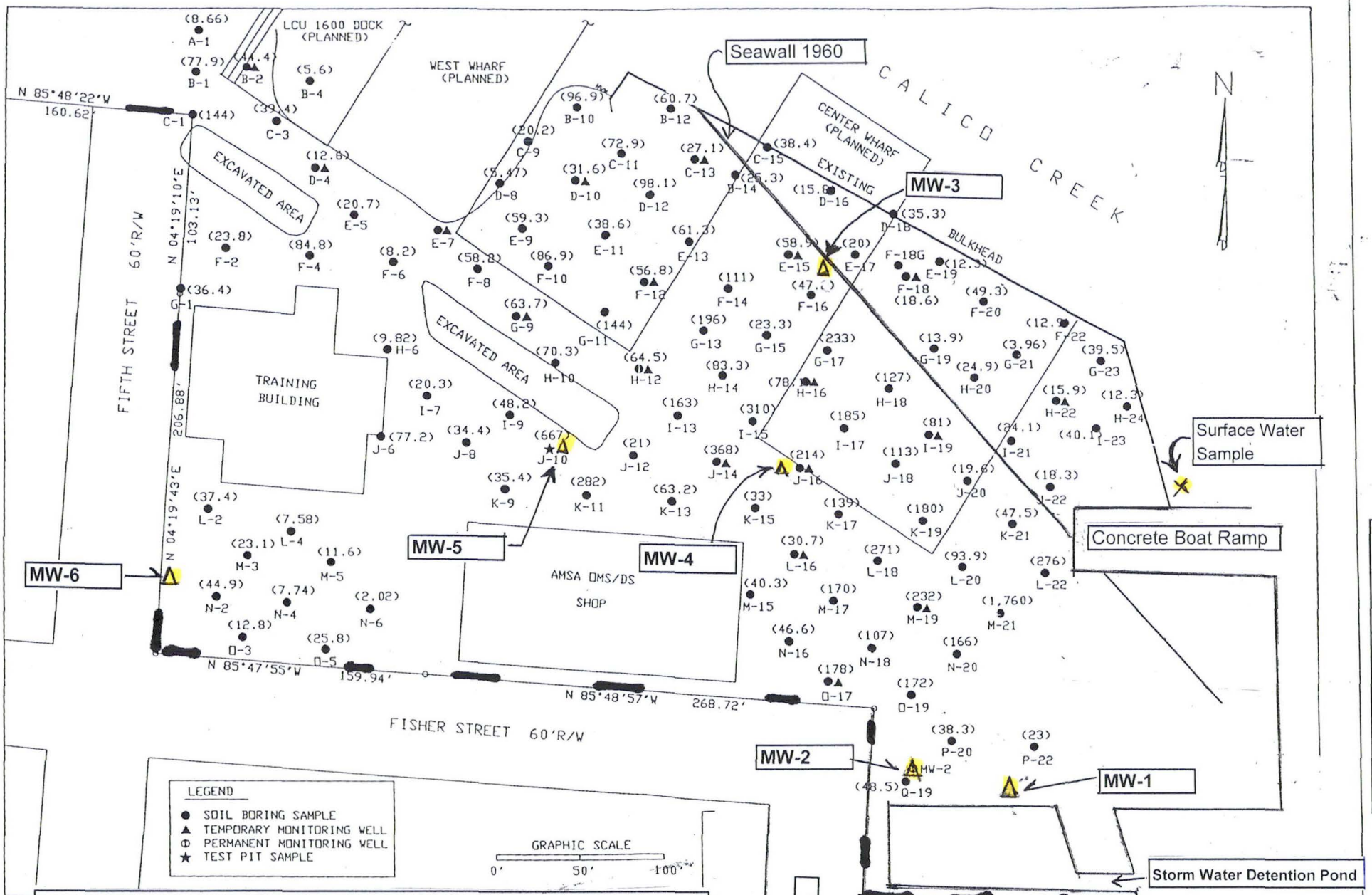
Beaufort
7.5-minute Quadrangle

NC SPCS E: 819621.2, N:110335.6 meters (NAD83)
Long: -76.7066817 W, Lat: 34.7227619 N (NAD83)

Site reference point: North end of 4th St. and Fisher St. intersection

VICINITY MAP





Sampling Locations of Soil Borings (with Lead Levels of 1996) Monitoring Wells, & Surface Water

USA Reserve XVIII Airborne Corps-Morehead City
NC5 210 022 906

This Site Map was adapted by NC Superfund from a Triangle Environmental Report for this site.

FIGURE 4b
TOTAL LEAD CONCENTRATION
U.S.A.R. CENTER / OMS / AMSA
MOREHEAD CITY, NORTH CAROLINA

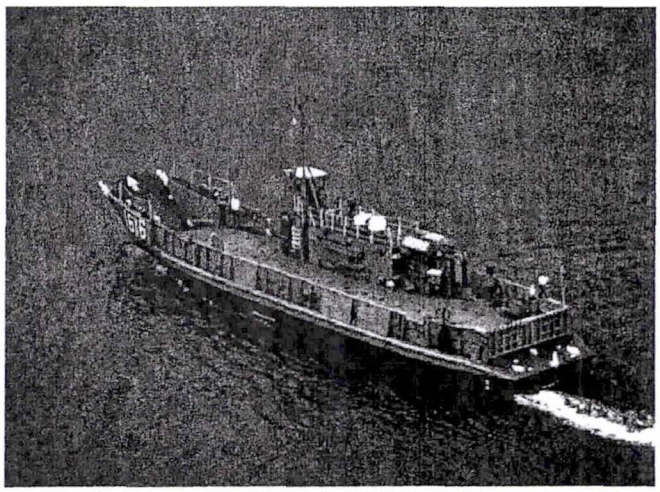
REFERENCE 2

REFERENCE 3

Environmental Assessment
And
Finding of No Significant Impact

For

Addition/Alteration – U.S. Army Reserve Center
Organizational Maintenance Shop
And Area Maintenance Support Activity Shop
Morehead City, Carteret County, North Carolina



Landing Craft Utility (LCU)

May 2004

ENVIRONMENTAL ASSESSMENT (EA)
FOR
ADDITION/ALTERATION - U.S. ARMY RESERVE CENTER (USARC)
ORGANIZATIONAL MAINTENANCE SHOP (OMS)
AND AREA MAINTENANCE SUPPORT ACTIVITY SHOP (AMSA)
MOREHEAD CITY, CARTERET COUNTY, NORTH CAROLINA

1.00 PURPOSE AND NEED FOR THE PROPOSED ACTION.

The Morehead City USAR Center in Morehead City, Carteret County, North Carolina, is located along Calico Creek near the mouth of the Newport River at the terminus of 4th Street (Figure 1). The USAR Center houses the 824th (Heavy Boat) Transportation Company whose mission is to provide and operate landing craft for the transportation of personnel, containers, and outsize cargo in offshore discharge operations and for augmenting lighterage service.

The 824th (Heavy Boat) Transportation Company is a high priority unit for wartime mobilization and, as such, it is critical that the unit maximize its combat readiness level. In order to do this, it is necessary that the existing facilities be expanded, as proposed by this project, to (1) facilitate command and control, training and administration, and operational supervision of water-oriented activities; (2) provide facilities capable of supporting the maintenance requirements for the vessels under its command; and (3) provide adequate facilities for access, docking, and loading/unloading of watercraft. This project is considered to be an essential part of the U.S. Army Reserve Command's mission of becoming part of the combat forces of the United States during periods of national emergency/war.

The unit is currently authorized ten Landing Craft, Marine Utility (5 LCU1600 Series, 5 LCU-2000 Series, and 1 Coastal Harbor Inland (CHI) boat). The 1600 series LCU's are 135 feet long, 30 feet wide, and draw 7 feet fully loaded; the 2000 series LCU's are 174 feet long, 42 feet wide, draw 11 feet fully loaded, and are equipped with a water jet bow thruster which provides better maneuverability. The unit is also authorized a 65-foot-long by 17-foot-wide CHI. Presently, the unit has received five of the 1600 series vessels and three of the 2000 series vessels. The project is needed to accommodate the total complement of authorized vessels.

In 1994 a contract was awarded for the construction and renovation work at the USAR Center. The landside work included the construction of a 16,000 square foot training building that would accommodate a 150 - member unit, a 13,000 square foot Organizational Maintenance building and associated site work and utilities. The contract also included the conversion of the existing 9,000 square foot training building into Unit Storage building.

Marine construction included a sheet steel bulkhead, concrete fixed piers for the 2000 series landing craft, finger piers for the 1600 series landing craft and dock related utilities. Marine construction also included channel deepening and a turning basin and a plan to mitigate the effects of channel and turning basin dredging.

REFERENCE 4

Pages in References

Ref 6 = CAP March 1997

pgs 4 → 11, Table 1 = well construction

H_2O Locations MAP, Soil Samples Location MAP

pg 25 → 29, Table 4 = TCLP, Table 5, Table 6

temporary Wells - Metals + Semi Volatiles

Ref 10 = Site Assess Aug 1996

Executive Summary, p1+2. Table 1 pages 22/24 TPH + Metals IN Soils

Table 2 p1→7, - Volatiles IN Soils Table 3 TCLP Soil Metals

REFERENCE 4

NATURAL ATTENUATION MONITORING REPORT
FOR NOVEMBER 2000
ARMY RESERVE CENTER
MOREHEAD CITY, CARTERET COUNTY, NORTH CAROLINA

RECEIVED
MAY 0 4 2006
SUPERFUND SECTION

MARCH 2001

SITE OWNER/OPERATOR:	US Department of the Army
GROUNDWATER INCIDENT #:	13066 and 16194
RISK CLASSIFICATION:	Intermediate
LAND USE CATEGORY:	Mixed Residential/Commercial
CONSULTANT:	TRC Triangle, Inc. (500 Glenwood Avenue) P.O. Box 41087 Raleigh, North Carolina 276269 (919) 828-3150
DISCOVERED DATE OF RELEASE:	October 1994 – sheen on detention pond
CAUSE OF DISCOVERED RELEASE:	Unknown
QUANTITY RELEASED:	Unknown
LATITUDE:	N 34° 43' 22"
LONGITUDE:	W 76° 42' 25"
TRC PROJECT NO:	02333-0010-00000
CONTRACT NO.	80802101G

NORTH CAROLINA PROFESSIONAL SEAL 7747 ENGINEER

R. Stan Taylor, P.E. #7747
Technical Director

Haynes D. Campbell
Geologist

NATURAL ATTENUATION MONITORING REPORT
FOR NOVEMBER 2000
ARMY RESERVE CENTER
MOREHEAD CITY, CARTERET COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

TRC Triangle, Inc. (TRC) was retained by Gulf South Research Corporation (GSRC) on behalf of the U.S. Army Reserve to perform a groundwater monitoring event at the Army Reserve site in Morehead City, North Carolina in accordance with the approved Corrective Action Plan (CAP) for the site. In addition to the groundwater monitoring, TRC collected samples from the on-site stockpiled soil. The site is located at 405 Fisher Street, Morehead City, NC 28557 (Figures 1a and 1b). The report contained herein includes the results of the groundwater monitoring event for November 2000.

2.0 SITE HISTORY

2.1 Historical Information

A detailed historical review or title search was not performed by TRC for this site. The background of the site was gathered during conversations with the general contractor site personnel, Army Reserve Center personnel, and U.S. Army Corps of Engineers (COE) personnel. Apparently, there has been some type of industrial activity at the subject site during much of the last 100 years. Reportedly, there was a sawmill at the site some time around the Civil War period and some type of ship refurbishing/sandblasting operation during World War II. A 1960 aerial photograph of the site shows a ship building operation on the eastern half of the site and single family dwellings on the western half. In a 1972-73 photograph, the ARC had built wharves on the eastern part of the site and added a new sea wall. The large ship building structure had been removed by 1978. After 1978, the site did not significantly change prior to the recent construction activities related to the expansion of the ARC.

2.2 Previous Assessments

A brief summary of environmentally related activities at the site follows. A more complete summary of the activities was included in the site assessment report.

1. Two 550-gallon heating oil underground storage tanks (UST) were permanently closed by removal in December of 1993. These two tanks were located at the former ARC facility on the south side of Fisher Street, across the road from the current facility. Reportedly, no soil or groundwater samples contained petroleum-related compounds above State action levels. The former ARC facility and associated USTs are outside of the area covered in this report.

2. On October 10, 1994, Soil and Materials Engineers (S&ME) collected seven soil samples and one groundwater sample from the site. On the same day, one water sample was collected from the storm water detention pond and analyzed for semi-volatile organic compounds using EPA Method 625.

3. On October 16, 1994, the Wilmington District COE received a Notice of Violation (NOV) for groundwater quality violations from the State of North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). The NOV was based on a sheen in the storm water detention pond, which was observed by a representative of the NCDEHNR.

4. On November 15 and 16, 1994, Wilmington District COE personnel collected 13 soil samples and one duplicate soil sample from borings around the foundation area of the Training Building and AMSA OMS/DS Shop.

5. On December 15, 1994, Paradigm Laboratory, Inc. personnel collected two samples from the soil stockpile resulting from the excavation of the storm water detention pond and collected two soil samples from the area of the two borings which contained total lead concentrations above 100 milligrams per kilogram (mg/kg). In February of 1995, the stockpiled soil was taken to a State approved disposal facility under a contract with Right Angle Engineering (RAE).

6. On January 18 and 19, 1995, Savannah District COE drillers installed two monitoring wells, MW-1 and MW-2, near the storm water detention pond in response to the October 1994 NOV. Soil and groundwater samples were reportedly collected. The locations of these wells are shown on Figure 2 and the well construction information is presented on Table 1.

7. During May and June of 1995, RAE performed health and safety monitoring and field screening of soil-related vapor-phase volatile organic compounds (VOCs) generated during the construction excavation activities at the site. During this time, approximately 3,000 cubic yards of soil were excavated. Approximately 400 cubic yards of soil were suspected to be contaminated and stockpiled on site for later removal and disposal. Additionally, over 50 tons of creosote timber were separated and stockpiled on site. Between June 1 and June 16, 1995, Carlisle Farms, Inc. transported and disposed of the stockpiled contaminated soil and creosote timber. Of the excavated soil not suspected to be contaminated, approximately 13,000 tons were transported to three off-site locations and stockpiled. Some previously excavated material had been stockpiled at two of the off-site locations. During this time RAE collected soil samples, described as grab samples, from 46 locations (including three stockpile samples and one duplicate). Three samples of water which had accumulated in the pit excavation were collected by RAE and analyzed for VOCs using EPA Methods 601 and 602 and for semivolatile organic compounds (SVOCs) using EPA Method 625. No VOCs were detected in the samples. Only one semivolatile compound, acenaphthene at 20 micrograms per liter (μg/L), was detected above quantitation limits. Several other target compounds, including pentachlorophenol, were identified in concentrations less than the quantitation limits of the laboratory method.

8. On June 27 and 28, 1995, S&ME, on behalf of W.F. Parker, collected eight soil samples.

9. Triangle Environmental, Inc. (now TRC Triangle, Inc.) performed a soil and groundwater investigation during the months of January and February of 1996. One hundred and fifty soil samples, including duplicates, were collected from 105 soil borings; 22 groundwater samples, including duplicates, were collected from 20 temporary shallow groundwater monitoring wells; and 15 soil samples were collected from five on-site stockpiles for laboratory analyses. The report Site Assessment and Work Plan for Corrective Action, dated August 1996, presented the findings and conclusions of the investigation.

10. In March of 1997, Triangle Environmental, Inc. (now TRC Triangle, Inc.) prepared and submitted a Corrective Action Plan (CAP) for remediation based on natural attenuation. Additional assessment was conducted in conjunction with the CAP, including the permanent installation and sampling of 4 additional shallow groundwater monitoring wells, re-sampling at selected soil boring locations, a three day monitoring of tidal fluctuations in the groundwater to predict the average groundwater flow direction, and slug tests to estimate aquifer parameters. The collected information was incorporated in the CAP. The plan was approved in May of 1997 (Appendix A).

2.3 Post Assessment Site Changes

Since 1997 there has been little change to the conditions of the site. The ARC has moved from its former location south of Fisher Street to the new facilities shown on Figure 2. The excavation areas located north and northeast of the training building recently have been backfilled. There has been no other grading work done to the back portion of the site, and the planned slips have not been dredged nor the planned wharves constructed. TRC understands that ARC is proposing grading and paving portions of the back area and installing wharves, modified from the 1996 plan.

3.0 POTENTIAL RECEPTORS

3.1 Water-Supply Wells

According to information provided by Mr. Joe Clayton, Director of the Water and Sewer Department, Morehead City, a municipal water well (Well #2) is located at 5th and Fisher Streets. The location of the well is shown on Figure 3. Well #2 is one of four water wells used for the City's municipal water supply. Mr. Clayton also stated that Well #2 was installed during the 1950s. It is an 8 or 10-inch diameter metal-pipe well with a total depth of approximately 360 feet deep. It has several screened intervals. The top of the highest screen is at approximately 290 feet. Well #2 yields approximately 460 gallons per minute.

TRC also asked Mr. Clayton about possible older wells in the area which are listed in the North Carolina Department of Water Resources bulletin *Geology and Ground-Water Resources of Wilmington-New Bern Area* (LeGrande, 1960). Mr. Clayton stated that the old (1930s) Carolina Water Company wells had been abandoned. He had no knowledge about a water supply well at the former Carteret Ice Factory (now a restaurant) being used and believes it probably was abandoned. Mr. Clayton noted that the last he knew the Sanitary Restaurant had a water well used to supply cooling water.

3.2 Well Head Protection Areas

Figure 3 is a map showing the designated Well Head Protection Areas (WHPAs) for Morehead City. The site is located within the WHPA for the municipal well #2. It is considered very unlikely that the nearby water supply well will become impacted by the limited groundwater contamination at the site. The average hydraulic gradient and predicted shallow groundwater flow direction at the site is towards Calico Creek, away from the water-supply well. In addition, it is unlikely, considering the geologic setting, that there would be downward vertical flow of the shallow groundwater at the site towards the well, and if this was occurring, then the water supply would have become brackish from the nearby Calico Creek. For these reasons, the municipal water supply well is <u>not</u> considered a potential receptor.

3.4 Deeper Aquifer

Under current State guidelines, a deeper semiconfined or unconfined aquifer used as a potable water source is considered a potential receptor. It is very unlikely, considering the geologic setting, that there would be downward vertical flow of the shallow groundwater at the site. The shallow groundwater is discharging to Calico Creek, which borders the site. If the shallow groundwater was recharging a deeper aquifer, then the deeper aquifer would have become brackish from the nearby Calico Creek and would not be a source for potable water.

3.5 Calico Creek

The site is bordered on the north and east by Calico Creek. The average hydraulic gradient at the site indicates the discharge of the site's shallow groundwater is to Calico Creek. Calico Creek is classified as tidal salt water (SC) by the NCDENR. State regulation 15A NCAC 2B describes the best usage of SC waters as "Aquatic life propagation and maintenance of biological integrity (including fishing, fish and functioning PNAs), wildlife, secondary recreation, and any other usage except primary recreation or shell fishing for market purposes."

3.6 Other Potential Receptors

No basements are located on the site or in the general area. Storm drains and sanitary sewer lines are/will be present at the site. The health and safety concerns of these types of potential receptors are that related to the potential collection of hazardous vapors. However, at the ARC site, the collection of hazardous vapors does not appear to be a potential risk due to the low concentrations and low volatility of the contaminants.

4.0 GROUNDWATER SAMPLING

4.1 Groundwater Elevations

Prior to gauging water levels, the monitoring wells were opened and the wells allowed to equilibrate to atmospheric pressure. The data are presented on Table 2 and included in Figure 4a. The water table at the site is complex because of the tidal influence and the presence of vertical barriers to vertical flow. For comparison, the January 1997 water tables at low and high tide and at 'average' conditions are shown on Figures 4b, 4c, and 4d, respectively. The excavated areas located north and northeast of the training building have been backfilled.

4.2 Groundwater and Surface Water Sampling

Groundwater samples were collected from four monitoring wells: MW-1, MW-3, MW-4, and MW-6. A duplicate sample from MW-3 was collected and labeled MW-7. Prior to collecting groundwater samples, the water level was gauged and the volume of water in the well calculated. A minimum of three well volumes of water was purged using a surface mounted dual-diaphragm pump with new disposable tubing. The wells were allowed to re-equilibrate before collecting the samples with new disposable bailers and nylon cord. To minimize turbidity, the bailers were gently lowered into the well and the first bailer was used for the metals analysis, followed by the

sample for volatile organic compounds (VOCs), then semivolatile organic compounds (SVOCs). The field data sheets for the groundwater sampling are presented in Appendix B.

The surface water sample was collected by lowering a clean laboratory-supplied one-liter bottle into the water tied to a new nylon cord. The collected water was gently transferred into the sample bottles that were sent to the laboratory for analysis.

The groundwater and surface water samples were collected for laboratory analyses in clean, laboratory-supplied bottles. The samples were labeled, logged onto a chain-of-custody form, packed in an ice-filled cooler, and delivered to the subcontracted analytical laboratory certified by NCDENR.

The monitoring well samples were analyzed for VOCs using Method SW846-8260B, for SVOCs using Method SW846-8270 with base/neutral extraction, and for lead using Method 6010 with standard preparation Method 3030C as required by the North Carolina Groundwater Section.

On December 12, 2000, monitoring well, MW-4, and the surface water were resampled using the methodology described above with the exception that a new disposable bailer was used to both purge and sample the well. The samples were analyzed using Method SW846-8270 with acid extraction. The additional analysis was required because pentachlorophenol was detected in 1997 at MW-4. Pentachlorophenol requires an acid extraction for detection by Method 8270.

4.3 Groundwater Sample Laboratory Results

The laboratory data sheets are included in Appendix C and the data are summarized on Table 3. There were no detections of target VOCs or SVOCs above the quantitation limits for the laboratory methods. Lead was detected in one groundwater sample, MW-1, above the North Carolina Groundwater Standard of 15 µg/L.

4.4 Surface Water Sample Laboratory Results

The laboratory data sheets are included in Appendix C and the data are summarized on Table 3. There were no detections of target VOCs or SVOCs above the quantitation limits for the laboratory methods.

5.0 STOCKPILE AND DEBRIS PILE SAMPLING

In addition to performing a groundwater monitoring event, TRC personnel collected samples from the stockpiles and debris piles remaining at the site. The locations of the stockpiles on the site are shown on Figure 5. The approximate dimensions of the stockpiles are listed on Table 4. As noted in Section 2.2, in 1996 15 stockpile samples were collected at the site. Since the 1996 stockpile samples the size of the stockpiles have changed. To TRC's knowledge, none of the 1996 stockpiles were removed for disposal. Some of the smaller stockpiles may have been consolidated into the largest pile (Stockpile #1-Figure 5), but overall the amount of stockpiled soil appears less than before. The three or more hurricanes and tropical storms, which hit the Morehead City area, may have reduced the size of some of the piles, and some of Stockpile #1 was recently used to backfill the excavated areas north and northeast of the training building.

Before collecting the stockpile samples, the larger stockpiles were visually divided into equal areas. A clean hand-auger with a stainless steel 3.25-inch diameter bucket was used to advance one boring per area. Samples were collected at one quarter, one half, and three quarters of the way into the stockpile and mixed in a stainless steel bowl to form one composite sample per boring location. Additional grab samples were collected at selected locations based on field evidence of contamination. The stockpile samples were collected for laboratory analyses in clean, laboratory-supplied bottles. The samples were labeled, logged onto a chain-of-custody form, packed in an ice-filled cooler, and delivered to the subcontracted analytical laboratory certified by NCDENR. In the laboratory, the composite samples were analyzed for total petroleum hydrocarbons (TPH) by Method 3550, Oil and Grease (O&G) 9071, SVOCs by Method 8270, total lead and chromium by Method 6010, extractable lead, extracted using the

toxicity characteristic leachate procedure (TCLP) Method 1311 and analyzed by Method 6010. The laboratory data sheets are included in Appendix D and summarized on Table 6 and Table 7. Also listed on Table 7 are current North Carolina Groundwater Section cleanup guidelines for in-place soils. Several samples have exceedences of these guideline levels.

The compounds for which there were exceedences and the maximum detected concentrations in the November 2000 stockpile samples are:

TPH 3550	100 mg/kg
O&G 9071	540 mg/kg
Total Lead	310 mg/kg
Benzo (a) anthrecene	0.70 mg/kg
Benzo (b) fluoranthene	1.2 mg/kg
Benzo (a) pyrene	1.0 mg/kg

6.0 CONCLUSIONS AND RECOMMENDATIONS

- There were no detections of target VOCs or SVOCs above the quantitation limits for the laboratory methods for groundwater or surface water. Lead was detected in one groundwater sample, MW-1, above the North Carolina Groundwater Standard of 15 µg/L.

- The on-site stockpiles contain TPH 3550, O&G 9071, SVOCs and lead in concentrations above North Carolina cleanup guidelines.

- It is recommended that quarterly groundwater monitoring continue at the site. For future samples, the project quantitation limits for VOCs should be set at 1 µg/L - below the Method 8260 quantitation limit of 5 µg/L. This recommendation is made because the North Carolina Groundwater Standard for benzene is 1 µg/L and it is meaningless to seek detection of a compound at a concentration greater than its regulatory allowable level.

- The destroyed monitoring well, MW-5, should be replaced; the damaged monitoring well, MW-4, should be properly abandoned and replaced.

- An additional monitoring well, to be used for quarterly sampling, should be installed at a location between MW-4 and the concrete loading ramp. Because of planned construction in the area and past damage to earlier groundwater monitoring wells by heavy equipment, it is important that the new and replacement well installation be coordinated with the construction activities or designed to minimize the risk of damage.

- The remaining stockpiles should be excavated and transported to an approved facility for disposal.

- Any future excavated material should be properly characterized and disposed of according to its characterization. Based on information collected during the current and earlier stockpile and soil assessments, there does not appear to be soil meeting the characteristics of a hazardous waste present at the site, but locally there is soil which would classify as a non-hazardous waste upon excavation.

Table 1
Well Construction Information

Monitoring Well	Date Installed	Date Abandoned / Destroyed	Top of casing elevation (feet)	Borehole diameter (inches)	Well inner diameter (inches)	Depth to ground surface (feet)	Depth to static water (feet)	Depth to top of screen (feet)	Depth to bottom of screen (feet)	
Army Reserve Center - Morehead City										
TRC Proj. # 02333-0010										
MW-1	1995		3.67	8.0	2.067	-0.3	1.88	1.5	10.5	Flush
MW-2	1995		3.25	8.0	2.067	-0.2	1.40	1.6	10.6	↓
MW-3	12/17/96		7.74	8.0	2.067	3.4	1.6 5.01	5.0	15.0	
MW-4	12/17/96		6.26	8.0	2.067	2.7	1.3 4.02	5.0	15.0	
MW-5	12/17/96	November-00	6.46	8.0	2.067	2.6	0.6 3.25	5.0	15.0	
MW-6	12/18/96		4.61	8.0	2.067	-0.7	1.22	2.5	12.5	Flush
All depths measured from top of casing										

SCREEN INTERVA
Screen INTER
from grade

1.6 → 11.6
2.3 12.3
2.4 12.4

Table 3
Groundwater and Surface Water Laboratory Data Summary

Army Reserve Center													
TRC Project #02333-0010													
Sample I.D.	*2L*	MW-1			MW-2		MW-3			MW-4		MW-10*	MW-4
Sample Date	*Standard*	12/19/96	1/13/97	11/1/00	12/19/96	1/13/97	12/19/96	1/13/97	11/1/00	12/19/96	1/13/97	1/13/97	11/1/00
Metals (µg/L)												MW-4 field duplicate*	
Arsenic	*50*	12.7	15.0	NA	<10.0	<10.0	15.2	20.1	NA	10.0	<10.0	<10.0	NA
Barium	*2,000*	677	992	NA	318	321	228	<200.0	NA	<200.0	221	278	NA
Cadmium	*5*	<5.00	<5.00	NA	<5.00	<5.00	<5.00	<5.00	NA	<5.00	<5.00	<5.00	NA
Chromium	*50*	<10.0	<10.0	NA	<10.0	<10.0	<10.0	<10.0	NA	<10.0	<10.0	<10.0	NA
Iron	*300*	NA	584	NA	NA	4,280	NA	971	NA	NA	584	9,770	NA
Lead	*15*	16.5	<3.00	32	<3.00	<3.00	<3.00	<3.00	<15	<3.00	<3.00	3.21	<15
Mercury	*1.1*	<0.200	<0.200	NA	<0.200	<0.200	<0.200	<0.200	NA	<0.200	<0.200	<0.200	NA
Selenium	*50*	<5.00	<5.00	NA	<5.00	<5.00	<5.00	<5.00	NA	<5.00	<5.00	<5.00	NA
Silver	*18*	<10.0	<10.0	NA	<10.0	<10.0	<10.0	<10.0	NA	<10.0	<10.0	<10.0	NA
SW-846 8260(µg/L)													
n-Butylbenzene	*70*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	20	15	16	<5.0
sec-Butylbenzene	*70*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	25	18	22	<5.0
Carbon Disulfide	*700*	220	59	<5.0	87	80	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene	*29*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	22	14	15	<5.0
Isopropylbenzene	*70*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	41	23	31	<5.0
p-Isopropyltoluene	^	<10	<5.0	<5.0	<5.0	<5.0	14	35	<5.0	13	9	<5.0	<5.0
Naphthalene	*21*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	22	38	25	<5.0
n-Propylbenzene	*70*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	56	32	41	<5.0
1,2,4 - Trimethylbenzene	*350*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	120	90	91	<5.0
1,3,5 - Trimethylbenzene	*350*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	30	21	23	<5.0
Xylene(s)	*530*	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	47	32	36	<5.0
SW-846 8270 (µg/L)													
bis (2-ethylhexyl) phthalate	^	<10.0	61	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<200	<200	<200	<10.0
Naphthalene	*21*	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<200	<200	<200	<10.0
Pentachlorophenol	*0.3*	<50.0	<50.0	NA	<50.0	<50.0	<50.0	<50.0	NA	1,200	590	1,300	<50

BL

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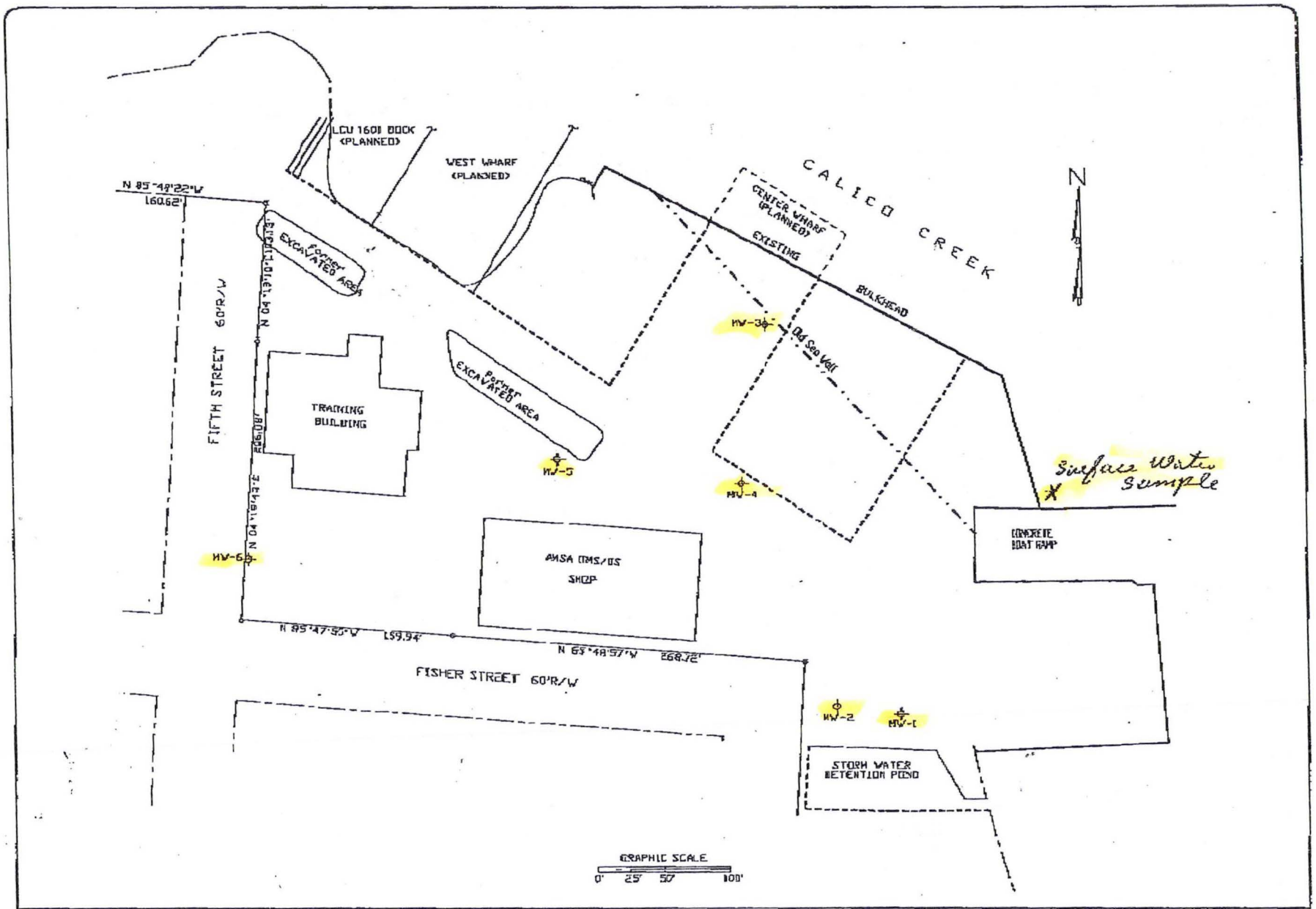
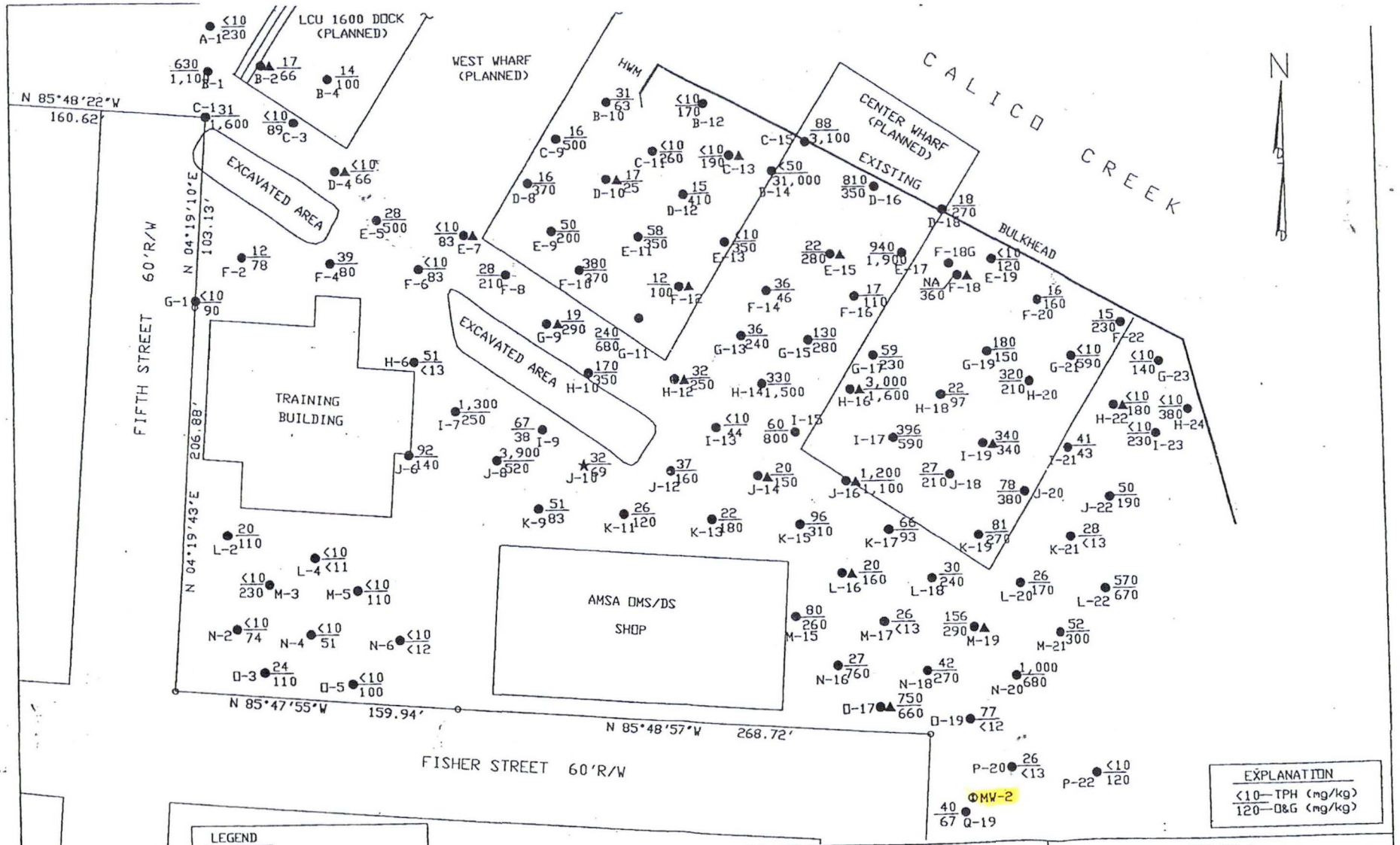
Table 3
Groundwater and Surface Water Laboratory Data Summary

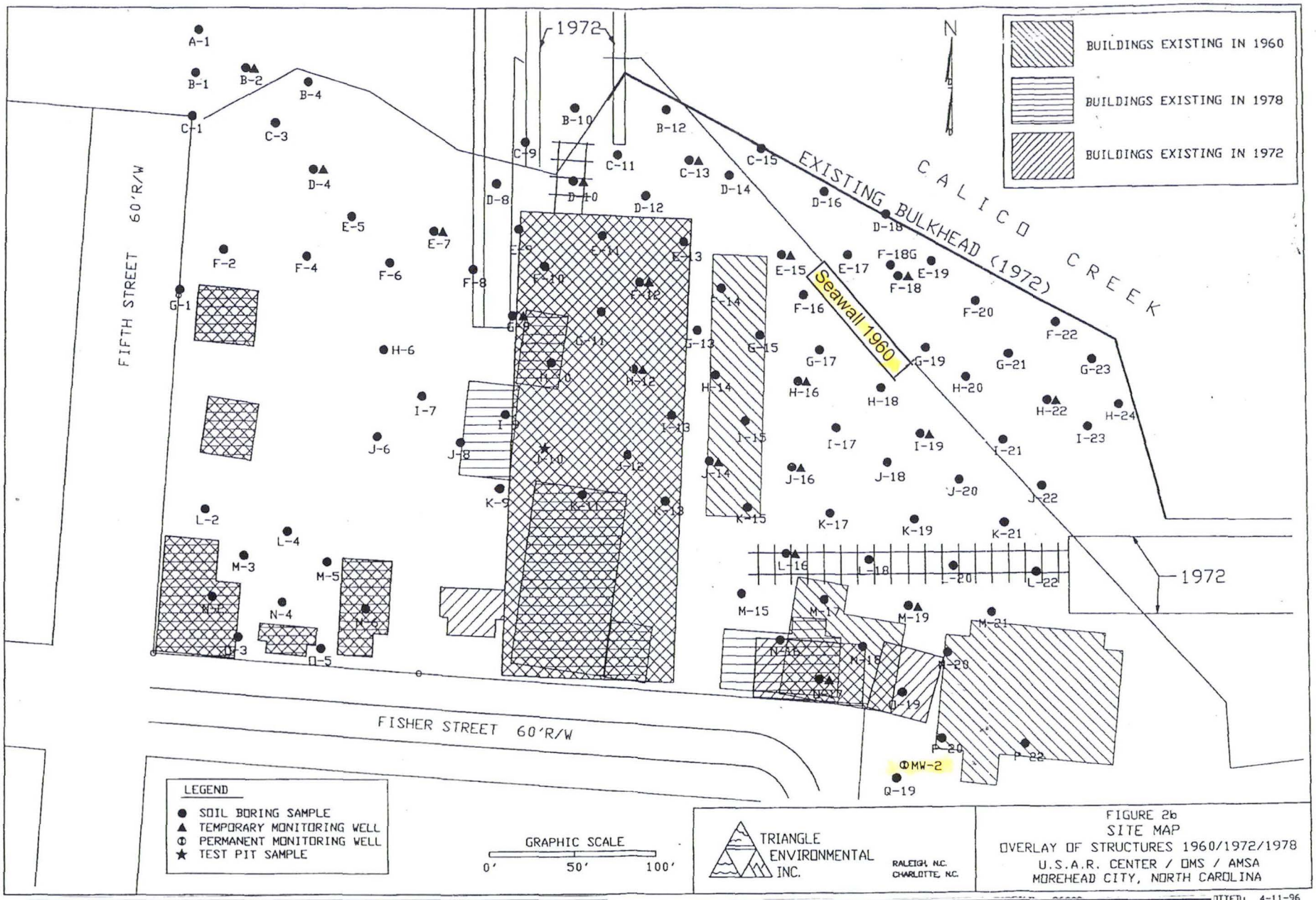
Army Reserve Center									
TRC Project #02333-0010									
Sample I.D.	*2L*	MW-5			MW-6			Surface	
Sample Date	*Standard*	12/19/96	1/13/97	11/1/00	12/19/96	1/13/97	11/1/00	11/1/00	
Metals (µg/L)				well					
Arsenic	*50*	<10.0	<10.0	damaged	10.0	<10.0	NA	NA	
Barium	*2,000*	409	595		<200.0	<200.0	NA	NA	
Cadmium	*5*	<5.00	<5.00	no	<5.00	<5.00	NA	NA	
Chromium	*50*	<10.0	<10.0	sample	<10.0	<10.0	NA	NA	
Iron	*300*	NA	30,600		NA	2,060	NA	NA	
Lead	*15*	<3.00	<3.00		<3.00	3.45	<15	<15	
Mercury	*1.1*	<0.200	0.224		<0.200	<0.200	NA	NA	
Selenium	*50*	<5.00	<5.00		<5.00	<5.00	NA	NA	
Silver	*18*	<10.0	<10.0		<10.0	<10.0	NA	NA	
SW-846 8260(µg/L)									
n-Butylbenzene	*70*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
sec-Butylbenzene	*70*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
Carbon Disulfide	*700*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
Ethylbenzene	*29*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
Isopropylbenzene	*70*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
p-Isopropyltoluene	^	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
Naphthalene	*21*	34	6		<5.0	<5.0	<5.0	<5.0	
n-Propylbenzene	*70*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
1,2,4 - Trimethylbenzene	*350*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
1,3,5 - Trimethylbenzene	*350*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
Xylene(s)	*530*	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	
SW-846 8270 (µg/L)									
bis (2-ethylhexyl) phthalate	^	<10.0	<10.0		<10.0	<10.0	<10.0	<10.0	
Naphthalene	*21*	26	<10.0		<10.0	<10.0	<10.0	<10.0	
Pentachlorophenol	*0.3*	<50.0	<50.0		<50.0	<50.0	NA	<50	

15



TRC Triangle, Inc. P.O. Box 41087 Raleigh, N.C. 27629 (919) 828-3150 (800) 849-5115 (919) 828-1977 fax	PROJECT: Army Reserve Center - Morehead Site Map	PROJ. #: 02333 DRAWN BY: jah SCALE:	FIGURE: 2


LCU 1600 DOCK (PLANNED)
WEST WHARF (PLANNED)
HWM
CALICO CREEK
CENTER WHARF (PLANNED)
EXISTING BULKHEAD
N
N 85°48'22"W
160.62'
EXCAVATED AREA
EXCAVATED AREA
TRAINING BUILDING
FIFTH STREET 60'R/W
N 04°19'10"E
103.13'
206.88'
N 04°19'43"E
AMSA OMS/DS SHOP
N 85°47'55"W
159.94'
N 85°48'57"W
268.72'
FISHER STREET 60'R/W
MW-2
EXPLANATION
<10 — TPH (mg/kg)
120 — O&G (mg/kg)
LEGEND
SOIL BORING SAMPLE
TEMPORARY MONITORING WELL
PERMANENT MONITORING WELL
TEST PIT SAMPLE
GRAPHIC SCALE
0' 50' 100'
TRIANGLE ENVIRONMENTAL INC.
RALEIGH, N.C.
CHARLOTTE, N.C.
FIGURE 4a
TPH AND O&G CONCENTRATION
U.S.A.R. CENTER / OMS / AMSA
MOREHEAD CITY, NORTH CAROLINA
CADFILE: 96008
DATE PLOTTED: 4-11-96



REFERENCE 5

USA Reserve XVIII Airborne Corps-Morehead City
NC5 210 022 906

This Site Map was adapted by NC Superfund from a Triangle Environmental Report for this site.

REFERENCE 6

REFERENCE 6

CORRECTIVE ACTION PLAN
U.S. ARMY RESERVE CENTER
MOREHEAD CITY
CARTERET COUNTY
NORTH CAROLINA

Prepared for:

D.S. SIMMONS,
GOLDSBORO, NORTH

Pls punch & put in front of TKs CSX Report Dir

Prepared b

TRIANGLE ENVIRONMENTAL, INC.
RALEIGH, NORTH CAROLINA

TRIANGLE PROJECT NO. 033-0509
CONTRACT NO. DACA 54-94-C0026

My Copy
John O. Kelly
3-31-97

MARCH 1997

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9. Triangle performed a soil and groundwater investigation during the months of January and February of 1996. The report Site Assessment and Work Plan for Corrective Action, dated August 1996, presented the findings and conclusions of the investigation.

2.0 SUMMARY OF SITE ASSESSMENT

During the site investigation conducted by Triangle, samples were collected from 105 soil borings, 20 temporary wells, one test pit, and five on-site stockpiles. The soil samples were analyzed for Total Petroleum Hydrocarbons (TPH) by Methods 3550 and 5030, oil and grease (O&G) by Method SW-846 9071, volatile and semivolatile organic compounds by Methods SW-846 8260 and 8270, and total concentrations of the RCRA 8 metals. The groundwater samples were analyzed for volatile and semivolatile organic compounds by Methods SW-846 8260 and 8270, and total concentrations of the RCRA 8 metals. After review of the analytical results from the above sampling, Triangle repeated the sampling at 11 soil boring locations, one test pit, five stockpile sample locations, and prepared an additional test pit for detailed soil-profile sampling. In addition to the analytical methods mentioned above, selected soil samples were analyzed for metals using the TCLP method. The data is presented in the analytical summary tables. (The information regarding the stockpile samples is not repeated in this report.)

The stockpiles are still located at the site, but Triangle understands that soil shall be transported off site for disposal under State permit. In addition, all non-native soils that are excavated during the proposed construction activities will be transported to an off-site disposal facility. Temporarily, excavated native soils will be transported to the same disposal facility and stockpiled separately for confirmation sampling. Triangle has been contracted to prepare a land application permit for the site selected for land farming. Two potential sites have been identified.

Forty-eight of 150 soil samples contained diesel-range TPH and/or O&G in concentrations above guidelines issued by the NCDEHNR Groundwater Section (Figure 4a). Laboratory analysis of selected soil for volatile and semivolatile organic compounds showed primarily low levels of petroleum-related compounds. Some non-petroleum organic contaminants were also detected but their concentrations were relatively low and their occurrences sporadic.

Soil samples were analyzed for total concentrations of the RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Lead was determined to be present above background levels in concentrations that could be potentially hazardous. The highest concentration of lead as determined by total analysis was 1,760 mg/kg (Figure 4b). A second round of sampling was performed to target areas where high concentrations of lead were detected. These soil samples were analyzed by the TCLP method to determine the leachability of the lead and possible regulatory implications. The highest concentration of extractable lead as determined by the TCLP method was 1.69 mg/L, which is less than the regulatory limit of 5.0 mg/L.

Groundwater samples from eight of 20 temporary monitoring wells contained low levels of petroleum-related compounds. Naphthalene was detected in concentrations above North Carolina groundwater standards in three temporary wells. Pentachlorophenol was detected in a concentration of 160 µg/L in one of the groundwater samples, which is above the NCAC 2L standard of 0.3 µg/L.

Four soil types described in the *Soil Survey of Carteret County* were identified during the field investigation including Leon-Urban land complex (Lu), Carteret sands (CH), Wando-Urban land complex (WuB), and localized occurrences of Lafitte muck (LF) and dredge spoils. An attempt was made during the site investigation to differentiate between the native

soils and fill material. In the area of the site where the land had been built up over former CH and LF soils, the top of native soil was easily identified by the first occurrence of rootlets, which are generally common in these buried soil types. The presence of debris also assisted in identifying non-native soils.

Non-native material, including sawdust, wood debris, concrete, brick, and sandy fill material comprise the upper 4 to 8 feet of soil over much of the site (Figures 3a through 3f). A wedge of dredged sand occurs between the old sea wall and the existing bulkhead (Figure 2b). In general, sawdust and fill sand comprise the lower portion of the non-native soils. This is overlain by more sand but with construction debris (e.g., brick and concrete fragments) becoming more common. In the eastern half to two thirds of the site, the upper portion of the non-native soils contain a 0.5 - 1.5 feet thick "black sand" layer of apparent sand blasting material (Figure 5).

A hydrogeologic study was not conducted during the site investigation.

The study concluded that the contamination at the site in the subsurface soils, the stockpiled soils, and the groundwater, did not meet the regulatory definition of a hazardous waste. The high total lead and total chromium concentrations found in the soil samples appeared to be related to the black sand layer. Further testing by the TCLP method did not identify high leachable concentrations of these metals.

Creosote timbers making up the old seawall and pilings for old rail tracks and possibly buildings were found at the site. The impact of these creosote timbers on the surrounding soil and groundwater appeared very limited. Creosol compounds were not detected during the investigation. Oil and Grease, as detected by Method SW-846 9071, was present above State action levels in 48 out of 143 samples. Its distribution appeared scattered and locally related to apparent creosote-treated timbers, diesel-range fuel contamination, and naturally occurring organics. In samples from near the seawall with black staining and obvious

creosote odors, O&G values were elevated but not extremely high and at least occasionally associated with elevated TPH 3550 values. The source of the diesel-range petroleum contamination was not identified. Diesel or similar fuels are used in wood treatment and it is possible that some of the TPH encountered is related to old building structures (Figures 2b and 6).

3.0 ADDITIONAL ASSESSMENT

A meeting with representatives of Triangle, D.S. Simmons, COE, and DWQ was held at the Wilmington Regional Office on August 20, 1996. In this meeting, the DWQ requested the following: 1) resample the soil areas of high O&G concentrations and analyze for O&G using Method 9071 modified with silica gel cleanup; 2) install permanent monitoring wells and sample; and 3) collect information to demonstrate that surface water will not become impacted by the groundwater contamination.

3.1 Field Activities

On December 17 and 18, 1996, four shallow groundwater monitoring wells (MW-3 through MW-6) were installed at the ARC site. The monitoring wells were installed using a track-mounted ATV drill rig with 4 1/4-inch ID hollow-stem augers. Continuous split-spoon samples were collected in the upper six feet prior to inserting a wood plug in the drill bit. The augers were advanced to between 13 and 14 feet below grade. The plugs were knocked out and a standard 2-inch diameter monitoring well was constructed through the augers. In addition to the monitoring wells, five soil borings (RC-15, RE-17, RH-14, RN-20, and RC-1) were advanced. The locations of all monitoring wells and soil borings are shown on Figure 2. Note that the recent borings advanced for soil resampling, RC-15 for example, are located near the original sample locations, C-15 for example, and are not shown separately on Figure 2. The elevations and positions of the monitoring wells were surveyed by a North Carolina

registered land surveyor. The elevations are listed on Table 7 along with selected well construction information.

A Triangle geologist supervised the drilling and installation of the monitoring wells and collected and described soil samples. The subsurface Drill Logs and Monitoring Well Construction Schematics are included in Appendix A of this report. Well construction Records have been submitted to the central office of the DWQ, as required by State Regulation 15A NCAC 2C.

Each monitoring well was developed using a surface mounted diaphragm pump and disposable tubing. After allowing time for the wells to equilibrate after development, groundwater samples were collected using a new disposable bailer for each well. All groundwater and soil samples were placed into laboratory-supplied glassware, stored in an ice-filled cooler, and sent to a laboratory certified by the NCDEHNR using standard chain-of-custody procedures. The groundwater sampling field data sheets are presented in Appendix A.

On December 19, 1996, falling- and rising-head (slug) tests were performed on monitoring wells MW-4 and MW-5. The test data along with descriptions of the test procedures are included in Appendix B. Also during this period from December 17 through 19, 1996, the water level fluctuations in monitoring well MW-1 were recorded (Appendix C).

Confirmation groundwater sampling was conducted on January 13, 1997. Sampling protocol was similar to that described above. A field duplicate, labeled MW-10, was collected from monitoring well MW-4.

After collecting the groundwater samples, pressure transducers were installed in four monitoring wells: MW-1, MW-3, MW-4, and MW-5. Water level fluctuations were monitored from January 13, 1997, to January 17, 1997. Data loggers were used to

automatically record changes in water level every 10 minutes. In addition, periodic measurements of water levels, using a electronic water level indicator, of these four wells plus MW-6, the creek level and the water level in the sedimentation basin were conducted. All water levels were referenced to mean sea level based on top of casing are spot check elevations provided by registered surveyor. The data are presented in Appendix D.

3.2 Soil Analytical Results

The soil and groundwater laboratory data are summarized in Tables 1 through 6. Laboratory data sheets are presented in Appendix H. Soil samples from each boring were collected for laboratory analysis of TPH using Method TPH 3550 and O&G using modified Method SW-846 9071 with silica gel cleanup. The purpose of the silica gel cleanup was to reduce the effects of naturally occurring organics on the analysis. The soil analytical data did not show any consistent lessening of O&G values with silica gel cleanup as from that without silica gel cleanup (Table 2). It is evident in the recent samples that the highest O&G readings correspond to the highest TPH readings (Table 1) which indicates that Method-846 9071 is measuring diesel-range petroleum as O&G. This apparent relationship was noted on the earlier data, but not consistently.

It appears that some of the elevated O&G values are related to petroleum contamination, although the earlier data may have contained some false positives due to naturally occurring organics.

3.3 Groundwater Analytical Results

There were two main purposes in installing permanent monitoring wells. The first purpose was to collect representative groundwater samples. Groundwater samples collected from temporary wells are useful in screening for contaminants but are not considered by the State to be adequate for compliance sampling. Additionally, samples from temporary wells often

contain induced turbidity which could result in false positives for metals and heavier polynuclear aromatic hydrocarbons (PAHs). The high concentration of metals in the earlier temporary well samples were of concern. The recent groundwater data indicate that the RCRA 8 metals identified in the groundwater samples from the temporary wells were sampling induced and not representative of groundwater concentrations. In the samples from the permanent wells, lead was measured once in monitoring well MW-1 above the State groundwater standard at 16.5 µg/L (the State groundwater standard is 15.5 µg/L). The well was resampled and lead was not present in a concentration above the detection limit of 3.0 µg/L.

In addition to metals, the groundwater samples were analyzed for volatile and semivolatile organic compounds. Relatively low levels of petroleum-related organic compounds were detected in MW-3, MW-4 and MW-5. Naphthalene was detected in concentrations up to 38 µg/L, which is above the listed State groundwater standard of 21 µg/L. Figure 7 is an isopleth map of naphthalene concentrations using data combined from the permanent and temporary wells. Several organic compounds which are not listed in the State groundwater standards were detected including n-butylbenzene, sec-butylbenzene, isoprobybenzene, p-isopropyltoluene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene.

A non-petroleum contaminant, pentachlorophenol (PCP), was detected in MW-4 with a maximum of 1,300 µg/L (Figure 8). MW-4 is located in the same area as temporary well J-16, which also detected PCP at 160 µg/L. PCP, as a component in various products, has been used as an herbicide, algacide, defoliant, wood preservative, germicide, fungicide, and molluscicide. Its commercial application in wood treatment began in 1933 and is still in current use. PCPs present use as a pesticide is largely restricted. As a wood preservative, PCP is commonly mixed with diesel-range petroleum (i.e., mineral spirits, No. 2 fuel oil, and kerosene) or can be blended with creosote.

The occurrence of PCP at the ARC site is limited to the area of MW-4. None of the surrounding temporary wells, J-14, H-16, I-19, M-19, and L-16, contained detectable concentrations (>50μg/L) of PCP.

3.4 Site Hydrogeology

The second purpose for installing the wells was to collect data on the groundwater hydrology. To accomplish this, slug tests were performed and water level measurements were conducted. This data is necessary to demonstrate the potential (or lack of potential) to impact surface waters from the discharge of contaminated groundwater.

3.4.1 Hydraulic Conductivity

Two falling and rising head slug tests were conducted at the ARC site to determine hydraulic conductivities. Monitoring wells MW-4 and MW-5 were selected, based on their responses during development, to represent the upper and lower conductivity range, respectively. The analysis, presented in Appendix E, was conducted under two assumptions: 1) that the soils over the entire 10-foot screened interval were equally permeable; and 2) that only the upper soils were permeable - the clayey native soils was assumed as relatively impermeable. The first assumption is clearly not valid at the ARC site. There should be a marked contrast in permeability between the non-native sands and the clayey native soils below. The first assumption, therefore, will result in a calculated hydraulic conductivity that is lower than actual for the permeable sands. However, at the same time, the clayey soil which locally is a clayey sand is not impermeable and assuming it is impermeable may result in over estimating the hydraulic conductivity. The calculated hydraulic conductivities (K), under the first assumption, ranged from 6.2×10^{-4} cm/sec in MW-5, to 3.2×10^{-3} cm/sec in MW-4, and under the second assumption ranged from 1.6×10^{-3} cm/sec to 8.5×10^{-3} cm/sec in MW-5 and MW-4, respectively.

A simple method to estimate the impact of natural discharge is to assume dilution of contaminated groundwater by complete and instantaneous mixing with the surface water. The assumption of relatively instantaneous mixing of groundwater in a creek with greater than 3 feet diurnal tides is probably valid. The 7Q10 (the low flow rate for seven consecutive days expected once every 10 years) is often used as a conservative flow volume to calculate dilution. This is appropriate for man-made point source discharges, but may not always be appropriate for groundwater discharges, since when there is no flow there is also no discharge. According to the WiRO-DWQ, there is no 7Q10 listed for the Calico Creek since it is a tidal creek. Although it is unlikely that there is a zero 7Q10 flow, there is no easy method to estimate minimum flow.

An alternative method to estimate the potential impact of contaminated groundwater naturally discharging to Calico Creek is proposed here. An estimated 37 ft^3/day of potentially contaminated groundwater naturally discharges to the creek in the area of the concrete ramp (calculated by FLOWPATH- Appendix F). The creek changes in volume approximately 75,000 cubic feet each tidal cycle in the area of the concrete ramp (50 foot creek frontage at the ramp by 500 feet wide creek by 3 foot tidal change). It would take roughly 2,000 days of zero net flow in the creek for the volume of discharged contaminated groundwater to equal the volume of one tidal change. With reported complete degradation of naphthalene at 50 μg/L in sea water within 10 to 500 days (Verschueren, 1983), it is clear that discharge of even the maximum detected concentration of 38 μg/L will not impact the creek.

Bacterial degradation of pentachlorophenol is also commonly reported. A search on the internet yielded the following reported decay rates in half-lives: 15 to 48 days for anaerobic and aerobic degradation, respectively (source: EXTOXNET), and 20 to 200 days (source found at gopher://ecosys.drdr.Vi...oxics/ Pentachlorophenol). With this information, it is still

obvious that the limited volume of groundwater discharging to the creek at the maximum concentration of 1,300 μg/L will not impact the creek.

8.0 CORRECTIVE ACTION PLAN

The CAP proposes natural remediation for the contaminated soil and groundwater. A monitoring program is proposed to evaluate the effectiveness of this plan. Although not part of this plan, the proposed construction activities at the site will assist in the clean-up and are discussed below.

8.1 Contaminated Soil

The soils at the site have been impacted by metal contamination (primarily lead), diesel-range fuel and its related volatile and semivolatile compounds, localized occurrences of creosote-treated timbers, and sporadic occurrences of non-petroleum compounds (acetone, MEK, and chlorobenzene). Because of the multiple origins of the O&G values from Method 9071 (diesel-fuel, natural organics, oil and grease, and possibly creosote) and the lack of evidence of used or waste oil, O&G will not be discussed separately in this section.

TCLP testing of the thin lead-bearing sand has demonstrated that the lead does not occur in leachable form. This is supported by the low lead content in groundwater samples collected from the permanent wells. The site is an industrial site, and once construction is complete and the site paved and landscaped, there will be no significant exposure risk. Because of the lack of environmental impact or exposure risk (except during the construction phase), there is no need for corrective action for lead-bearing sand. However, if construction proceeds as currently planned, over three quarters of the estimated area containing the lead-bearing sand will be removed. The planned excavation will remove the upper soils at the site from the

existing excavation areas north east to the existing bulkhead and southeast nearly to the area concrete ramp (Figure 13).

Diesel-range TPH was detected in the soil over a large part of the site, but is distributed in a random pattern that does not point to a single source. Soil analysis for volatile and semivolatile organic compounds detected several compounds typical of diesel range fuels. Because some of these same compounds were also detected in the groundwater, it appears that the soil contamination is a secondary source for groundwater contamination. However, as shown in Section 7, there is no significant impact of these contaminants to Calico Creek. Because of the lack of environmental impact, this plan proposes no active remedial action. As noted above, the proposed construction activities will remove some of the contaminated soil, possibly up to half. All of the known contaminated soil within the dock areas will be removed. However, some TPH contaminated soil will remain northeast of the existing excavation, unlike the lead-bearing sand which occurs very shallow, within 2 foot of grade. Figure 13 is an isopach map of the non-native soils remaining in the proposed excavation area. The data collected indicate that the TPH contamination is primarily in the non-native soils.

There is no evidence that the creosote-treated timbers have caused an environmental impact. Timbers encountered during excavation will be handled and disposed of in a proper manner.

There is equally no evidence of the non-petroleum compounds acetone, MEK, and chlorobenzene resulting in an environmental impact. Their occurrence is limited and sporadic and there is no detection of these compounds in the groundwater.

8.2 Contaminated Groundwater

Two compounds were detected in groundwater samples above listed State groundwater standards. These compounds are naphthalene and pentachlorophenol. The maximum detected concentrations were 55 µg/L and 1,300 µg/L, respectively. Several other organic compounds typical of diesel-range petroleum which are not listed in the State groundwater standards were also detected including, n-butylbenzene, sec-butylbenzene, isoprobybenzene, p-isopropyltoluene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene. Their maximum detected concentrations were 29 µg/L, 37 µg/L, 64 µg/L, 190 µg/L, 120 µg/L, and 30 µg/L, respectively. The potential impact of naphthalene and pentachlorophenol to Calico Creek was considered in Section 7. The modeling suggests that shallow groundwater impacted by these compounds could be discharging to Calico Creek; however, simple calculations of discharge volumes indicated that there is no potential impact to the creek. For this reason, the CAP proposes natural attenuation.

It should be noted that the proposed construction will encounter groundwater in the area of impacted groundwater. Proper engineering controls should be taken to minimize the risk of environmental impact during dewatering operations. There is a possibility that dewatering, if it occurs, will significantly reduce the limited groundwater contamination at the site.

8.3 Monitoring Plan

The proposed construction activities at the site may necessitate the abandonment of monitoring wells MW-3, MW-4, and MW-5. This plan proposes to replace these wells after construction and install one additional monitoring well, MW-7 proposed, between MW-4 and the concrete boat ramp. The monitoring wells should be tested quarterly for the first year. The samples should be analyzed by Methods SW-846 8260 and 8270 or other methods

approved by the DWQ. A report will be prepared after the first monitoring event and after one year. If at any time the contaminants are detected in concentrations one order of magnitude above those listed in this report (550 μg/L for naphthalene and 13,000 for pentachlorophenol), or if free product is detected, the regional office will be contacted within 24 hours. After one year the frequency of monitoring should be re-evaluated.

Table 4
Soil Analysis - TCLP and Total Metals
(Previous Samples)

Army Reserve Center										
Triangle Project No. 033-0509										
	SOIL BORING SAMPLES									
Sample I.D.	G11R	G17R	I15R	J10R	J14R	J16R	K11R	L18R	L22R	M19R
Sample Date	3/26/96	3/27/96	3/26/96	3/27/96	3/26/96	3/26/96	3/26/96	3/26/96	3/26/96	3/26/96
Sampled Interval (ft.)	0.0 - 5.0	0.5 - 1.5	0.0 - 4.5	0.0 - 0.5	0.0 - 5.0	0.0 - 5.0	0.7 - 3.5	0.0 - 5.7	0.6 - 5.8	0.0 - 7.8
Metals (total analysis)		NA	NA		NA	NA	NA	NA	NA	NA
Arsenic (mg/kg)	5			6.7						
Chromium (mg/kg)	22.3			173						
Lead (mg/kg)	156			807						
Mercury (mg/kg)	2.5			0.70						
Metals (TCLP)										
Arsenic (mg/L)	0.006	0.005	0.020	<0.004	0.008	0.006	0.005	0.006	0.007	<0.004
Chromium (mg/L)	0.007	0.012	0.002	0.018	0.002	0.001	0.002	0.002	0.002	0.001
Lead (mg/L)	0.588	1.69	0.047	0.702	0.038	0.093	0.060	0.094	0.023	0.112
Mercury (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
NA = Not Analyzed										

Table 4
Soil Analysis - TCLP and Total Metals
(Previous Samples)

Army Reserve Center								
Triangle Project No. 033-0509								
	SOIL BORING SAMPLES				SOIL PROFILE SAMPLES			
Sample I.D.	M21R	M21RD	N20Ra	N20Rb	TP1a	TP1b	TP1bD	TP1c
Sample Date	3/26/96	3/26/96	3/26/96	3/26/96	3/27/96	3/27/96	3/27/96	3/27/96
Sampled Interval (ft.)	3.0 - 6.7	3.0 - 6.7	0.7 - 2.7	6.0 - 8.0	0.0 - 0.5	0.5 - 1.0	0.5 - 1.0	1.0 - 1.9
Metals (total analysis)			NA				NA	
Arsenic (mg/kg)	4.9	4.5		1.3	2.8	3.4		5.1
Chromium (mg/kg)	16.0	12.7		13.3	11.5	173		17.0
Lead (mg/kg)	158	148		6.3	52.1	773		40.9
Mercury (mg/kg)	4.3	1.4		<0.098	0.18	0.31		1.4
Metals (TCLP)								
Arsenic (mg/L)	0.011	0.009	0.021	0.012	<0.004	<0.004	<0.004	<0.004
Chromium (mg/L)	0.002	0.002	0.018	0.002	0.006	0.141	0.146	0.001
Lead (mg/L)	0.198	0.217	0.88	0.013	0.011	0.417	0.429	0.040
Mercury (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
NA = Not Analyzed								

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Table 5
Groundwater Analysis - Recent Samples

Army Reserve Center									
Triangle Project No. 033-0509									
Sample I.D.	MW-1		MW-2		MW-3		MW-4		MW-10*
Sample Date	12/19/96	1/13/97	12/19/96	1/13/97	12/19/96	1/13/97	12/19/96	1/13/97	1/13/97
Metals (µg/L)								MW-4 field duplicate*	
Arsenic	12.7	15.0	<10.0	<10.0	15.2	20.1	10.0	<10.0	<10.0
Barium	677	992	318	321	228	<200.0	<200.0	221	278
Cadmium	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Chromium	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Iron	NA	584	NA	4,280	NA	971	NA	584	9,770
Lead	16.5	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00	3.21
Mercury	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Selenium	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Silver	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
SW-846 8260(µg/L)									
n-Butylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	20	15	16
sec-Butylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	25	18	22
Carbon Disulfide	220	59	87	80	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	22	14	15
Isopropylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	41	23	31
p-Isopropyltoluene	<10	<5.0	<5.0	<5.0	14	35	13	9	<5.0
Naphthalene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	22	38	25
n-Propylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	56	32	41
1,2,4 - Trimethylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	120	90	91
1,3,5 - Trimethylbenzene	<10	<5.0	<5.0	<5.0	<5.0	<5.0	30	21	23
Xylene(s)	<10	<5.0	<5.0	<5.0	<5.0	<5.0	47	32	36
SW-846 8270 (µg/L)									
bis (2-ethylhexyl) phthalate	<10.0	61	<10.0	<10.0	<10.0	<10.0	<200	<200	<200
Naphthalene	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<200	<200	<200
Pentachlorophenol	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	1,200	590	1,300
Alkalinity (mg/L)	NA	616	NA	243	NA	440	NA	528	530
Nitrate (mg/L)	NA	0.039	NA	0.045	NA	0.03	NA	0.069	0.051
T-Phosphate	NA	1.74	NA	2.05	NA	2.74	NA	7.24	4.93
Sulfate (mg/L)	NA	830	NA	1,500	NA	270	NA	176	171
Plate count (CFU/mL)	NA	11,600	NA	510	NA	64,100	NA	3,990	3,000
Field Data									
pH	6.47	6.9	7.24	7.2	6.93	6.7	6.76	6.9	
Conductivity (µS/cm)	>20,000	>20,000	>20,000	>20,000	15,600	8,600	8,300	9,000	
Temperature (F)	59	58	61	56	56.5	62	62	59	
D.O. (ppm)	NA	0	NA	0	NA	0	NA	NA	

Table 5
Groundwater Analysis - Recent Samples

Army Reserve Center					
Triangle Project No. 033-0509					
Sample I.D.	MW-5		MW-6		*2L*
Sample Date	12/19/96	1/13/97	12/19/96	1/13/97	*Standard*
Metals (µg/L)					
Arsenic	<10.0	<10.0	10.0	<10.0	*50*
Barium	409	595	<200.0	<200.0	*2,000*
Cadmium	<5.00	<5.00	<5.00	<5.00	*5*
Chromium	<10.0	<10.0	<10.0	<10.0	*50*
Iron	NA	30,600	NA	2,060	*300*
Lead	<3.00	<3.00	<3.00	3.45	*15*
Mercury	<0.200	0.224	<0.200	<0.200	*1.1*
Selenium	<5.00	<5.00	<5.00	<5.00	*50*
Silver	<10.0	<10.0	<10.0	<10.0	*18*
SW-846 8260(µg/L)					
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	^
sec-Butylbenzene	<5.0	<5.0	<5.0	<5.0	^
Carbon Disulfide	<5.0	<5.0	<5.0	<5.0	*700*
Ethylbenzene	<5.0	<5.0	<5.0	<5.0	*29*
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	^
p-Isopropyltoluene	<5.0	<5.0	<5.0	<5.0	^
Naphthalene	34	6	<5.0	<5.0	*21*
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	^
1,2,4 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	^
1,3,5 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	^
Xylene(s)	<5.0	<5.0	<5.0	<5.0	*530*
SW-846 8270 (µg/L)					
bis (2-ethylhexyl) phthalate	<10.0	<10.0	<10.0	<10.0	^
Naphthalene	26	<10.0	<10.0	<10.0	*21*
Pentachlorophenol	<50.0	<50.0	<50.0	<50.0	*0.3*
Alkalinity (mg/L)	NA	505	NA	253	
Nitrate (mg/L)	NA	0.028	NA	0.063	
T-Phosphate	NA	3.34	NA	2.2	
Sulfate (mg/L)	NA	598	NA	102	
Plate count (CFU/mL)	NA	5,650	NA	13,300	
Field Data					
pH	6.85	6.9	7.10	6.9	
Conductivity (µS/cm)	6,460	12,600	1,550	1,330	
Temperature (F)	56	58	62	58	
D.O. (ppm)	NA	NA	NA	0	

Table 6
Groundwater Analysis - Previous Samples

Army Reserve Center					
Triangle Project No. 033-0201					
Sample I.D.	B2	C13	D4	D10	E7
Sample Date	2/8/96	2/9/96	2/8/96	2/9/96	2/8/96
Metals (total analysis)					
Arsenic (µg/L)	15.5	<10.0	12.5	23.3	10.6
Barium (µg/L)	242	<200.0	<200.0	346	<200
Cadmium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Chromium (µg/L)	15.3	<10.0	<10.0	<10.0	<10.0
Lead (µg/L)	12.4	11.5	<3.00	4.63	<3.00
Mercury (µg/L)	<0.200	<0.200	<0.200	0.22	<0.200
Selenium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Silver (µg/L)	<10.0	<10.0	<10.0	<10.0	<10.0
SW-846 8260(µg/L)					
p-Isopropyltoluene	<5.0	<5.0	<5.0	<5.0	<5.0
sec-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	<5.0	26	<5.0	<5.0	<5.0
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,4 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
1,3,5 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorobutadiene	6.8	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/L)					
Acenaphthene	<10.0	12	<10.0	<10.0	<10.0
bis(2-Ethylhexyl) phthalate	<10.0	<10.0	<10.0	<10.0	<10.0
Dibenzofuran	<10.0	<10.0	<10.0	<10.0	<10.0
Fluorene	<10.0	<10.0	<10.0	<10.0	<10.0
Indeno (1,2,3-cd) pyrene	<10.0	<10.0	<10.0	<10.0	<10.0
2-Methylnaphthalene	<10.0	21	<10.0	<10.0	<10.0
Naphthalene	<10.0	20	<10.0	<10.0	<10.0
Pentachlorophenol	<50.0	<50.0	<50.0	<50.0	<50.0
Phenanthrene	<10.0	<10.0	<10.0	<10.0	<10.0
TICs (total)	36	97	34	102	44
NA - Not Analyzed					
TICs = Tentatively Identified Compounds					

Table 6
Groundwater Analysis - Previous Samples

Army Reserve Center					
Triangle Project No. 033-0201					
Sample I.D.	E15	F12	F18	G9	H12
Sample Date	2/9/96	2/9/96	2/9/96	2/8/96	2/8/96
Metals (total analysis)					
Arsenic (µg/L)	16.8	<10.0	<10.0	<10.0	**50.1**
Barium (µg/L)	<200.0	<200.0	<200.0	<200.0	<200.0
Cadmium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Chromium (µg/L)	28	<10.0	<10.0	10.4	<10.0
Lead (µg/L)	**19.6**	**24.1**	<3.00	**16.7**	**34.6**
Mercury (µg/L)	<0.200	0.217	<0.200	<0.200	0.234
Selenium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Silver (µg/L)	<10.0	<10.0	<10.0	<10.0	<10.0
SW-846 8260(µg/L)					
p-Isopropyltoluene	22	<5.0	<5.0	<5.0	<5.0
sec-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	<5.0	<5.0	<5.0	<5.0	<5.0
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,4 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
1,3,5 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorobutadiene	<5.0	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/L)					
Acenaphthene	<10.0	<10.0	<10.0	<10.0	<10.0
bis(2-Ethylhexyl) phthalate	<10.0	<10.0	<10.0	<10.0	<10.0
Dibenzofuran	<10.0	<10.0	<10.0	<10.0	<10.0
Fluorene	<10.0	<10.0	<10.0	<10.0	<10.0
Indeno (1,2,3-cd) pyrene	<10.0	<10.0	<10.0	<10.0	<10.0
2-Methylnaphthalene	<10.0	<10.0	<10.0	<10.0	<10.0
Naphthalene	<10.0	<10.0	<10.0	<10.0	<10.0
Pentachlorophenol	<50.0	<50.0	<50.0	<50.0	<50.0
Phenanthrene	<10.0	<10.0	<10.0	<10.0	<10.0
TICs (total)	442	34	23	48	153
NA - Not Analyzed					
TICs = Tentatively Identified Compounds					

Table 6
Groundwater Analysis - Previous Samples

Army Reserve Center					
Triangle Project No. 033-0201					
Sample I.D.	H12D	H16	H22	I19	J14
Sample Date	2/8/96	2/8/96	2/8/96	2/8/96	2/8/96
Metals (total analysis)					
Arsenic (µg/L)	48.1	<10.0	<10.0	12.7	<10.0
Barium (µg/L)	<200.0	<200.0	234	870	<200.0
Cadmium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Chromium (µg/L)	10.4	<10.0	<10.0	12	<10.0
Lead (µg/L)	59.3	9.53	3.66	207	6.62
Mercury (µg/L)	0.512	<0.200	<0.200	<0.200	<0.200
Selenium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Silver (µg/L)	<10.0	<10.0	<10.0	<10.0	<10.0
SW-846 8260(µg/L)					
p-Isopropyltoluene	<5.0	<5.0	<5.0	9.2	<5.0
sec-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	<5.0	<5.0	<5.0	55	<5.0
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,4 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
1,3,5 - Trimethylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorobutadiene	<5.0	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/L)					
Acenaphthene	<10.0	<10.0	<10.0	19	<10.0
bis(2-Ethylhexyl) phthalate	<10.0	<10.0	<10.0	<10.0	<10.0
Dibenzofuran	<10.0	<10.0	<10.0	12	<10.0
Fluorene	<10.0	<10.0	<10.0	13	<10.0
Indeno (1,2,3-cd) pyrene	<10.0	<10.0	<10.0	<10.0	<10.0
2-Methylnaphthalene	<10.0	<10.0	<10.0	26	<10.0
Naphthalene	<10.0	<10.0	<10.0	36	<10.0
Pentachlorophenol	<50.0	<50.0	<50.0	<50.0	<50.0
Phenanthrene	<10.0	<10.0	<10.0	17	<10.0
TICs (total)	40	205	134	293	24
NA - Not Analyzed					
TICs = Tentatively Identified Compounds					

Table 6
Groundwater Analysis - Previous Samples

Army Reserve Center					
Triangle Project No. 033-0201					
Sample I.D.	J16	L16	M19	N20	M21
Sample Date	2/9/96	2/8/96	2/8/96	2/8/96	2/9/96
Metals (total analysis)					
Arsenic (µg/L)	<10.0	<10.0	12.2	31.8	14.8
Barium (µg/L)	242	<200.0	1140	1150	1010
Cadmium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Chromium (µg/L)	15.7	<10.0	47.4	37.9	17.3
Lead (µg/L)	**108**	49.4	**265**	**490**	**105**
Mercury (µg/L)	0.326	<0.200	**2.63**	**6.22**	0.887
Selenium (µg/L)	<5.00	<5.00	<5.00	<5.00	<5.00
Silver (µg/L)	<10.0	<10.0	<10.0	<10.0	<10.0
SW-846 8260(µg/L)					
p-Isopropyltoluene	<5.0	<5.0	<5.0	13	180
sec-Butylbenzene	<5.0	<5.0	37	<5.0	<5.0
n-Butylbenzene	<5.0	<5.0	29	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	64	<5.0	<5.0
Naphthalene	<5.0	12	48	<5.0	<5.0
tert-Butylbenzene	<5.0	<5.0	14	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	130	<5.0	<5.0
1,2,4 - Trimethylbenzene	5.7	<5.0	13	<5.0	<5.0
1,3,5 - Trimethylbenzene	<5.0	<5.0	7.8	<5.0	<5.0
Hexachlorobutadiene	<5.0	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/L)					
Acenaphthene	<10.0	<10.0	<10.0	<10.0	<10.0
bis(2-Ethylhexyl) phthalate	<10.0	<10.0	<10.0	<10.0	<10.0
Dibenzofuran	<10.0	<10.0	<10.0	<10.0	<10.0
Fluorene	<10.0	<10.0	<10.0	<10.0	<10.0
Indeno (1,2,3-cd) pyrene	<10.0	<10.0	<10.0	<10.0	<10.0
2-Methylnaphthalene	<10.0	<10.0	16	12	<10.0
Naphthalene	<10.0	<10.0	**41**	<10.0	<10.0
Pentachlorophenol	**160**	<50.0	<50.0	<50.0	<50.0
Phenanthrene	<10.0	<10.0	<10.0	<10.0	<10.0
TICs (total)	1,328	111	437	368	221
NA - Not Analyzed					
TICs = Tentatively Identified Compounds					

Table 6

Groundwater Analysis - Previous Samples

Army Reserve Center			
Triangle Project No. 033-0201			
Sample I.D.	M21D	O17	*2L*
Sample Date	2/9/96	2/8/96	*Standard*
Metals (total analysis)			
Arsenic (µg/L)	18.8	12.2	*50*
Barium (µg/L)	1010	340	*2,000*
Cadmium (µg/L)	<5.00	<5.00	*5*
Chromium (µg/L)	24	12.9	*50*
Lead (µg/L)	113	88.3	*15*
Mercury (µg/L)	0.964	<0.200	*1.1*
Selenium (µg/L)	<5.00	<5.00	*50*
Silver (µg/L)	<10.00	<10.0	*18*
SW-846 8260(µg/L)			
p-Isopropyltoluene	190	<5.0	^
sec-Butylbenzene	<5.0	<5.0	^
n-Butylbenzene	<5.0	<5.0	^
Isopropylbenzene	<5.0	<5.0	^
Naphthalene	<5.0	<5.0	*21*
tert-Butylbenzene	<5.0	<5.0	^
n-Propylbenzene	<5.0	<5.0	^
1,2,4 - Trimethylbenzene	<5.0	<5.0	^
1,3,5 - Trimethylbenzene	<5.0	<5.0	^
Hexachlorobutadiene	<5.0	<5.0	^
SW-846 8270 (µg/L)			
Acenaphthene	<10.0	<10.0	*80*
bis(2-Ethylhexyl) phthalate	<10.0	27	^
Dibenzofuran	<10.0	<10.0	^
Fluorene	<10.0	<10.0	*280*
Indeno (1,2,3-cd) pyrene	<10.0	<10.0	^
2-Methylnaphthalene	<10.0	<10.0	^
Naphthalene	<10.0	<10.0	*21*
Pentachlorophenol	<50.0	<50.0	*0.3*
Phenanthrene	<10.0	<10.0	*210*
TICs (total)	356	226	*Not Applicable*
NA - Not Analyzed	^ *No Listed Groundwater Standard*		
TICs = Tentatively Identified Compounds			

Table 7
Well Construction Information

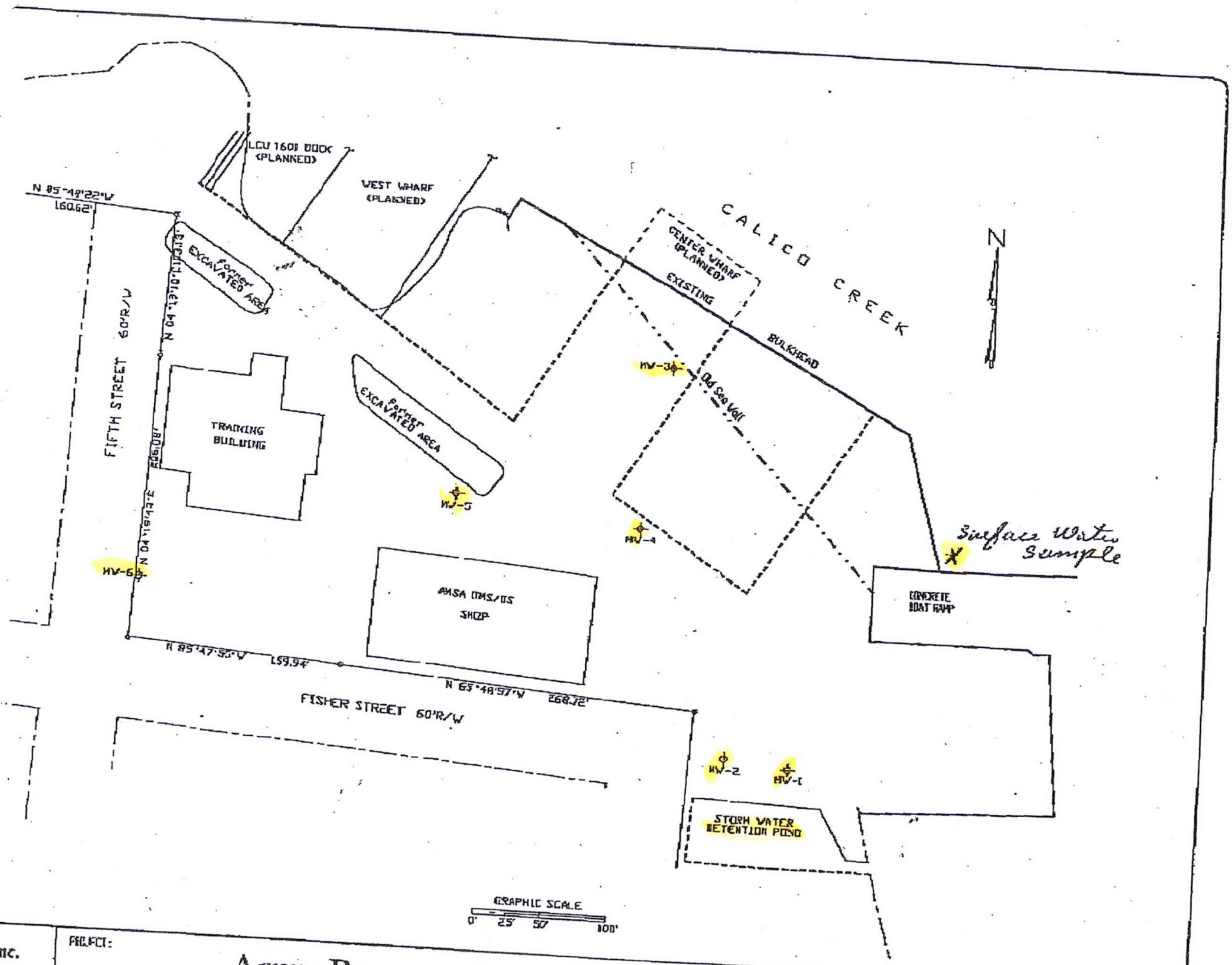
Army Reserve Center - Morehead City									
Triangle Proj. No. 033-0509									
Monitoring Well	Top of casing elevation	Borehole diameter	Well inner diameter	Depth to ground surface	Depth to static water	Depth to top of screen	Depth to bottom of screen	Depth to top of sand pack	Depth to bottom of sand pack
	(feet*)	(inches)	(inches)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
MW-1	3.67	8.0	2.067	-0.3	1.88	1.5	10.5	1.2	12.7
MW-2	3.25	8.0	2.067	-0.2	1.40	1.6	10.6	1.3	12.8
MW-3	7.74	8.0	2.067	3.4	5.01	5.0	15.0	5.0	15.9
MW-4	6.26	8.0	2.067	2.7	4.02	5.0	15.0	4.5	16.2
MW-5	6.46	8.0	2.067	2.6	3.25	5.0	15.0	4.5	16.1
MW-6	4.61	8.0	2.067	-0.7	1.22	2.5	12.5	2.0	12.7
All depths measured from top of casing									

Table 1
Well Construction Information

Army Reserve Center - Morehead City
TRC Proj. # 02333-0010

Monitoring Well	Date Installed	Date Abandoned / Destroyed	Top of casing elevation (feet)	Borehole diameter (inches)	Well inner diameter (inches)	Depth to ground surface (feet)	Depth to static water (feet)	Depth to top of screen (feet)	Depth to bottom of screen (feet)		INTERVAL SCREEN INTERVAL Screen MW from grade
MW-1	1995		3.67	8.0	2.067	-0.3	1.88	1.5	10.5	Flush	
MW-2	1995		3.25	8.0	2.067	-0.2	1.40	1.6	10.6	↓	
MW-3	12/17/96		7.74	8.0	2.067	3.4	1.6 5.01	5.0	15.0		1.6 → 11.6
MW-4	12/17/96		6.26	8.0	2.067	2.7	1.3 4.02	5.0	15.0		2.3 12.3
MW-5	12/17/96	November-00	6.46	8.0	2.067	2.6	0.6 3.25	5.0	15.0		2.4 12.4
MW-6	12/18/96		4.61	8.0	2.067	-0.7	1.22	2.5	12.5	Flush	

All depths measured from top of casing



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PROJECT:

Army Reserve Center - Morehead

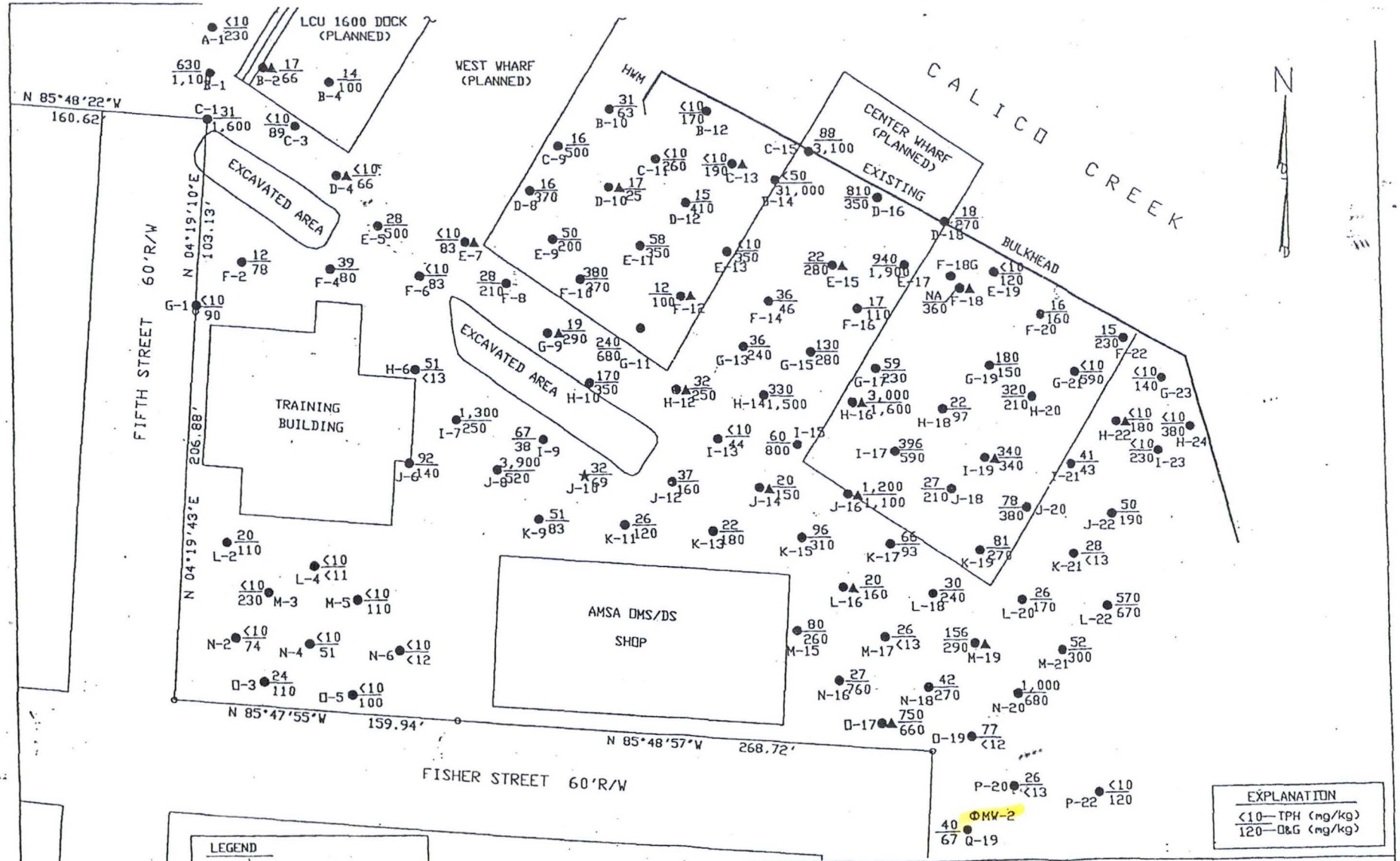
Site Map

PROJ. #: 02333

DRAWN BY: jah

SCALE:

FIGURE: 2


LCU 1600 DOCK (PLANNED)
WEST WHARF (PLANNED)
HWM
CALICO CREEK
CENTER WHARF (PLANNED)
EXISTING BULKHEAD
EXCAVATED AREA
EXCAVATED AREA
TRAINING BUILDING
AMSA DMS/DS SHOP
FIFTH STREET 60'R/W
FISHER STREET 60'R/W
N 85°48'22"W 160.62'
N 04°19'10"E 103.13'
N 04°19'43"E 206.88'
N 85°47'55"W 159.94'
N 85°48'57"W 268.72'
N
LEGEND
SOIL BORING SAMPLE
TEMPORARY MONITORING WELL
PERMANENT MONITORING WELL
TEST PIT SAMPLE
GRAPHIC SCALE
0' 50' 100'
EXPLANATION
<10 — TPH (mg/kg)
120 — O&G (mg/kg)
TRIANGLE ENVIRONMENTAL INC.
RALEIGH, N.C.
CHARLOTTE, N.C.
FIGURE 4a
TPH AND O&G CONCENTRATION
U.S.A.R. CENTER / DMS / AMSA
MOREHEAD CITY, NORTH CAROLINA
CADFILE: 96008
DATE PLOTTED: 4-11-96

REFERENCE 7

MEMORANDUM

TO: File

FROM: S. Franch, Environmental Chemist, NC Superfund Section

DATE: May 16, 2005

SUBJECT: Status of U.S. Army Reserve Centers in North Carolina

SITE: USA Reserves XVIII Airborne Corps Sites in North Carolina (see attached email, dated 5-12-05, with list of sites)

Summary from telecommunications of April 7 and May 5, 2005 with Michelle Hook (803 751-6757). She is the Environmental Manager that oversees the reserve centers in both North and South Carolina. Ms. Hook is a contractor to the US Army 81st Regional Readiness Command (RRC), Installation Management, employed by Bregman & Company and based in Fort Jackson, SC. The RRC's environmental division chief is Mr. Steven Francis (205 912-6957) who is based in Alabama.

Michelle Hook has visited all of the NC sites in the capacity of an environmental auditor. She has been in this position since 1999 and doesn't have many records prior to 1992. Prior to 1992, military bases were not required to comply with local environmental regulations or keep records of spent solvents, nor did they have an Environmental Program. They did have guidelines on handling of hazardous substances such as Army Regulations 200-1 and 200-2. The Federal Facilites Compliance act was passed in 1992 that required the military to abide by local regulations and keep records of spent chemicals. All of these reserve centers are conditionally exempt from RCRA.

As auditor she examines the sites for dead vegetation, inquires about any spills, reviews handling procedures for various solvents and reviews their recycling program. The Defense Reutilization Marketing Office (DRMO) manages recyleable and non-recyled generated products at military installations. This program selects a contractor to retrieve and redistribute for reprocessing or reuse as a fuel additive in boilers elsewhere. All spent solvents (used oil, antifreeze, lubricants, and batteries) are collected by a contractor (Safety Kleen) and transported off site. The contractor also removes such items as any leftover paint cans, oil soaked vermiculite, and greasy rags.

The original administrator of these centers --Director of Engineering and Housing-- was based under the 18th Airborne Corps at Fort Bragg. None of the reserve centers have gasoline pumps on site. Fuel is obtained at nearby civilian gas stations and nearby military installations. All of the centers had heating oil tanks, mainly above

ground. These have been removed during the coversion to natural gas. Both the Hickory (NC6 210 021 626) and the Wilmington (NC0 210 021 929) centers had underground storage tanks for heating oil. Contractors that removed the oil tanks would determine whether samples should be obtained if they saw any suspected leaks or soil discoloration. Several of the centers have only administration buildings with no facilities for vehicle maintenance. None of the centers were on well water. Because the reserve centers are mostly located within the city, all are connected to city sewers.

Two of the centers are in the process/or have been sold. These are the Greenville center (NC8 210 022 044) and the Durham Center (NC9 210 022 787) on Foster Street. The Greenville center is undergoing an EBS (Environmental Baseline Study) prior to being sold. The Durham Center on Foster Street has been sold to the City of Durham. A Durham Reserve Center still remains on Carol Street (NC4 210 021 891).

The Rocky Mount center (NC8 210 021 624) had a non-reportable quantity spill of hydraulic fluid. The Morehead City Reserve center (NC5 210 022 906) has been undergoing a site investigation. This was initiated since there had been construction plans to add more piers to accommodate additional landing boats. This project has been delayed following September 2001. This harbor area had been used for shipbuilding periodically since the 1860s.

Attachment: Email from Michelle Cook dated 5-12-05 (USA Reserve Centers in NC).

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

REFERENCE 8

RECEIVED
AUG 17 1990
SUPERFUND SECTION

AUG 1 4 1990

4WD-RCRA & FF

Colonel K.W. Crissman
Director of Engineering & Housing
Headquarters, XVIII Airborne Corps & Fort Bragg
Fort Bragg, North Carolina 28307-5000

Re: Preliminary Assessments
U.S. Army Reserve Centers in North Carolina

Dear Colonel Crissman:

The Preliminary Assessment forms for potential hazardous waste sites at U.S. Army Reserve Centers in North Carolina, submitted by letter of June 21, 1990, have been reviewed by the U.S. Environmental Protection Agency. Based upon the information submitted and a telephone verification by Mr. William A. Kern of your Directorate, we have concluded that no further action is needed at this time.

If any releases of hazardous substances to the environment should occur in the future or any information on any past releases should be found, these should be reported to EPA. If you have questions concerning this review, please contact Mr. J.C. Meredith, P.E., Remedial Project Manager, at (404) 347-3016.

Sincerely yours,

James H. Scarbrough

James H. Scarbrough, P.E., Chief
RCRA & Federal Facilities Branch
Waste Management Division

cc: Lee Crosby, NCDEHNR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

REFERENCE 9

AUG 27 1991

WD-RCRA & FF

RECEIVED

SEP 09 1991

HAZARDOUS WASTE SECTION

Certified Mail
Return Receipt Requested

Commander
Directorate of Engineering and Housing
Attention: AFZA-DE-RJ (Mr. Robert Turner)
Fort Bragg, NC 28307

RE: Updating Preliminary Assessments for the Revised Hazard Ranking System
U. S. Army Reserve Centers

Dear Sir:

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires the U.S. Environmental Protection Agency (EPA) to establish a Federal Agency Hazardous Waste Compliance Docket to provide information on the status and compliance of federal facilities that may have releases of hazardous substances. Section 120 specifically addresses federal agency compliance with requirements on response actions, site evaluations, and hazard ranking procedures for facilities on the Docket. The U. S. Army Reserve Centers on the enclosed list are on the Docket.

EPA Region IV is currently contacting each federal facility on the Docket but not on the National Priorities List (NPL) to request updated information required by the revised Hazard Ranking System (HRS2) of the National Contingency Plan (NCP), which became effective March 14, 1991. Our records indicate that a Preliminary Assessment (PA) report or its equivalent was submitted previously for the reserve centers and that it was determined that no further action was needed at that time. We are writing to request updated information on any releases of hazardous substances that may have occurred or been discovered since that time.

We are enclosing the basic guidelines for a Preliminary Assessment. If the EPA determines from the updated PA information that a release has occurred or there is a potential for release, we may require further investigation later in the form of a Site Inspection (SI). We are also enclosing guidelines on the requirements of HRS2, generally to be utilized following an SI; however, we are not requesting that level of investigation at this time. Both PA and SI are defined in the NCP (40 CFR 300).

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We are requesting submittal of the updated PA information within 60 days of receipt of this letter. If that is not feasible, we request submittal of a timetable for compliance within 30 days of receipt of this letter.

If you have questions regarding the updating of PA information, please contact Mr. J. C. Meredith of this office at (404) 347-3016.

Sincerely yours,

Beverly A. Spragg

for James H. Scarbrough, P.E., Chief
RCRA & Federal Facilities Branch
Waste Management Division

Enclosure

cc: Mr. William L. Meyer, Director
Division of Solid Waste Management
North Carolina Department of Environment,
Health & Natural Resources
Post Office Box 27687
Raleigh, NC 27611-7687

Commander
U. S. Army Toxic & Hazardous Materials Agency
CETHA-IR-S (Conrad Swann)
Aberdeen Proving Ground, MD 21010-5401

cc: Jack Butler
Superfund

REFERENCE 10

REFERENCE 10

SITE ASSESSMENT
and
WORK PLAN FOR CORRECTIVE ACTION
U.S. ARMY RESERVE CENTER
MOREHEAD CITY
CARTERET COUNTY
NORTH CAROLINA

PREPARED FOR:

D.S. SIMMONS, INC.
GOLDSBORO, NORTH CAROLINA

PREPARED BY:

TRIANGLE ENVIRONMENTAL, INC.
RALEIGH, NORTH CAROLINA

NORTH CAROLINA PROFESSIONAL SEAL 020101 ENGINEER R. S. LAWTER, JR.

TRIANGLE PROJECT NO. 033-0201
CONTRACT NO. DACA 54-94-C0026

NORTH CAROLINA PROFESSIONAL SEAL 7747 ENGINEER R. STANLEY

AUGUST 1996

AROCSA_CAPR.DOC

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(Continued)

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Appendix A Boring Logs
Appendix B Groundwater Sampling Field Data Sheets
Appendix C Laboratory Data Sheets (bound separately)

EXECUTIVE SUMMARY

Triangle Environmental, Inc. (Triangle) was contracted by D.S. Simmons, Inc. to perform an environmental investigation and prepare a plan for corrective action for the Army Reserve Center (ARC) site located in Morehead City on Fisher Street between 4th and 5th Streets. At the time of the investigation the site was under construction. The purpose of the investigation was to identify and characterize potential soil and groundwater contamination at the site. The purpose of the Plan for Corrective Action is to identify the regulatory impact and health and safety concerns that the identified contaminants may have on further construction activities and to recommend appropriate actions.

Forty-eight of 150 soil samples contained petroleum compounds in concentrations above guidelines issued by the North Carolina Department of Environment, Health and Natural Resource (NCDEHNR) Groundwater Section. These petroleum compounds were primarily related to diesel-range fuel and oil and grease compounds. Laboratory analysis of selected soil for volatile and semivolatile organic compounds showed primarily low levels of petroleum-related compounds. Some non-petroleum organic contaminants were also detected but their concentrations were relatively low and their occurrences sporadic.

Soil samples were analyzed for total concentrations of the RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Lead was determined to be present above background levels in concentrations that could be potentially hazardous. The highest concentration of lead as determined by total analysis was 1,760 mg/kg. A second round of sampling was performed to target areas where high concentrations of lead were detected. These soil samples were analyzed by the TCLP method to determine the leachability of the lead and possible regulatory implications. The highest concentration of extractable lead as determined by the TCLP method was 1.69 mg/L, which is less than the regulatory limit of 5.0 mg/L.

Groundwater samples from eight of 20 temporary monitoring wells contained low levels of petroleum-related compounds. Naphthalene was detected in concentrations above North Carolina groundwater standards in three temporary wells. Pentachlorophenol was detected in a concentration of 160 μg/L in one of the groundwater samples, which is above the NCAC 2L standard of 0.3 μg/L.

The source of the petroleum contamination was not specifically identified. The petroleum contamination appears to be in the upper four feet of soil with the exception of the old bulk head area where contamination may extend to a depth of eight feet. Elevated concentrations of lead appear to be related to a 0.5 to 1.5 foot thick "black sand" layer of apparent sandblasting material. This black sand occurs over a half to two-thirds of the site and is generally present in the upper two feet of soil.

SITE ASSESSMENT and WORK PLAN for CORRECTIVE ACTION
ARMY RESERVE CENTER

1.0 INTRODUCTION

Triangle Environmental, Inc. (Triangle) was contracted by D. S. Simmons, Inc. to perform an environmental investigation and prepare a plan for corrective action for the Army Reserve Center (ARC) site presently under construction. The site is located north of Fisher Street, between 4th and 5th Streets, in Morehead City (Carteret County), North Carolina (Figure 1). As part of Triangle's on-site investigation, samples were collected from 105 soil borings, 20 temporary wells, one test pit, and five on-site stock piles. After review of the analytical results from the above sampling, Triangle repeated the sampling at 11 soil boring locations, one test pit, five stockpile sample locations, and prepared an additional test pit for detailed soil-profile sampling. Discussions of the field activities and analytical results are presented in Sections 2 and 4, respectively. The sample locations are shown on Figure 2a. This report summarizes the information collected for the on-site investigation.

In addition to this investigation, Triangle was contracted to perform sampling at three off-site properties where soil from the ARC site has been stockpiled or used as topsoil. The off-site sampling is covered in three reports, bound separately.

1.1 Background

No detailed historical review or title search was performed by Triangle for this site. The general background of the site was gathered during conversations with D. S. Simmons' site personnel, ARC personnel, and Army Corps of Engineers personnel. Apparently, there has been some type of industrial activity at the subject site during much of the last 100 years. Reportedly, there was a saw mill at the site some time around the Civil War period and some type of ship refurbishing/sandblasting operation during World War II. A 1960 aerial photograph of the site shows a ship building operation in the eastern half of the site and on the western half, single family dwellings (Figure 2b). In a 1972-73 photograph, the ARC had built wharves on the eastern part of the site and added a new sea wall (Figure 2b). The large

ship building structure had been removed by 1978. After 1978, the site did not significantly change prior to the recent construction activities related to the expansion of the ARC.

1.2 Previous Actions

Two 550-gallon heating oil underground storage tanks (UST) were removed from the site at the existing ARC building located on the south side of Fisher Street in December 1993 (former UST locations are not shown in figures attached to this report). Reportedly, no soil or groundwater contamination was identified above State Action Levels.

On October 10, 1994, Soil and Materials Engineers (S&ME) collected seven soil samples and one groundwater sample from the site. The soil samples were analyzed for total petroleum hydrocarbons (TPH) for gasoline-range organics by Method SW-846 8015M with purge and trap Method 5030, hereafter referred to as Method 5030, and for diesel-range organics by Method SW-846 8015M with extraction 3550, hereafter referred to as Method 3550. Reportedly, none of the soil samples contained TPH in concentrations above the State of North Carolina Action Levels, which are 10 mg/kg for Method 5030, and 40 mg/kg for Method 3550. On the same day, one water sample was collected from the storm water detention pond and analyzed for semi-volatile organic compounds using EPA Method 625. Reportedly, no target compounds were detected above quantitation limits but some unknown hydrocarbons were tentatively identified during a library search of the gas chromatograph mass spectrogram.

On October 16, 1994, the Wilmington District, U.S. Army Corps of Engineers (COE) received a Notice of Violation (NOV) for groundwater quality violations from the State of North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). The NOV was based on a sheen in the storm water detention pond which was observed by a representative of the NCDEHNR.

On November 15 and 16, 1994, Wilmington District COE personnel collected 13 soil samples and one duplicate from borings around the foundation area of the Training Building and AMSA OMS/DS Shop. The samples were analyzed for EPA Priority Pollutants. Minor amounts of Polynuclear Aromatic Hydrocarbons (PAHs) and pesticides were identified

TABLES

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	A1	B1	B2	B4	B4D	B10	B10D
Sample Date	1/18/96	2/1/96	2/6/96	2/6/96	2/6/96	1/23/96	1/23/96
Sampled Interval (ft.)	0.5 - 14.0	0.0-4.6	0.0-5.7	0.0-5.7	0.0-5.7	0.0-4.0	0.0-4.0
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA
TPH 3550 (total - mg/kg)	<10	**630**	17	14	20	31	NA
#2 Fuel Oil (mg/kg)	<10	630	17	14	20	31	
kerosene (mg/kg)	<10	<100	<10	<10	<10	<10	
Varsol (mg/kg)	<10	<100	<10	<10	<10	<10	
O&G SW-846 9071 (mg/kg)	230	**1,100**	66	100	70	63	220
Metals (total analysis)							
Arsenic (mg/kg)	5.42	2.33	2.84	4.14	4.24	2.89	2.76
Barium (mg/kg)	<25.3	<25.4	34.6	<24.6	<24.2	<25.6	<26.3
Cadmium (mg/kg)	<0.632	<0.635	<0.624	<0.615	<0.605	<0.640	<0.658
Chromium (mg/kg)	15.7	5.2	7.19	15.5	12.1	13.9	18.1
Lead (mg/kg)	8.66	77.9	44.4	5.6	69.3	96.9	69
Mercury (mg/kg)	<0.126	0.237	<0.125	<0.123	<0.121	0.454	0.324
Selenium (mg/kg)	<0.632	<0.635	<0.624	<0.615	<0.605	<0.640	<0.658
Silver (mg/kg)	<1.26	<1.27	<1.25	<1.23	<1.21	<1.28	<1.32
Additional Analyses							
SW-846 8260	Y	N	N	N	N	Y	N
SW-846 8270	Y	N	N	N	N	Y	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	B12	C1	C3	C9	C11	C13	C15
Sample Date	1/30/96	1/22/96	1/22/96	1/23/96	1/29/96	1/29/96	1/30/96
Sampled Interval (ft.)	0.0-4.4	0.0-4.5	0.0-5.3	0.0-4.3	0.0-4.7	0.0-3.9	0.0-6.5
TPH 5030 (mg/kg)	<2.0	NA	NA	<2.0	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	<10	31	<10	16	<10	<10	**88**
#2 Fuel Oil (mg/kg)	<10	31	<10	16	<10	<10	88
kerosene (mg/kg)	<10	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	170	**1,600**	89	**500**	**260**	190	**3,100**
Metals (total analysis)							
Arsenic (mg/kg)	3.48	3.53	1.96	4.11	5.74	1.81	2.95
Barium (mg/kg)	<23.8	166	<23.3	<27.7	<24.3	<23.2	<24.0
Cadmium (mg/kg)	<0.595	<0.625	<0.583	<0.694	<6.08	<0.580	<0.601
Chromium (mg/kg)	11.7	23.9	6.11	8.32	11.5	4.85	8.27
Lead (mg/kg)	60.7	**144**	39.4	20.2	72.9	27.1	38.4
Mercury (mg/kg)	<0.119	<0.125	<0.117	0.155	0.364	<0.116	<0.120
Selenium (mg/kg)	<0.595	<0.625	<0.583	<0.694	<0.608	<0.580	<0.601
Silver (mg/kg)	<1.19	<1.25	<1.17	<1.39	<1.22	<1.16	<1.20
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	D4	D8	D10	D12a	D12aD	D12b	D12c
Sample Date	1/22/95	1/30/96	1/24/96	1/24/96	1/24/96	1/24/96	1/24/96
Sampled Interval (ft.)	0.0-4.7	0.0-.35	0.0-8.5	0.0-8.0	0.0-8.0	8.0-9.0	10.0-13.8
TPH 5030 (mg/kg)	NA	<2.0	<2.0	<2.0	<2.0	NA	<2.0
TPH 3550 (total - mg/kg)	<10	16	17	15	16	NA	<10
#2 Fuel Oil (mg/kg)	<10	16	17	15	16		<10
kerosene (mg/kg)	<10	<10	<10	<10	<10		<10
Varsol (mg/kg)	<10	<10	<10	<10	<10		<10
O&G SW-846 9071 (mg/kg)	66	**370**	25	**410**	**310**	NA	30
Metals (total analysis)						NA	
Arsenic (mg/kg)	3.54	<1.21	3.46	8.82	4.31		6.46
Barium (mg/kg)	<24.1	<24.2	<25.0	<24.7	<24.6		37.9
Cadmium (mg/kg)	<0.603	<0.606	<0.626	<0.617	<0.614		<0.672
Chromium (mg/kg)	9.06	3.52	10.8	21	12.7		17.4
Lead (mg/kg)	12.6	5.47	31.6	98.1	**106**		6.73
Mercury (mg/kg)	<0.121	<0.121	0.616	0.381	0.394		<0.134
Selenium (mg/kg)	<0.603	<0.606	<0.626	<0.617	<0.614		<0.672
Silver (mg/kg)	<1.21	<1.21	<1.25	<1.23	<1.23		<1.34
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	Y	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	D14a	D14aD	D14b	D16	D18	E5	E7
Sample Date	1/30/96	1/30/96	1/30/96	1/23/96	1/23/96	1/22/95	1/22/96
Sampled Interval (ft.)	0.0-5.1	0.0-5.1	8.0-14.0	0.0-4.0	0.0-4.0	0.0-5.5	0.0-6.2
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	NA	NA	NA	NA
TPH 3550 (total - mg/kg)	<50	<10	<10	**810**	18	28	<10
#2 Fuel Oil (mg/kg)	<50	<10	<10	810	18	28	<10
kerosene (mg/kg)	<50	<10	<10	<50	<10	<10	<10
Varsol (mg/kg)	<50	<10	<10	<50	<10	<10	<10
O&G SW-846 9071 (mg/kg)	**31,000**	91	130	**350**	**270**	**500**	83
Metals (total analysis)							
Arsenic (mg/kg)	2.07	2.18	4.72	2.92	8.7	3.43	2.24
Barium (mg/kg)	<23.7	<24.6	46.2	<25.3	<23.7	<24.0	<24.0
Cadmium (mg/kg)	<0.593	<0.614	<0.614	<0.632	<0.593	<0.600	<0.599
Chromium (mg/kg)	5.12	7.8	18.2	13.1	12.7	9.04	3.52
Lead (mg/kg)	25.3	72.3	7.33	15.8	35.3	20.7	4.3
Mercury (mg/kg)	<0.119	<0.123	<0.123	0.164	<0.119	<0.120	<0.120
Selenium (mg/kg)	<0.593	<0.614	<0.614	<0.632	<0.593	<0.600	<0.599
Silver (mg/kg)	<1.19	<1.23	<1.23	<1.26	<1.19	<1.20	<1.20
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	E9a	E9b	E11	E13	E13D	E15	E17
Sample Date	1/24/96	1/24/96	1/29/96	1/30/96	1/30/96	1/24/96	1/22/96
Sampled Interval (ft.)	0.0-5.3	8.0-14.0	0.0-5.5	2.0-7.1	2.0-7.1	1.0-6.2	0.0-4.0
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	NA	NA	<2.0	NA
TPH 3550 (total - mg/kg)	**50**	<10	**58**	<10	**360**	22	**940**
#2 Fuel Oil (mg/kg)	<50	<10	58	<10	360	22	940
kerosene (mg/kg)	50	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<50	<10	<10	<10	<10	<10	<100
O&G SW-846 9071 (mg/kg)	200	<12	**350**	**350**	**650**	**280**	**1,900**
Metals (total analysis)					NA		
Arsenic (mg/kg)	3.91	3.07	3.1	3.35		6.63	4.22
Barium (mg/kg)	<26.2	<25.8	<25.1	<24.9		<30.0	<23.9
Cadmium (mg/kg)	<0.654	<0.645	<0.626	<0.623		<0.750	1.33
Chromium (mg/kg)	12	12.6	9.02	11.6		15.8	13.8
Lead (mg/kg)	59.3	5.81	38.6	61.3		58.9	20
Mercury (mg/kg)	0.654	<0.129	0.261	<0.124		<0.150	<0.120
Selenium (mg/kg)	<0.654	<0.645	<0.626	<0.623		<0.750	<0.598
Silver (mg/kg)	<1.31	<1.29	<1.25	<1.24		<1.50	<1.20
Additional Analyses							
SW-846 8260	N	N	N	Y	N	N	N
SW-846 8270	N	N	N	Y	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	E19	F2	F4	F6a	F6b	F8	F10a
Sample Date	1/23/96	1/31/96	1/31/96	1/24/96	1/24/96	1/22/96	2/6/96
Sampled Interval (ft.)	0.0-4.0	0.0-2.9	0.6-3.4	0.0-4.0	8.0-11.8	0.0-6.0	0.0-3.2
TPH 5030 (mg/kg)	NA	<2.0	<2.0	<2.0	<2.0	NA	<2.0
TPH 3550 (total - mg/kg)	<10	12	39	<10	<10	28	12
#2 Fuel Oil (mg/kg)	<10	12	39	<10	<10	28	12
kerosene (mg/kg)	<10	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	120	78	80	83	31	210	110
Metals (total analysis)							
Arsenic (mg/kg)	1.43	3.02	1.96	6.62	12.8	3.17	6.06
Barium (mg/kg)	<24.0	29.8	54.8	<23.9	<24.9	37.6	<23.4
Cadmium (mg/kg)	<0.599	<0.577	0.654	<0.597	<0.622	<0.651	<0.584
Chromium (mg/kg)	4.83	4.24	7.66	6.81	15.8	9.47	17.4
Lead (mg/kg)	12.3	23.8	84.8	8.2	6.51	58.2	73.4
Mercury (mg/kg)	<0.120	<0.115	0.215	<0.119	<0.124	0.352	<0.117
Selenium (mg/kg)	<0.599	<0.577	<0.595	<0.597	<0.622	<3.26	<0.584
Silver (mg/kg)	<1.20	<1.15	<1.19	<1.19	<1.24	<1.30	<1.17
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	F10b	F12	F12D	F14	F16	F18	F18a
Sample Date	2/6/96	1/30/96	1/30/96	1/24/96	1/19/96	1/23/96	1/23/96
Sampled Interval (ft.)	4.0-5.0	0.0-2.5	0.0-2.5	0.7-6.1	0.0 - 6.2	3.3-6.0	6.7-10.0
TPH 5030 (mg/kg)	<2.0	<2.0	NA	<2.0	<2.0	NA	NA
TPH 3550 (total - mg/kg)	**380**	12	NA	36	17	NA	39
#2 Fuel Oil (mg/kg)	380	12		36	17		39
kerosene (mg/kg)	<50	<10		<10	<10		<10
Varsol (mg/kg)	<50	<10		<10	<10		<10
O&G SW-846 9071 (mg/kg)	**370**	100	NA	46	110	**360**	<13.0
Metals (total analysis)							
Arsenic (mg/kg)	4.85	2.34	2.46	9.95	7.24	3.1	2.63
Barium (mg/kg)	42.4	<22.3	<22.4	<28.3	<29.4	<25.1	<25.9
Cadmium (mg/kg)	<0.690	<0.558	<0.560	<0.708	<0.734	<0.628	<0.647
Chromium (mg/kg)	8.54	12.6	13.9	14.2	15.3	8.22	6.77
Lead (mg/kg)	86.9	56.8	54.5	111	47.2	18.6	9.02
Mercury (mg/kg)	4.46	0.339	0.496	1.09	0.286	<0.126	<0.129
Selenium (mg/kg)	<0.690	<0.558	<0.560	<0.708	<0.734	<0.628	<0.647
Silver (mg/kg)	<1.38	<1.12	<1.12	<1.42	<1.47	<1.26	<1.29
Additional Analyses							
SW-846 8260	N	N	N	N	Y	N	N
SW-846 8270	N	N	N	N	Y	Y	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	F18c	F18g	F20	F22	G1	G9	G11
Sample Date	1/23/96	1/24/96	1/23/96	1/23/96	1/31/96	1/22/96	1/24/96
Sampled Interval (ft.)	cuttings	8.0-13.8	0.0-4.0	0.0-2.7	0.0-3.1	0.0-4.9	0.0-5.6
TPH 5030 (mg/kg)	NA	<2.0	<2.0	NA	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	NA	16	16	15	<10	19	**240**
#2 Fuel Oil (mg/kg)		16	16	15	<10	19	240
kerosene (mg/kg)		<10	<10	<10	<10	<10	<10
Varsol (mg/kg)		<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	**260**	130	160	230	90	**290**	**680**
Metals (total analysis)	NA						
Arsenic (mg/kg)		1.62	4.2	2.3	2.46	2.46	5.26
Barium (mg/kg)		<24.7	<24.6	<26.7	61.2	50.8	59.2
Cadmium (mg/kg)		<0.618	<0.614	<0.699	<0.626	<0.666	<0.714
Chromium (mg/kg)		3.75	12.4	5.39	5.63	7.87	15.5
Lead (mg/kg)		21.6	49.3	12.9	36.4	63.7	**144**
Mercury (mg/kg)		<0.124	0.238	0.474	<0.125	<0.133	2.36
Selenium (mg/kg)		<0.618	<0.614	<0.669	<0.626	<0.666	<0.714
Silver (mg/kg)		<1.24	<1.23	<1.34	<1.25	<1.33	<1.43
Additional Analyses							
SW-846 8260	Y	N	N	N	N	Y	Y
SW-846 8270	Y	N	N	N	N	Y	Y
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	G11D	G13	G15	G17	G19a	G19b	G21
Sample Date	1/24/96	1/19/96	1/19/96	2/6/96	1/23/96	1/22/96	1/23/96
Sampled Interval (ft.)	0.0-5.6	0.0 - 7.5	0.0 - 6.0	0.0-6.7	0.0-8.0	9.0-12.0	0.0-8.0
TPH 5030 (mg/kg)	<2.0	NA	NA	<2.0	NA	NA	NA
TPH 3550 (total - mg/kg)	**280**	36	**130**	**59**	<10	**180**	<10
#2 Fuel Oil (mg/kg)	280	36	130	59	<10	180	<10
kerosene (mg/kg)	<20	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<20	<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	180	240	**280**	230	160	150	**590**
Metals (total analysis)							
Arsenic (mg/kg)	6.44	6.39	2.59	7.02	3.65	1.8	2.73
Barium (mg/kg)	134	40.2	<24.7	48.2	<27.7	<26.3	<24.0
Cadmium (mg/kg)	<0.723	2.14	<0.617	<0.608	<0.694	<0.658	<0.600
Chromium (mg/kg)	12	23.6	7.39	24.9	11.7	3.18	5.37
Lead (mg/kg)	**320**	**196**	23.3	**233**	5.87	13.9	3.96
Mercury (mg/kg)	3.68	0.34	<0.100	<0.122	<0.139	<0.132	<0.120
Selenium (mg/kg)	<0.723	<0.640	<0.617	<3.04	<0.694	<0.658	<6.00
Silver (mg/kg)	<1.45	<1.28	<1.23	<1.22	<1.39	<1.32	<1.20
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	H12b	H14	H16a	H16b	H18	H20	H22
Sample Date	1/19/96	1/19/96	2/6/96	2/6/96	1/23/96	1/23/96	1/23/96
Sampled Interval (ft.)	5.8 - 10.0	0.0 - 8.0	2.0-5.0	7.0-10.0	0.0-7.0	7.8-12.0	0.0-8.0
TPH 5030 (mg/kg)	NA	NA	<10.0	<2.0	NA	NA	NA
TPH 3550 (total - mg/kg)	21	**330**	**3,000**	24	22	**320**	<10
#2 Fuel Oil (mg/kg)	21	330	3,000	24	22	320	<10
kerosene (mg/kg)	<10	<10	<100	<10	<10	<50	<10
Varsol (mg/kg)	<10	<50	<100	<10	<10	<50	<10
O&G SW-846 9071 (mg/kg)	220	**1,500**	**1,600**	38	97	210	180
Metals (total analysis)							
Arsenic (mg/kg)	6.37	4.62	5.05	1.99	4.64	5	3.12
Barium (mg/kg)	43.7	<24.7	175	<25.2	34.8	<29.9	<25.5
Cadmium (mg/kg)	<0.716	<0.617	3.34	<0.630	<0.686	<0.748	<0.638
Chromium (mg/kg)	15.9	8.57	9.7	11.7	13.4	14.2	6.94
Lead (mg/kg)	8.74	83.3	78.1	6.15	**127**	24.9	15.9
Mercury (mg/kg)	<0.143	0.12	<0.234	<0.126	0.194	<0.150	<0.128
Selenium (mg/kg)	<0.716	<0.617	<1.17	<0.630	<0.686	<0.748	<0.638
Silver (mg/kg)	<1.43	<1.23	<2.34	<1.26	<1.37	<1.50	<1.28
Additional Analyses							
SW-846 8260	N	N	Y	N	N	N	N
SW-846 8270	N	N	Y	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	H24	I7	I9a	I9b	I13	I15	I15D
Sample Date	1/24/96	2/1/96	2/1/96	2/1/96	1/19/96	1/22/95	1/22/96
Sampled Interval (ft.)	0.0-6.6	0.0-5.0	0.0-5.9	5.9-11.2	0.0 - 6.0	0.0-5.5	0.0-5.5
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0
TPH 3550 (total - mg/kg)	<10	**1,300**	**67**	<10	<10	**60**	**90**
#2 Fuel Oil (mg/kg)	<10	1,300	67	<10	<10	60	90
kerosene (mg/kg)	<10	<200	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<200	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	**380**	**250**	38	42	44	**800**	200
Metals (total analysis)							
Arsenic (mg/kg)	2.1	2.33	2.94	1.57	3.74	6.4	7.96
Barium (mg/kg)	<24.4	<27.9	<26.8	<24.9	<28.1	59.5	59.4
Cadmium (mg/kg)	<0.609	<0.698	<0.670	<0.623	<0.702	<0.740	<0.696
Chromium (mg/kg)	4.43	5.09	5.4	9.26	4.53	42.4	22.3
Lead (mg/kg)	12.3	20.3	48.2	4.72	**163**	**310**	**228**
Mercury (mg/kg)	<0.122	<0.140	0.139	<0.124	<0.100	0.164	0.166
Selenium (mg/kg)	<0.609	<0.698	<0.670	0.793	<0.702	<3.70	<3.48
Silver (mg/kg)	<1.22	<1.40	<1.34	<1.24	<1.40	<1.48	<1.39
Additional Analyses							
SW-846 8260	N	Y	Y	N	N	Y	Y
SW-846 8270	N	Y	Y	N	N	Y	Y
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	I17	I19	I21	I21s	I21sD	I23	J6
Sample Date	1/23/96	1/22/96	1/23/96	1/23/96	1/23/96	1/24/96	2/1/96
Sampled Interval (ft.)	0.0-5.7	0.0-3.5	7.9-11.3	0.0-4.0	0.0-4.0	0.0-4.0	0.0-3.2
TPH 5030 (mg/kg)	NA	NA	NA	NA	NA	<2.0	<2.0
TPH 3550 (total - mg/kg)	**396**	**340**	**41**	NA	NA	<10	**92**
#2 Fuel Oil (mg/kg)	330	340	41			<10	92
kerosene (mg/kg)	<50	<20	<10			<10	<10
Varsol (mg/kg)	66	<20	<10			<10	<10
O&G SW-846 9071 (mg/kg)	**590**	**340**	43	NA	NA	230	140
Metals (total analysis)							
Arsenic (mg/kg)	5.43	8.27	4.38	4.18	2.54	3.69	4.34
Barium (mg/kg)	101	62.7	<28.4	<23.5	<24.4	<24.6	40.7
Cadmium (mg/kg)	<0.636	<0.598	<0.710	<0.587	<0.610	<0.614	<0.646
Chromium (mg/kg)	13	22.8	13.1	10.3	7.41	8.76	10.1
Lead (mg/kg)	**185**	81	24.1	15.1	27.3	40.1	77.2
Mercury (mg/kg)	0.142	<0.120	0.204	<0.117	<0.122	<0.123	<0.129
Selenium (mg/kg)	<0.636	<0.598	<0.710	<0.587	<0.610	<0.614	<0.646
Silver (mg/kg)	<1.27	<1.20	<1.42	<1.17	<1.22	<1.23	<1.29
Additional Analyses							
SW-846 8260	N	Y	N	N	N	N	N
SW-846 8270	N	Y	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	J8	J8D	J10	J12a	J12b	J14	J16
Sample Date	2/1/96	2/1/96	2/1/96	1/19/96	1/19/96	1/19/96	1/18/96
Sampled Interval (ft.)	0.0-5.9	0.0-5.9	0.5-1.0	0.0 - 5.2	6.0 - 10.0	0.0 - 5.3	0.0 - 5.0
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	<2.0	NA	NA	<25
TPH 3550 (total - mg/kg)	**3,900**	**11,000**	32	37	<10	20	**1,200**
#2 Fuel Oil (mg/kg)	3,900	11,000	32	37	<10	20	1,200
kerosene (mg/kg)	<1,000	<1,000	<10	<10	<10	<10	<10
Varsol (mg/kg)	<1,000	<1,000	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	**520**	NA	69	160	190	150	**1,100**
Metals (total analysis)		NA					
Arsenic (mg/kg)	8.11		2.92	23.8	2.8	2.4	2.95
Barium (mg/kg)	<25.4		71.6	<29.0	<25.5	<28.4	50.3
Cadmium (mg/kg)	<0.635		0.707	<0.726	<0.638	<0.710	<0.708
Chromium (mg/kg)	11.1		**398**	39.0	5.44	21.4	16.4
Lead (mg/kg)	34.4		**667**	21.0	4.85	**368**	**214**
Mercury (mg/kg)	<0.127		<0.111	0.189	<0.128	0.264	0.706
Selenium (mg/kg)	<3.18		<2.77	<0.726	<0.638	<0.710	<0.708
Silver (mg/kg)	<1.27		<1.11	<1.45	<1.28	<1.42	<1.42
Additional Analyses							
SW-846 8260	Y		Y	Y	N	N	N
SW-846 8270	Y		Y	Y	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

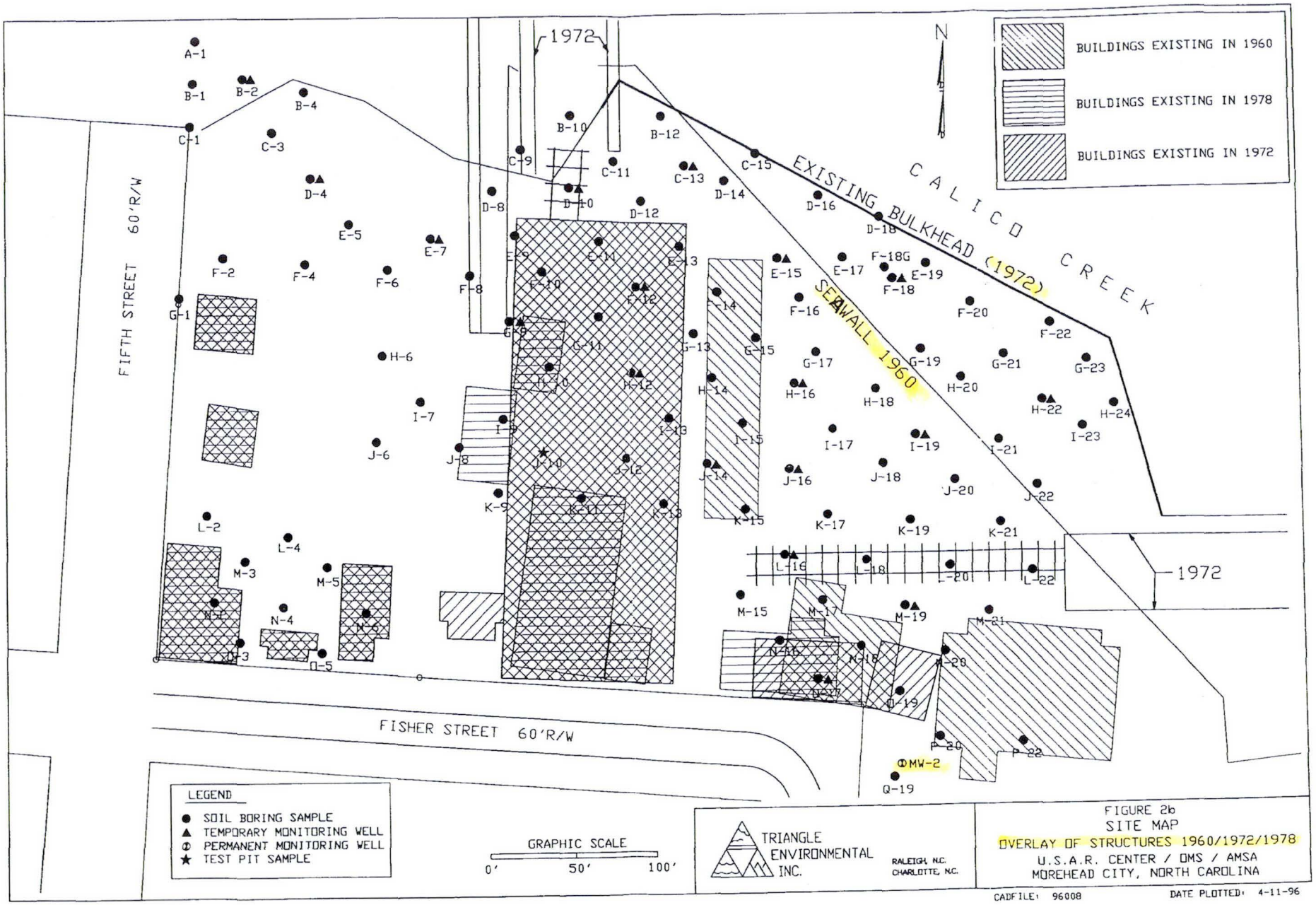
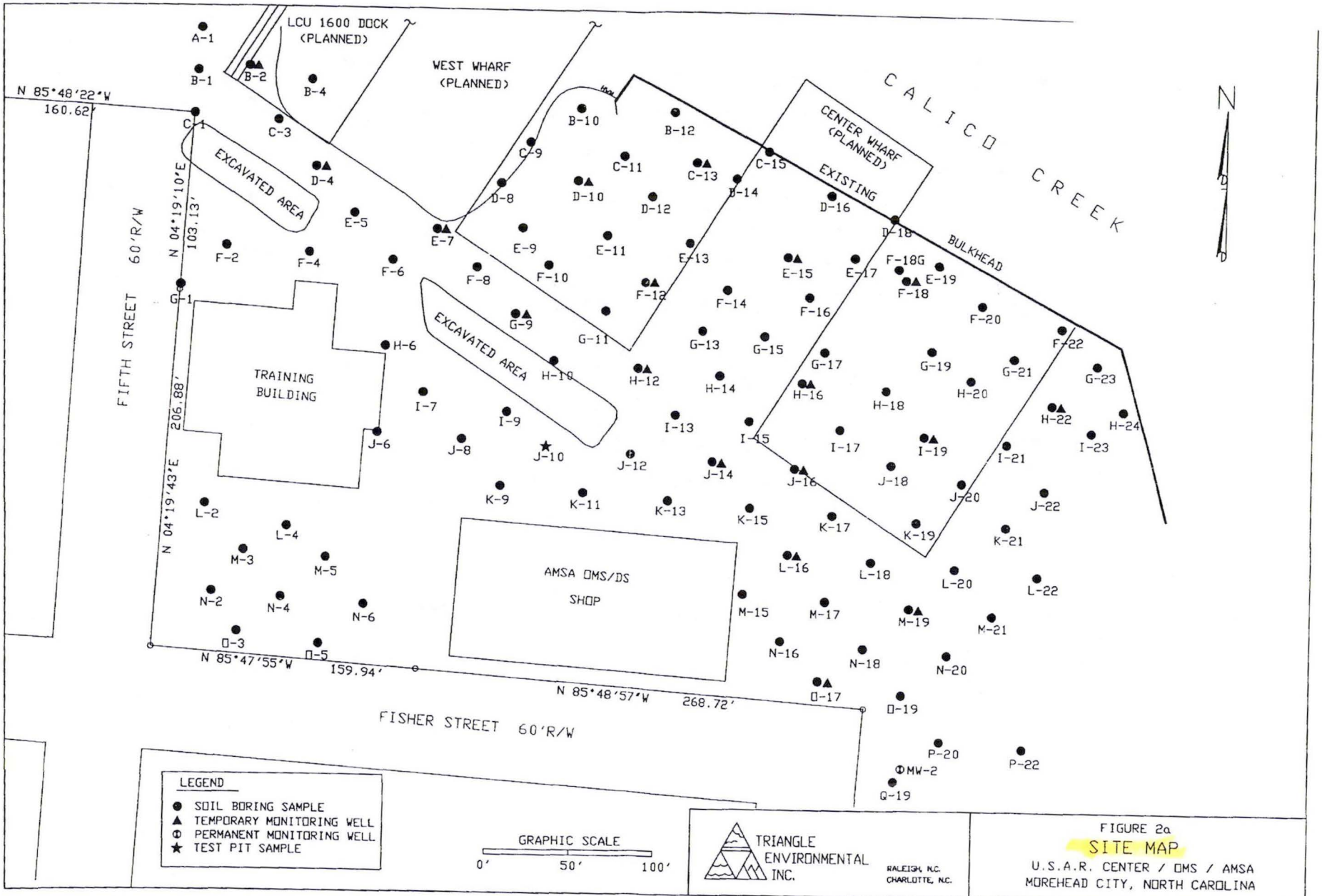


FIGURE 2b
SITE MAP
OVERLAY OF STRUCTURES 1960/1972/1978
U.S.A.R. CENTER / OMS / AMSA
MOREHEAD CITY, NORTH CAROLINA

CADFILE: 96008 DATE PLOTTED: 4-11-96


LCU 1600 DOCK
(PLANNED)
WEST WHARF
(PLANNED)
CENTER WHARF
(PLANNED)
EXISTING
BULKHEAD
CALICO CREEK
N
N 85°48'22"W
160.62'
N 04°19'10"E
103.13'
N 04°19'43"E
206.88'
N 85°47'55"W
159.94'
N 85°48'57"W
268.72'
FIFTH STREET 60'R/W
FISHER STREET 60'R/W
EXCAVATED AREA
EXCAVATED AREA
TRAINING
BUILDING
AMSA OMS/DS
SHOP
A-1
B-1
B-2
B-4
C-1
C-3
C-9
C-11
C-13
C-15
D-4
D-8
D-10
D-12
D-16
D-18
E-5
E-7
E-9
E-11
E-13
E-15
E-17
E-19
F-2
F-4
F-6
F-8
F-10
F-12
F-14
F-16
F-18
F-18G
F-20
F-22
G-1
G-9
G-11
G-13
G-15
G-17
G-19
G-21
G-23
H-6
H-10
H-12
H-14
H-16
H-18
H-20
H-22
H-24
I-7
I-9
I-13
I-15
I-17
I-19
I-21
I-23
J-6
J-8
J-10
J-12
J-14
J-16
J-18
J-20
J-22
K-9
K-11
K-13
K-15
K-17
K-19
K-21
L-2
L-4
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L-18
L-20
L-22
M-3
M-5
M-15
M-17
M-19
M-21
N-2
N-4
N-6
N-16
N-18
N-20
O-3
O-5
O-17
O-19
P-20
P-22
MW-2
Q-19
LEGEND
SOIL BORING SAMPLE
TEMPORARY MONITORING WELL
PERMANENT MONITORING WELL
TEST PIT SAMPLE
GRAPHIC SCALE
0'
50'
100'
TRIANGLE
ENVIRONMENTAL
INC.
RALEIGH, N.C.
CHARLOTTE, N.C.
FIGURE 2a
SITE MAP
U.S.A.R. CENTER / OMS / AMSA
MOREHEAD CITY, NORTH CAROLINA
CADFILE: 96008
DATE PLOTTED: 4-11-96

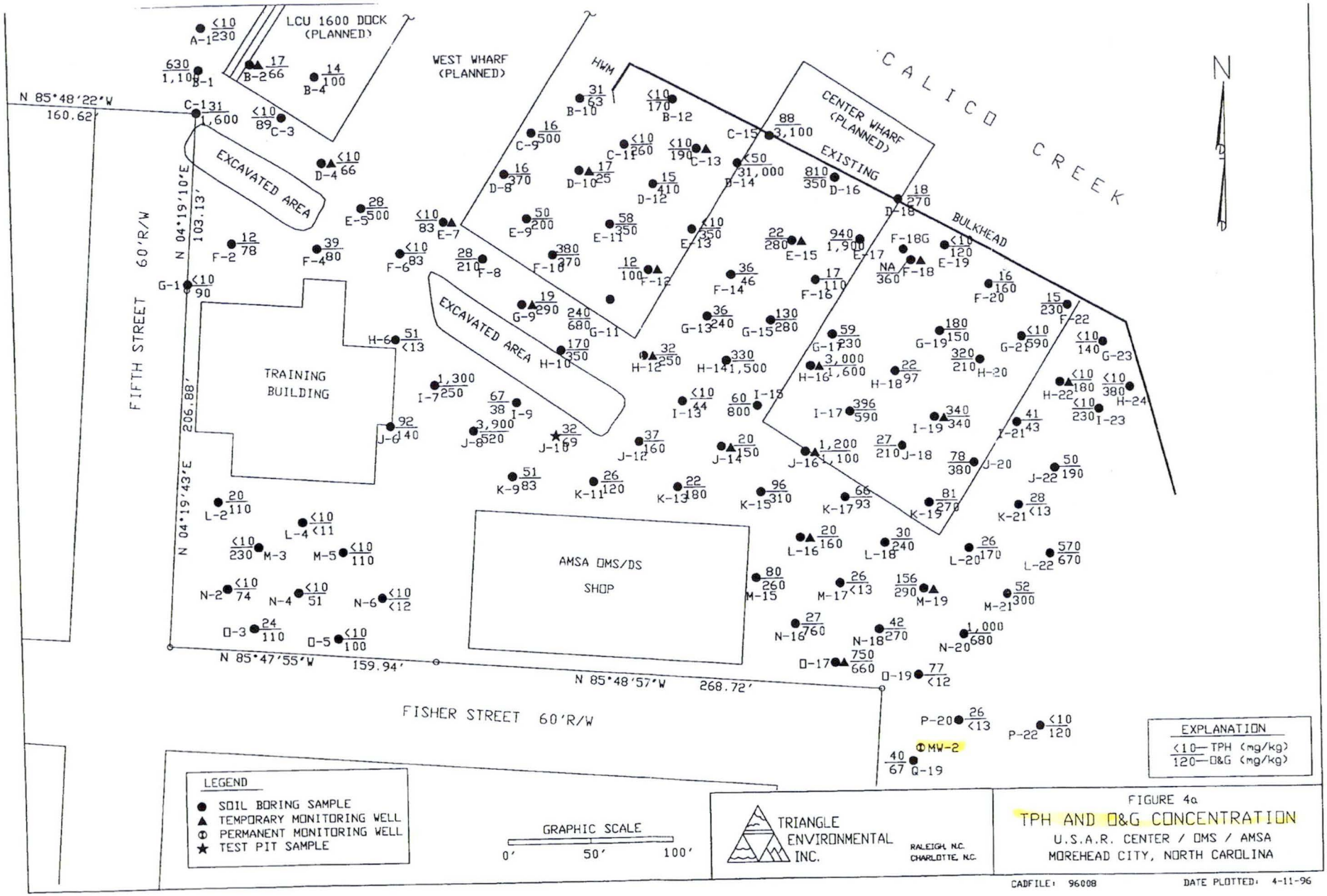
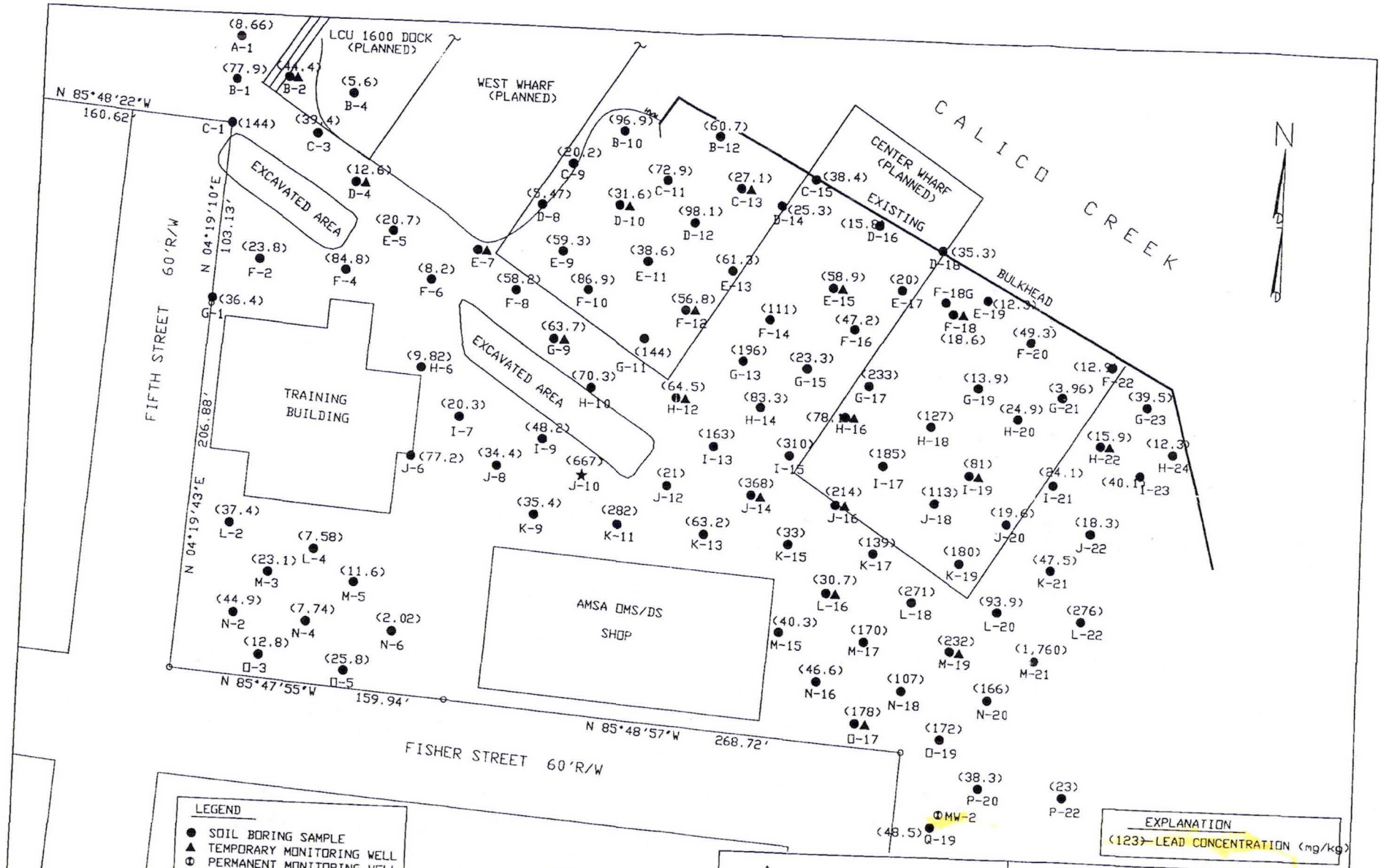


FIGURE 4a

TPH AND O&G CONCENTRATION

U.S.A.R. CENTER / OMS / AMSA

MOREHEAD CITY, NORTH CAROLINA


LCU 1600 DOCK (PLANNED)
WEST WHARF (PLANNED)
CENTER WHARF (PLANNED)
EXISTING BULKHEAD
CALICO CREEK
EXCAVATED AREA
EXCAVATED AREA
TRAINING BUILDING
AMSA OMS/DS SHOP
FIFTH STREET 60'R/W
FISHER STREET 60'R/W
N 85°48'22"W 160.62'
N 04°19'10"E 103.13'
N 04°19'43"E 206.88'
N 85°47'55"W 159.94'
N 85°48'57"W 268.72'
N
A-1 (8.66)
B-1 (77.9)
B-2 (44.4)
B-4 (5.6)
C-1 (144)
C-3 (39.4)
D-4 (12.6)
E-5 (20.7)
F-2 (23.8)
F-4 (84.8)
F-6 (8.2)
G-1 (36.4)
H-6 (9.82)
I-7 (20.3)
J-6 (77.2)
L-2 (37.4)
L-4 (7.58)
M-3 (23.1)
M-5 (11.6)
N-2 (44.9)
N-4 (7.74)
N-6 (2.02)
O-3 (12.8)
O-5 (25.8)
E-7
F-8 (58.2)
D-8 (5.47)
C-9 (20.2)
B-10 (96.9)
B-12 (60.7)
E-9 (59.3)
F-10 (86.9)
G-9 (63.7)
H-10 (70.3)
I-9 (48.2)
J-10 (667)
K-9 (35.4)
K-11 (282)
D-10 (31.6)
E-11 (38.6)
F-12 (56.8)
G-11 (144)
H-12 (64.5)
I-13 (163)
J-12 (21)
K-13 (63.2)
C-11 (72.9)
D-12 (98.1)
E-13 (61.3)
F-14 (111)
G-13 (196)
H-14 (83.3)
I-15 (310)
J-14 (368)
K-15 (33)
C-13 (27.1)
B-14 (25.3)
C-15 (38.4)
D-16 (15.8)
E-15 (58.9)
F-16 (47.2)
G-15 (23.3)
H-16 (78)
I-17 (185)
J-16 (214)
K-17 (139)
L-16 (30.7)
M-15 (40.3)
N-16 (46.6)
O-17 (178)
E-17 (20)
F-18G
F-18 (18.6)
E-19 (12.3)
D-18 (35.3)
F-20 (49.3)
G-17 (233)
H-18 (127)
I-18 (113)
J-18
K-19 (180)
L-18 (271)
M-17 (170)
N-18 (107)
O-19 (172)
G-19 (13.9)
H-20 (24.9)
I-19 (81)
J-20 (19.6)
L-20 (93.9)
M-19 (232)
N-20 (166)
P-20 (38.3)
Q-19 (48.5)
MW-2
F-22 (12.9)
G-21 (3.96)
G-23 (39.5)
H-22 (15.9)
I-21 (24.1)
J-22 (18.3)
K-21 (47.5)
L-22 (276)
M-21 (1,760)
P-22 (23)
H-24 (12.3)
I-23 (40.1)
LEGEND
SOIL BORING SAMPLE
TEMPORARY MONITORING WELL
PERMANENT MONITORING WELL
TEST PIT SAMPLE
GRAPHIC SCALE
0' 50' 100'
EXPLANATION
(123) LEAD CONCENTRATION (mg/kg)
TRIANGLE ENVIRONMENTAL INC.
RALEIGH, N.C.
CHARLOTTE, N.C.
FIGURE 4b
TOTAL LEAD CONCENTRATION
U.S.A.R. CENTER / OMS / AMSA
MOREHEAD CITY, NORTH CAROLINA
CADFILE: 96008

APPENDIX A

Soil Boring Logs

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	J18	J20s	J20a	J20aD	J20B	J22	K9
Sample Date	1/23/96	1/31/96	1/31/96	1/31/96	1/31/96	1/24/96	1/31/96
Sampled Interval (ft.)	0.0-4.0	0.0-0.9	0.9-5.2	0.9-5.2	8.5-13.5	0.0-4.0	0.0-7.1
TPH 5030 (mg/kg)	NA	NA	<2.0	NA	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	27	NA	**78**	NA	<10	**50**	**51**
#2 Fuel Oil (mg/kg)	27		78		<10	50	51
kerosene (mg/kg)	<10		<10		<10	<10	<10
Varsol (mg/kg)	<10		<10		<10	<10	<10
O&G SW-846 9071 (mg/kg)	210	NA	**380**	NA	47	190	83
Metals (total analysis)				NA			
Arsenic (mg/kg)	3.44	2.72	1.93		2.47	8.9	1.3
Barium (mg/kg)	29.5	<23.4	<24.2		25.8	<23.8	<25.6
Cadmium (mg/kg)	<0.612	<0.586	<0.605		<0.621	<0.594	<0.639
Chromium (mg/kg)	25.1	11.7	10.3		18.4	12	3.12
Lead (mg/kg)	**113**	36.7	19.6		6.04	18.3	35.4
Mercury (mg/kg)	0.330	0.137	0.183		<0.124	<0.119	<0.128
Selenium (mg/kg)	<0.612	<5.86	<0.605		<0.621	<0.594	<0.639
Silver (mg/kg)	<1.22	<1.17	<1.21		<1.24	<1.19	<1.28
Additional Analyses							
SW-846 8260	N	N	Y	Y	N	N	N
SW-846 8270	N	N	Y	Y	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	K9D	K11	K13	K15	K15b	K17	K19
Sample Date	1/31/96	1/31/96	1/31/96	1/18/96	1/18/96	1/18/96	1/23/96
Sampled Interval (ft.)	0.0-7.1	0.4-4.5	0.0-4.5	0.0 - 6.5	7.0 - 10.0	0.0 - 10.0	0.0-3.0
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	NA	NA	NA	NA
TPH 3550 (total - mg/kg)	**51**	26	22	**96**	<10	**66**	**81**
#2 Fuel Oil (mg/kg)	51	26	22	96	<10	66	81
kerosene (mg/kg)	<10	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<10	<50
O&G SW-846 9071 (mg/kg)	210	120	180	**310**	200	93	**270**
Metals (total analysis)							
Arsenic (mg/kg)	1.42	4.29	<1.54	5.55	1.47	3.45	5.19
Barium (mg/kg)	<26.5	36.5	<30.7	<28.2	<24.4	37.1	29.6
Cadmium (mg/kg)	<0.663	<0.636	<0.768	<0.704	<0.610	<0.627	<0.609
Chromium (mg/kg)	7	34	7.26	14.9	19.6	27.8	14.4
Lead (mg/kg)	37.6	**282**	63.2	33	7.18	**139**	**180**
Mercury (mg/kg)	<0.133	<0.127	<0.154	<0.141	<0.122	0.247	0.69
Selenium (mg/kg)	<0.663	<3.18	<0.768	<0.704	<0.610	<0.627	<0.609
Silver (mg/kg)	<1.33	<1.27	<1.54	<1.41	<1.22	<1.25	<1.22
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	K19D	K19a	K21	L2	L4	L16a	L16b
Sample Date	1/23/96	1/23/96	1/24/96	1/31/96	1/31/96	1/18/96	1/18/96
Sampled Interval (ft.)	0.0-3.0	4.0-6.9	0.0-8.8	0.0-2.7	0.0 - 2.8	0.0 - 4.8	2.0 - 3.6
TPH 5030 (mg/kg)	NA	NA	<2.0	<2.0	<2.0	NA	NA
TPH 3550 (total - mg/kg)	38	<10	28	20	<10	20	<10
#2 Fuel Oil (mg/kg)	38	<10	28	20	<10	20	<10
kerosene (mg/kg)	<10	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	**320**	170	<13	110	<11	160	<12
Metals (total analysis)							
Arsenic (mg/kg)	4.37	2.13	49.8	<1.16	<1.16	2.12	4.01
Barium (mg/kg)	26.2	<24.7	75.7	<23.3	<23.3	<26.4	75.7
Cadmium (mg/kg)	<0.612	<0.618	<0.679	<0.579	<0.582	<0.660	<1.65
Chromium (mg/kg)	14	3.37	25.7	2.9	2.73	17.8	15.2
Lead (mg/kg)	**139**	6.11	47.5	37.4	7.58	30.7	**153**
Mercury (mg/kg)	0.748	<0.124	0.259	<0.116	<0.116	0.233	<0.330
Selenium (mg/kg)	<0.612	<0.618	<0.679	<0.579	<0.582	<0.660	<1.65
Silver (mg/kg)	<1.22	<1.24	<1.36	<1.16	<1.16	<1.32	<3.30
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	L16c	L18	L20	L22	M3	M5	M15
Sample Date	1/18/96	1/18/96	1/18/96	1/24/96	1/31/96	1/31/96	1/30/96
Sampled Interval (ft.)	6.0 - 8.0	0.0 - 10.0	0.0 - 10.0	0.6-6.0	0.0-2.8	0.0-2.6	1.3-5.2
TPH 5030 (mg/kg)	NA	NA	<2.0	<2.0	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	<10	30	26	570	<10	<10	80
#2 Fuel Oil (mg/kg)	<10	30	26	570	<10	<10	80
kerosene (mg/kg)	<10	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	<12	240	170	670	230	110	260
Metals (total analysis)							
Arsenic (mg/kg)	1.68	5.36	7.12	6.02	<1.15	2.03	5.16
Barium (mg/kg)	28.2	46.9	148	30.4	<23.0	<22.9	<30.0
Cadmium (mg/kg)	<0.614	<0.650	<0.635	<0.619	<0.575	<0.573	<0.749
Chromium (mg/kg)	26.4	33.6	38	78.5	2.64	4.48	9.99
Lead (mg/kg)	10.8	271	93.9	276	23.1	11.6	40.3
Mercury (mg/kg)	<0.123	1.6	0.32	0.693	<0.115	<0.114	<0.150
Selenium (mg/kg)	<0.614	<0.650	<0.632	<3.10	<0.575	<0.573	<0.749
Silver (mg/kg)	<1.23	<1.30	<1.26	<1.24	<1.15	<1.14	<1.50
Additional Analyses							
SW-846 8260	N	N	Y	Y	N	N	Y
SW-846 8270	N	N	Y	Y	N	N	Y
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	M17	M17D	M19	M21a	M21b	N2	N4
Sample Date	1/18/96	1/18/96	1/18/96	1/24/96	1/24/96	2/1/96	1/31/96
Sampled Interval (ft.)	0.0 - 6.0	0.0 - 6.0	0.0 - 10.0	0.3-2.0	3.0-6.7	0.0-3.1	0.0-5.2
TPH 5030 (mg/kg)	NA	NA	NA	NA	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	26	39	**156**	NA	**52**	<10	<10
#2 Fuel Oil (mg/kg)	26	39	59		52	<10	<10
kerosene (mg/kg)	<10	<10	<20		<50	<10	<10
Varsol (mg/kg)	<10	<10	97		<50	<10	<10
O&G SW-846 9071 (mg/kg)	<13	<11	**290**	**370**	**300**	74	51
Metals (total analysis)							
Arsenic (mg/kg)	6.57	9.05	5.91	5.9	11	1.47	3.46
Barium (mg/kg)	63.6	32.4	87.9	<23.2	977	<23.0	<22.5
Cadmium (mg/kg)	<0.642	<0.624	0.637	<0.579	<0.833	<0.574	<0.564
Chromium (mg/kg)	26	23.2	26.9	17.5	25	4.12	5.6
Lead (mg/kg)	**170**	**124**	**232**	42.0	**1,760**	44.9	7.47
Mercury (mg/kg)	1.19	3.62	**4.34**	0.765	4.58	<0.115	<0.113
Selenium (mg/kg)	<0.642	<0.624	<0.601	<0.579	<0.833	<0.574	<0.564
Silver (mg/kg)	<1.28	<1.25	<1.20	<1.16	<1.66	<1.15	<1.13
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	Y
SW-846 8270	N	N	N	N	N	N	Y
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	N6a	N6b	N6bD	N16	N18	N20a	N20b
Sample Date	1/31/96	1/31/96	1/31/96	1/30/96	1/18/96	1/19/96	1/19/96
Sampled Interval (ft.)	0.8-5.3	5.5-8.0	.5.5-8.0	0.0-5.0	0.0 - 5.0	0.0 - 5.0	6.0 - 8.0
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	<2.0	NA	NA	NA
TPH 3550 (total - mg/kg)	<10	<10	<10	27	**42**	**1,000**	**150**
#2 Fuel Oil (mg/kg)	<10	<10	<10	27	42	1,000	150
kerosene (mg/kg)	<10	<10	<10	<10	<10	<100	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<100	<10
O&G SW-846 9071 (mg/kg)	<12	30	<12	**760**	**270**	**680**	160
Metals (total analysis)							
Arsenic (mg/kg)	2.72	5.1	2.11	8.32	10.5	5.71	#
Barium (mg/kg)	<23.0	26	35	<29.7	32.3	27.7	
Cadmium (mg/kg)	<0.576	<0.595	<0.594	<0.742	<0.706	<0.653	
Chromium (mg/kg)	3.28	17.5	21.7	9.24	16.7	19.9	
Lead (mg/kg)	2.02	5.89	6.65	46.6	**107**	**166**	
Mercury (mg/kg)	<0.115	<0.119	<0.119	0.672	0.526	2.7	
Selenium (mg/kg)	<0.576	<0.595	<0.594	<0.742	<0.706	<0.653	
Silver (mg/kg)	<1.15	<1.19	<1.19	<1.48	<1.41	<1.31	
				# Data rejected by quality control review			
Additional Analyses							
SW-846 8260	N	N	N	N	N	N	N
SW-846 8270	N	N	N	N	N	N	N
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	O3a	O3b	O5	O17a	O17b	O19	P20
Sample Date	2/1/96	2/1/96	1/31/96	1/31/96	1/31/96	2/1/96	2/1/96
Sampled Interval (ft.)	0.0-5.5	5.5-8.0	0.0-3.0	1.6-5.1	5.5-9.4	0.0-2.7	0.0-3.5
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	<25	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	24	<10	<10	750	<10	77	26
#2 Fuel Oil (mg/kg)	24	<10	<10	640	<10	77	26
kerosene (mg/kg)	<10	<10	<10	<50	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	110	<10	<10	<10
O&G SW-846 9071 (mg/kg)	110	79	100	660	<12	<12	<13
Metals (total analysis)							
Arsenic (mg/kg)	1.93	3.43	3.22	7.01	<1.24	6.89	6.24
Barium (mg/kg)	<23.4	<24.1	<22.8	41.8	<24.8	37.8	41.6
Cadmium (mg/kg)	<0.585	<0.603	<0.570	<0.676	<0.620	<0.647	<0.587
Chromium (mg/kg)	65.2	83.6	4.32	13.4	2.3	23.6	3.95
Lead (mg/kg)	12.8	6.72	25.8	178	1.79	172	38.3
Mercury (mg/kg)	<0.117	0.135	<0.114	0.516	<0.124	<0.129	<0.117
Selenium (mg/kg)	<0.585	<0.603	<0.570	<0.676	<0.620	<0.647	<0.585
Silver (mg/kg)	<1.17	<1.20	<1.14	<1.35	<1.24	<1.29	<1.17
Additional Analyses							
SW-846 8260	N	N	N	Y	N	N	Y
SW-846 8270	N	N	N	Y	N	N	Y
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 1
Soil Analysis - Total Petroleum Hydrocarbons and Total Metals

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	P22	Q19	Q19D	S-A1	S-B1	S-B1D	S-F11
Sample Date	2/1/96	2/1/96	2/1/96	2/7/96	2/7/96	2/7/96	2/7/96
Sampled Interval (ft.)	0.0-2.9	0.0-6.6	0.0-6.6	Stockpile	Stockpile	Stockpile	Stockpile
TPH 5030 (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
TPH 3550 (total - mg/kg)	<10	40	32	<10	16	41	26
#2 Fuel Oil (mg/kg)	<10	40	32	<10	16	41	26
kerosene (mg/kg)	<10	<10	<10	<10	<10	<10	<10
Varsol (mg/kg)	<10	<10	<10	<10	<10	<10	<10
O&G SW-846 9071 (mg/kg)	120	67	<12	150	120	84	140
Metals (total analysis)							
Arsenic (mg/kg)	2.82	2.38	3.37	7.89	4.83	3.7	7.53
Barium (mg/kg)	<23.9	<24.1	<24.0	<27.4	<25.0	<24.4	<25.1
Cadmium (mg/kg)	<0.597	<0.602	<0.601	<0.685	<0.624	<0.609	<0.627
Chromium (mg/kg)	5.41	4.58	5.8	23	12.6	9.02	19.2
Lead (mg/kg)	23	48.5	49.5	14	13.6	15.2	79.6
Mercury (mg/kg)	<0.119	0.14	<0.120	<0.137	<0.125	0.18	1.03
Selenium (mg/kg)	<0.597	<0.602	<0.601	<0.685	<0.624	<0.609	<0.627
Silver (mg/kg)	<1.19	<1.20	<1.20	<1.37	<1.25	<1.22	<1.25
Additional Analyses							
SW-846 8260	N	N	N	Y	Y	N	Y
SW-846 8270	N	N	N	Y	Y	N	Y
NA=Not Analyzed							
< = Less than the given detection limit							
Y = Yes							
N = No							

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	A1	B10	D12b	E13	F16	F18	F18c
Sample Date	1/18/96	1/23/96	1/24/96	1/30/96	1/19/96	1/23/96	1/23/96
Sampled Interval (ft.)	0.5 - 14.0	0.0-4.0	8.0-9.0	2.0-7.1	0.0 - 6.2	3.3-6.0	cuttings
SW-846 8260 (µg/kg)			NA			NA	
Acetone	<50.0	<50.0		<50.0	<50.0		<50.0
2-Butanone (MEK)	<10.0	<10.0		<10.0	<5.0		<10.0
n-Butylbenzene	<5.0	<5.0		<5.0	<5.0		<5.0
sec-Butylbenzene	<5.0	<5.0		<5.0	<5.0		<5.0
tert-Butylbenzene	<5.0	<5.0		<5.0	<5.0		<5.0
Chlorobenzene	<5.0	<5.0		15	<5.0		<5.0
1,4 Dichlorobenzene	<5.0	<5.0		38	<5.0		<5.0
Isopropylbenzene	<5.0	<5.0		15	<5.0		<5.0
p-Isopropyltoluene	<5.0	<5.0		44	<5.0		<5.0
Naphthalene	<5.0	16		<5.0	<5.0		16
n-Propylbenzene	<5.0	<5.0		<5.0	<5.0		<5.0
SW-846 8270 (µg/kg)							
Acenaphthene	<330	<330	1,700	<330	<330	<330	<330
Acenaphthylene	<330	<330	<330	<330	<330	<330	<330
Anthracene	<330	<330	<330	<330	<330	<330	<330
Benzo (a) anthracene	<330	<330	<330	<330	<330	<330	<330
Benzo (b) fluoranthene	<330	<330	<330	<330	<330	<330	<330
Benzo (k) fluoranthene	<330	<330	<330	<330	<330	<330	<330
Benzo (g,h,i) perylene	<330	<330	<330	<330	<330	<330	<330
Benzo (a) pyrene	<330	<330	<330	<330	<330	<330	<330
bis(2-Ethylhexyl) phthalate	<330	<330	<330	540	<330	<330	<330
Chrysene	<330	<330	<330	<330	<330	<330	<330
Dibenzofuran	<330	<330	<330	<330	<330	<330	<330
Di-n-butylphthalate	<330	<330	2,200	<330	<330	1,000	640
Fluoranthene	<330	<330	4,500	<330	<330	<330	<330
Fluorene	<330	<330	2,000	<330	<330	<330	<330
Indeno (1,2,3-cd) pyrene	<330	<330	<330	<330	<330	<330	<330
2-Methylnaphthalene	<330	<330	<330	<330	<330	<330	<330
Naphthalene	<330	<330	<330	<330	<330	<330	<330
N-Nitrosodiphenylamine	<330	<330	<330	<330	<330	<330	<330
Phenanthrene	<330	<330	7,700	<330	<330	<330	<330
Pyrene	<330	<330	3,000	<330	<330	<330	<330
TICs (total)	210	10,590	16,070	21,470	7,100	12,640	14,820
b = found in laboratory blank							

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	G9	G11	H6	H16a	I7	I9a	I15
Sample Date	1/22/96	1/24/96	2/1/96	2/6/96	2/1/96	2/1/96	1/22/95
Sampled Interval (ft.)	0.0-4.9	0.0-5.6	0.0-5.0	2.0-5.0	0.0-5.0	0.0-5.9	0.0-5.5
SW-846 8260 (µg/kg)							
Acetone	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	170
2-Butanone (MEK)	<10.0	<10.0	<10.0	<10	<10.0	<10.0	36
n-Butylbenzene	<5.0	<10.0	<5.0	180	<5.0	<5.0	8
sec-Butylbenzene	<5.0	<5.0	<5.0	260	<5.0	<5.0	12
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4 Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8
p-Isopropyltoluene	<5.0	<5.0	<5.0	<5.0	17	<5.0	13
Naphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/kg)							
Acenaphthene	<330	<330	<330	<330	<330	<330	<330
Acenaphthylene	<330	<330	<330	<330	<330	<330	<330
Anthracene	<330	<330	<330	<330	<330	<330	<330
Benzo (a) anthracene	<330	<330	<330	<330	<330	<330	<330
Benzo (b) fluoranthene	<330	<330	<330	<330	<330	<330	<330
Benzo (k) fluoranthene	<330	<330	<330	<330	<330	<330	<330
Benzo (g,h,i) perylene	<330	<330	<330	<330	<330	<330	<330
Benzo (a) pyrene	<330	<330	<330	<330	<330	<330	<330
bis(2-Ethylhexyl) phthalate	<330	<330	<330	<330	<330	<330	<330
Chrysene	<330	<330	<330	<330	<330	<330	<330
Dibenzofuran	<330	<330	<330	<330	<330	<330	<330
Di-n-butylphthalate	<330	2400b	<330	<330	<330	<330	<330
Fluoranthene	<330	<330	<330	<330	<330	<330	<330
Fluorene	<330	<330	<330	<330	<330	<330	<330
Indeno (1,2,3-cd) pyrene	<330	<330	<330	<330	<330	<330	<330
2-Methylnaphthalene	<330	<330	<330	<330	<330	<330	<330
Naphthalene	<330	<330	<330	<330	<330	<330	<330
N-Nitrosodiphenylamine	<330	<330	<330	<330	<330	<330	<330
Phenanthrene	<330	<330	<330	<330	<330	<330	<330
Pyrene	<330	<330	<330	<330	<330	<330	<330
TICs (total)	2,430	7,150	3,190	255,000	417,600	4,680	9,820
b = found in laboratory blank							

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	I15D	I19	J8	J10	J12a	J20a	J20aD
Sample Date	1/22/96	1/22/96	2/1/96	2/1/96	1/19/96	1/31/96	1/31/96
Sampled Interval (ft.)	0.0-5.5	0.0-3.5	0.0-5.9	0.5-1.0	0.0 - 5.2	8.5-13.5	8.5-13.5
SW-846 8260 (µg/kg)							
Acetone	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2-Butanone (MEK)	<10.0	<10.0	<10.0	12	<10.0	<10.0	<10.0
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
sec-Butylbenzene	8	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4 Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
p-Isopropyltoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	<5.0	4,000	<5.0	<5.0	<5.0	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/kg)							
Acenaphthene	<330	7,400	<330	<330	<330	<330	<330
Acenaphthylene	1,200	<330	<330	<330	<330	<330	<330
Anthracene	<330	4,100	<330	<330	<330	<330	<330
Benzo (a) anthracene	910	<330	<330	<330	<330	<330	<330
Benzo (b) fluoranthene	2,200	<330	<330	<330	<330	<330	<330
Benzo (k) fluoranthene	1,400	<330	<330	<330	<330	<330	<330
Benzo (g,h,i) perylene	910	<330	<330	<330	<330	<330	<330
Benzo (a) pyrene	1,700	<330	<330	<330	<330	<330	<330
bis(2-Ethylhexyl) phthalate	<330	<330	<330	<330	<330	<330	<330
Chrysene	1,200	<330	<330	<330	<330	<330	<330
Dibenzofuran	<330	6,400	<330	<330	<330	<330	<330
Di-n-butylphthalate	<330	<330	<330	<330	<330	<330	<330
Fluoranthene	1,400	7,300	<330	<330	<330	<330	<330
Fluorene	<330	8,400	<330	<330	<330	<330	<330
Indeno (1,2,3-cd) pyrene	880	<330	<330	<330	<330	<330	<330
2-Methylnaphthalene	<330	8,400	<330	<330	<330	<330	<330
Naphthalene	<330	10,000	<330	<330	<330	<330	<330
N-Nitrosodiphenylamine	<330	<330	<330	<330	<330	<330	<330
Phenanthrene	<330	15,000	<330	<330	<330	<330	<330
Pyrene	1,400	5,300	<330	<330	<330	<330	<330
TICs (total)	11,600	40,000	443,100	9,410	4,280	2,921	4,750
b = found in laboratory blank							

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center						
Triangle Project No. 033-0201						
Sample I.D.	L20	L22	M15	N4	O17a	P20
Sample Date	1/18/96	1/24/96	1/30/96	1/31/96	1/31/96	2/1/96
Sampled Interval (ft.)	0.0 - 10.0	0.6-6.0	1.3-5.2	0.0-5.2	1.6-5.1	0.0-3.5
SW-846 8260 (µg/kg)						
Acetone	<50.0	<50.0	76	<50.0	<50.0	<50.0
2-Butanone (MEK)	<10.0	<10.0	20	<10.0	<10.0	<10.0
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	110	<5.0
sec-Butylbenzene	<5.0	<5.0	<5.0	<5.0	170	<5.0
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	63	<5.0
Chlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4 Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	53	<5.0
p-Isopropyltoluene	8.6	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	<5.0	6,500	<5.0	<5.0	140	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	120	<5.0
SW-846 8270 (µg/kg)						
Acenaphthene	<330	1,500	<330	<330	7,300	<330
Acenaphthylene	<330	<330.0	<330	<330	<330	<330
Anthracene	<330	490	<330	<330	1,600	<330
Benzo (a) anthracene	<330	460	980	<330	<330	1,100
Benzo (b) fluoranthene	<330	<330.0	<330	<330	<330	1,000
Benzo (k) fluoranthene	<330	<330.0	<330	<330	<330	930
Benzo (g,h,i) perylene	<330	<330.0	<330	<330	<330	<330
Benzo (a) pyrene	<330	<330.0	<330	<330	<330	840
bis(2-Ethylhexyl) phthalate	<330	<330	<330	<330	<330	<330
Chrysene	<330	530	940	<330	<330	1,300
Dibenzofuran	<330	760	<330	<330	3,400	<330
Di-n-butylphthalate	860	2,800	4,300	<330	<330	<330
Fluoranthene	<330	2,300	2,700	<330	6,500	1,700
Fluorene	<330	910	<330	<330	4,500	<330
Indeno (1,2,3-cd) pyrene	<330	<330.0	<330	<330	<330	<330
2-Methylnaphthalene	<330	450	<330	<330	4,500	<330
Naphthalene	<330	1,900	<330	<330	<330	<330
N-Nitrosodiphenylamine	<330	<330	<330	<330	1,400	<330
Phenanthrene	<330	1,800	2,000	<330	8,800	<330
Pyrene	<330	1,800	2,400	<330	4,900	1,500
TICs (total)	16,950	21,350	15,460	170	57,600	6,860

b = found in laboratory blank

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center							
Triangle Project No. 033-0201							
Sample I.D.	S-A1	S-B1	S-F11	S-F14b	S-H17f	S-H17fD	S-P19
Sample Date	2/7/96	2/7/96	2/7/96	2/7/96	2/8/96	2/8/96	2/7/96
Sampled Interval (ft.)	Stockpile	Stockpile	Stockpile	Stockpile	Stockpile	Stockpile	Stockpile
SW-846 8260 (µg/kg)							
Acetone	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
2-Butanone (MEK)	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
n-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
sec-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
tert-Butylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4 Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
p-Isopropyltoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
n-Propylbenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
SW-846 8270 (µg/kg)							
Acenaphthene	<330	<330	<330	<330	<330	<330	<330
Acenaphthylene	<330	<330	<330	<330	<330	<330	<330
Anthracene	<330	<330	<330	<330	<330	<330	<330
Benzo (a) anthracene	<330	<330	<330	<330	<330	<330	730
Benzo (b) fluoranthene	<330	<330	<330	<330	<330	<330	1,200
Benzo (k) fluoranthene	<330	<330	<330	<330	<330	<330	580
Benzo (g,h,i) perylene	<330	<330	<330	<330	<330	<330	<330
Benzo (a) pyrene	<330	<330	<330	<330	<330	<330	790
bis(2-Ethylhexyl) phthalate	<330	<330	<330	<330	<330	<330	<330
Chrysene	<330	<330	<330	<330	<330	<330	870
Dibenzofuran	<330	<330	<330	<330	<330	<330	<330
Di-n-butylphthalate	<330	<330	<330	<330	<330	<330	<330
Fluoranthene	<330	480	<330	<330	<330	<330	840
Fluorene	<330	<330	<330	<330	<330	<330	<330
Indeno (1,2,3-cd) pyrene	<330	<330	<330	<330	<330	<330	<330
2-Methylnaphthalene	<330	<330	<330	<330	<330	<330	<330
Naphthalene	<330	<330	<330	<330	<330	<330	<330
N-Nitrosodiphenylamine	<330	<330	<330	<330	<330	<330	<330
Phenanthrene	<330	<330	<330	<330	<330	<330	<330
Pyrene	<330	810	<330	<330	<330	<330	820
TICs (total)	2,103	2,045	3,380	4,450	2,497	2,589	6,010
b = found in laboratory blank							

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center Triangle Project No. 033-0201	Summary of VOC & SVOC Analysis for Soil Boring Samples			
Sample I.D. Sample Date Sampled Interval (ft.)	Number of samples above detection limits	Minimum detected conc. (µg/kg)	Maximum detected conc. (µg/kg)	Mean of samples with detectable conc. (µg/kg)
SW-846 8260 (µg/kg)				
Acetone	2	76	170	123
2-Butanone (MEK)	3	12	36	22.7
n-Butylbenzene	3	8	180	99.3
sec-Butylbenzene	4	8	260	113
tert-Butylbenzene	1	63	63	63
Chlorobenzene	1	15	15	15.0
1,4 Dichlorobenzene	1	38	38	38.0
Isopropylbenzene	3	8	53	25.3
p-Isopropyltoluene	4	8.6	44	20.7
Naphthalene	5	16	6500	2,134
n-Propylbenzene	1	63	63	120.0
SW-846 8270 (µg/kg)				
Acenaphthene	4	1,500	7,400	4,475
Acenaphthylene	1	1,200	1,200	1,200
Anthracene	3	490	1,600	2,063
Benzo (a) anthracene	4	460	1,100	863
Benzo (b) fluoranthene	2	1,000	2,200	1,600
Benzo (k) fluoranthene	2	930	1,400	1,165
Benzo (g,h,i) perylene	1	910	910	910
Benzo (a) pyrene	2	1,700	840	1,270
bis(2-Ethylhexyl) phthalate	1	540	540	540
Chrysene	4	530	1,300	993
Dibenzofuran	3	760	6,400	3,520
Di-n-butylphthalate	6	640	4,300	1,967
Fluoranthene	7	1,400	7,300	3,771
Fluorene	4	910	8,400	3,953
Indeno (1,2,3-cd) pyrene	1	880	880	880
2-Methylnaphthalene	3	450	8,400	4,450
Naphthalene	2	1,900	10,000	5,950
N-Nitrosodiphenylamine	1	1,400	1,400	1,400
Phenanthrene	5	1,800	15,000	7,060
Pyrene	7	1,400	5,300	2,900
TICs (total)	27	170	443,100	52,490

b = found in laboratory blank

Table 2
Soil Analysis - Volatile and Semivolatile Organic Compounds

Army Reserve Center Triangle Project No. 033-0201	Summary of VOC & SVOC Analysis for Stockpile Samples			
Sample I.D. Sample Date Sampled Interval (ft.)	Number of samples above detection limits	Minimum detected conc. (µg/kg)	Maximum detected conc. (µg/kg)	Mean of samples with detectable conc. (µg/kg)
SW-846 8260 (µg/kg)				
Acetone	0			
2-Butanone (MEK)	0			
n-Butylbenzene	0			
sec-Butylbenzene	0			
tert-Butylbenzene	0			
Chlorobenzene	0			
1,4 Dichlorobenzene	0			
Isopropylbenzene	0			
p-Isopropyltoluene	0			
Naphthalene	0			
n-Propylbenzene	0			
SW-846 8270 (µg/kg)				
Acenaphthene	0			
Acenaphthylene	0			
Anthracene	0			
Benzo (a) anthracene	1	730	730	730
Benzo (b) fluoranthene	1	1,200	1,200	1,200
Benzo (k) fluoranthene	1	580	580	580
Benzo (g,h,i) perylene	0			
Benzo (a) pyrene	1	790	790	790
bis(2-Ethylhexyl) phthalate	0			
Chrysene	1	870	870	870
Dibenzofuran	0			
Di-n-butylphthalate	0			
Fluoranthene	2	480	840	660
Fluorene	0			
Indeno (1,2,3-cd) pyrene	0			
2-Methylnaphthalene	0			
Naphthalene	0			
N-Nitrosodiphenylamine	0			
Phenanthrene	0			
Pyrene	2	810	820	815
TICs (total)	7	2,045	6,010	3,296

b = found in laboratory blank

Table 3
Soil Analysis - TCLP and Total Metals

Army Reserve Center										
Triangle Project No. 033-0201										
	SOIL BORING SAMPLES									
Sample I.D.	G11R	G17R	I15R	J10R	J14R	J16R	K11R	L18R	L22R	M19R
Sample Date	3/26/96	3/27/96	3/26/96	3/27/96	3/26/96	3/26/96	3/26/96	3/26/96	3/26/96	3/26/96
Sampled Interval (ft.)	0.0 - 5.0	0.5 - 1.5	0.0 - 4.5	0.0 - 0.5	0.0 - 5.0	0.0 - 5.0	0.7 - 3.5	0.0 - 5.7	0.6 - 5.8	0.0 - 7.8
Metals (total analysis)		NA	NA		NA	NA	NA	NA	NA	NA
Arsenic (mg/kg)	5			6.7						
Chromium (mg/kg)	22.3			173						
Lead (mg/kg)	156			807						
Mercury (mg/kg)	2.5			0.70						
Metals (TCLP)										
Arsenic (mg/L)	0.006	0.005	0.020	<0.004	0.008	0.006	0.005	0.006	0.007	<0.004
Chromium (mg/L)	0.007	0.012	0.002	0.018	0.002	0.001	0.002	0.002	0.002	0.001
Lead (mg/L)	0.588	1.69	0.047	0.702	0.038	0.093	0.060	0.094	0.023	0.112
Mercury (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
NA = Not Analyzed										

Table 3
Soil Analysis - TCLP and Total Metals

Army Reserve Center									
Triangle Project No. 033-0201									
	SOIL BORING SAMPLES				SOIL PROFILE SAMPLES				
Sample I.D.	M21R	M21RD	N20Ra	N20Rb	TP1a	TP1b	TP1bD	TP1c	SP19R
Sample Date	3/26/96	3/26/96	3/26/96	3/26/96	3/27/96	3/27/96	3/27/96	3/27/96	3/27/96
Sampled Interval (ft.)	3.0 - 6.7	3.0 - 6.7	0.7 - 2.7	6.0 - 8.0	0.0 - 0.5	0.5 - 1.0	0.5 - 1.0	1.0 - 1.9	stockpile
Metals (total analysis)			NA				NA		
Arsenic (mg/kg)	4.9	4.5		1.3	2.8	3.4		5.1	5.5
Chromium (mg/kg)	16.0	12.7		13.3	11.5	173		17.0	19.3
Lead (mg/kg)	158	148		6.3	52.1	773		40.9	408
Mercury (mg/kg)	4.3	1.4		<0.098	0.18	0.31		1.4	3.2
Metals (TCLP)									
Arsenic (mg/L)	0.011	0.009	0.021	0.012	<0.004	<0.004	<0.004	<0.004	<0.004
Chromium (mg/L)	0.002	0.002	0.018	0.002	0.006	0.141	0.146	0.001	0.002
Lead (mg/L)	0.198	0.217	0.88	0.013	0.011	0.417	0.429	0.040	0.734
Mercury (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
NA = Not Analyzed									

Table 3
Soil Analysis - TCLP and Total Metals

Army Reserve Center									
Triangle Project No. 033-0201									
	STOCKPILE SAMPLES					SURFACE SAMPLES			
Sample I.D.	SP19RD	SH17cR	SH17dR	SH17eR	SH17fR	G13SS	L16SS	M21SS	Q19SS
Sample Date	3/27/96	3/27/96	3/27/96	3/27/96	3/27/96	3/27/96	3/27/96	3/27/96	3/27/96
Sampled Interval (ft.)	stockpile	stockpile	stockpile	stockpile	stockpile	surface	surface	surface	surface
Metals (total analysis)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic (mg/kg)									
Chromium (mg/kg)									
Lead (mg/kg)									
Mercury (mg/kg)									
Metals (TCLP)									
Arsenic (mg/L)	<0.004	0.005	0.005	0.004	<0.004	<0.004	<0.004	<0.004	0.006
Chromium (mg/L)	0.002	0.007	0.004	0.002	0.001	<0.001	0.006	0.002	0.002
Lead (mg/L)	0.465	0.131	0.049	0.042	0.027	<0.002	0.046	0.074	0.178
Mercury (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
NA = Not Analyzed									

REFERENCE 11

DEPARTMENT OF THE ARMY
HEADQUARTERS, 81ST REGIONAL READINESS COMMAND
255 WEST OXMOOR ROAD
BIRMINGHAM, ALABAMA 35209-6383

REPLY TO
ATTENTION OF:

Natural Attenuation Monitoring Report for April 2004
Army Reserve Center, Morehead City, NC

Charles F. Stehman, P.G., Ph.D.
Environmental Regional Supervisor
Division of Water Quality/Groundwater Section
North Carolina Department of Environment and Natural Resources
127 Cardinal Drive Extension
Wilmington, NC 28405

Dear Dr. Stehman,

In accordance with the Natural Attenuation Corrective Action Plan (CAP) requiring quarterly monitoring dated May 19, 1997 and your letter dated May 16, 2003, the 81st Regional Readiness Command (RRC) contracted with Environmental Enterprise Group (EEG), Inc. to install one monitoring well and re-develop five existing wells at the Morehead City US Army Reserve Center.

The six wells were sampled April 2004 to satisfy quarterly groundwater monitoring requirements as outlined in the CAP. They were sampled for EPA Method 602 with Xylenes, MADEP VPH, MADEP EPH and EPA Method 625 with top ten peaks. See enclosure for sample analysis data.

If you have any questions about this report, please do not hesitate to contact our Environmental Manager, Ms. Michelle Hook, at (803) 751-6757.

Sincerely,

Steven Francis
Environmental Division Chief
Deputy Chief of Staff Installation Management

Enclosure

TestAmerica
ANALYTICAL TESTING CORPORATION

371474

April 2K4

To assist us in using the proper analytical methods, is this work being conducted for regulatory purposes?
Compliance Monitoring _____

Client Name: EEG Client #: 2449
Address: 1345 Barracks Rd. Project Name: US Army Reserve Center
City/State/Zip Code: North Charleston, S.C. 29405 Project #: _____
Project Manager: Pratt Shaw Site/Location ID: Morehead City State: N.C.
Telephone Number: (843) 202-8074 Fax: (843) 202-8091 Report To: Pratt Shaw
Sampler Name (Print Name): Pratt Shaw Invoice To: _____
Sampler Signature: [signature] Quote #: _____ PO#: _____

TAT: X Standard 371474 ___ Rush (surcharges may apply)
Date Needed: Routine
Fax Results: (Y) N

Matrix: SL - Sludge, DW - Drinking Water, S - Soil/Solid, GW - Groundwater, WW - Wastewater, Specify Other
Preservation & # of Containers: HNO3, HCl 40 ml / VOA, NaOH, H2SO4, Methanol, None / Lite Amber, Other (Specify) HCl / Lite Amber
Analyze For: VPH (with 10 spikes), G25, EPH, G02 + xylenes

SAMPLE ID	Date Sampled	Time Sampled	G = Grab, C = Composite	Field Filtered	Matrix	HNO3	HCl 40 ml / VOA	NaOH	H2SO4	Methanol	None / Lite Amber	Other (Specify) HCl / Lite Amber	VPH (with 10 spikes)	G25	EPH	G02 + xylenes					REMARKS
MW-1C	4/13/04	0750	G	—	GW		4				1	1	2	1	1	2			55867		MW-1
MW-2C	↓	0821	G	—	GW		4				1	1	2	1	1	2			66		MW-2
MW-3C		0944	G	—	GW		4				1	1	2	1	1	2			67		MW-3
MW-4C		1027	G	—	GW		4				1	1	2	1	1	2			70		MW-4
MW-6C		1117	G	—	GW		4				1	1	2	1	1	2			71		MW-6
MW-7C	↓	0903	G	—	GW		4				1	1	2	1	1	2			72		MW-7
Trip Blank																			55873		

QC Deliverables: ___ None ___ Level 2 (Batch QC) ___ Level 3 ___ Level 4 Other: _____

Special Instructions:

Relinquished By	Date	Time	Received By	Date	Time
[signature]	4/13/04	1430	FEDEX		
Relinquished By:	Date:	Time:	Received By: [signature]	Date: 4-14-04	Time: 8:00
Relinquished By	Date:	Time:	Received By:	Date:	Time:

LABORATORY COMMENTS:
Init Lab Temp:
Rec Lab Temp: 2.4
Custody Seals: Y N N/A
Bottles Supplied by Test America: Y N
Method of Shipment:

TestAmerica
ANALYTICAL TESTING CORPORATION

2960 Foster Creighton Drive • Nashville, Tennessee 37204
800-765-0980 • 615-726-3404 Fax

ANALYTICAL REPORT

Laboratory Number: 04-A55867
Sample ID: MW-1C
Project:
Page 2

Analyte	Result	Units	Report Limit	Dil Factor	Analysis Date	Analysis Time	Analyst	Method	Batch
Benzo(g,h,i)perylene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Benzo(k)fluoranthene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
4-Bromophenylphenylether	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Butylbenzylphthalate	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
4-Chloro-3-methylphenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
bis(2-Chloroethoxy)methane	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
bis(2-Chloroethyl)ether	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
bis(2-Chloroisopropyl)ether	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2-Chloronaphthalene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2-Chlorophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
4-Chlorophenylphenylether	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Chrysene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Dibenz(a,h)anthracene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
1,2-Dichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
1,3-Dichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
1,4-Dichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
3,3'-Dichlorobenzidine	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2,4-Dichlorophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Diethylphthalate	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2,4-Dimethylphenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Dimethylphthalate	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Di-n-butylphthalate	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2,4-Dinitrophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2,4-dinitrotoluene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2,6-Dinitrotoluene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Di-n-octylphthalate	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
1,2-Diphenylhydrazine	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Fluoranthene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Fluorene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Hexachlorobenzene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Hexachlorobutadiene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Hexachlorocyclopentadiene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Hexachloroethane	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Indeno(1,2,3-cd)pyrene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Isophorone	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2-Methyl-4,6-dinitrophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656

Sample report continued . . .

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ANALYTICAL TESTING CORPORATION

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ANALYTICAL REPORT

Laboratory Number: 04-A55867
Sample ID: MW-1C
Project:

Analyte	Result	Units	Report Limit	Dil Factor	Analysis Date	Analysis Time	Analyst	Method	Batch
Naphthalene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Nitrobenzene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2-Nitrophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
4-Nitrophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
N-nitrosodi-n-propylamine	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
N-nitrosodiphenylamine	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
N-nitrosodimethylamine	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Pentachlorophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Phenanthrene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Phenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Pyrene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
Bis(2-ethylhexyl)phthalate	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
1,2,4-Trichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656
2,4,6-Trichlorophenol	ND	ug/L	11.1	1.0	4/20/04	3:14	R. Beard	625	7656

Sample Extraction Data

Parameter	Wt/Vol Extracted	Extract Vol	Date	Time	Analyst	Method
EPH	950. ml	1.0 ml	4/15/04	14:01	K. Turner	MADEP EPH
625	900. ml	1. ml	4/15/04		M. Ricke	625

Surrogate	% Recovery	Target Range
BTEX/GRO Surr., a,a,a-TFT	107.	70. - 124.
VPH Surr-2,5-Dibromotoluene (PID)	128.	70. - 130.
VPH Surr-2,5-Dibromotoluene (FID)	93.	70. - 130.
Surr-Nitrobenzene-d5	72.	12. - 135.
Surr-2-Fluorobiphenyl	83.	14. - 132.
Surr-Terphenyl d14	95.	11. - 142.

Sample report continued . . .

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ANALYTICAL REPORT

EEG - ENV. ENTERPRISE GROUP 2449
RICK ALBERS
1345 BARRACKS ROAD
N. CHARLESTON, SC 29405

Lab Number: 04-A55870
Sample ID: MW-4C
Sample Type: Water
Site ID:

Date Collected: 4/13/04
Time Collected: 10:27
Date Received: 4/14/04
Preservation: HCl
Temperature: 2.4 degrees C
Time Received: 8:00
Page: 1

Project:
Project Name: US ARMY RESERVE CENTER
Matrix: Water
Received condition: Good
Sampler: PRATT SHAW

VPH Sample pH: < 2.00

Analyte	Result	Units	Report Limit	Dil Factor	Analysis Date	Analysis Time	Analyst	Method	Batch
VPH C5-C8 Aliphatics	ND	ug/L	100.	1.0	4/17/04	2:09	J. Redmond	MADEP-VPH	4948
VPH C9-C12 Aliphatics	ND	ug/L	100.	1.0	4/17/04	2:09	J. Redmond	MADEP-VPH	4948
VPH C9-C10 Aromatics	ND	ug/L	100.	1.0	4/17/04	2:09	J. Redmond	MADEP-VPH	4948
C9-C18 Aliphatic Hyd	ND	ug/L	105.	1.0	4/18/04	0:50	Weatherly	MADEP-EPH	8408
C19-C36 Aliphatic Hyd	ND	ug/L	105.	1.0	4/18/04	0:50	Weatherly	MADEP-EPH	8408
C11-C22 Aromatic Hyd	ND	ug/L	105.	1.0	4/18/04	0:50	Weatherly	MADEP-EPH	8408
ORGANIC PARAMETERS									
Benzene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
Toluene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
Ethylbenzene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
Xylenes, total	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
Chlorobenzene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
1,2-Dichlorobenzene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
1,3-Dichlorobenzene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
1,4-Dichlorobenzene	ND	ug/L	1.0	1.0	4/16/04	20:23	A. Cobbs	602	6624
EXTRACTABLE ORGANICS									
Acenaphthene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Acenaphthylene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Anthracene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Benzidine	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Benzo(a)anthracene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Benzo(a)pyrene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Benzo(b)fluoranthene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656

Sample report continued . . .

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ANALYTICAL REPORT

Laboratory Number: 04-A55870
Sample ID: MW-4C
Project:

Analyte	Result	Units	Report Limit	Dil Factor	Analysis Date	Analysis Time	Analyst	Method	Batch
Benzo(g,h,i)perylene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Benzo(k)fluoranthene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
4-Bromophenylphenylether	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Butylbenzylphthalate	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
4-Chloro-3-methylphenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
bis(2-Chloroethoxy)methane	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
bis(2-Chloroethyl)ether	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
bis(2-Chloroisopropyl)ether	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2-Chloronaphthalene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2-Chlorophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
4-Chlorophenylphenylether	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Chrysene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Dibenz(a,h)anthracene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
1,2-Dichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
1,3-Dichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
1,4-Dichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
3,3'-Dichlorobenzidine	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2,4-Dichlorophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Diethylphthalate	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2,4-Dimethylphenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Dimethylphthalate	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Di-n-butylphthalate	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2,4-Dinitrophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2,4-dinitrotoluene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2,6-Dinitrotoluene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Di-n-octylphthalate	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
1,2-Diphenylhydrazine	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Fluoranthene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Fluorene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Hexachlorobenzene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Hexachlorobutadiene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Hexachlorocyclopentadiene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Hexachloroethane	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Indeno(1,2,3-cd)pyrene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Isophorone	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2-Methyl-4,6-dinitrophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656

Sample report continued . . .

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ANALYTICAL REPORT

Laboratory Number: 04-A55870
Sample ID: MW-4C
Project:

Analyte	Result	Units	Report Limit	Dil Factor	Analysis Date	Analysis Time	Analyst	Method	Batch
Naphthalene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Nitrobenzene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2-Nitrophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
4-Nitrophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
N-nitrosodi-n-propylamine	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
N-nitrosodiphenylamine	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
N-nitrosodimethylamine	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Pentachlorophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Phenanthrene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Phenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Pyrene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
Bis(2-ethylhexyl)phthalate	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
1,2,4-Trichlorobenzene	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656
2,4,6-Trichlorophenol	ND	ug/L	11.1	1.0	4/20/04	19:10	R. Beard	625	7656

Sample Extraction Data

Parameter	Wt/Vol Extracted	Extract Vol	Date	Time	Analyst	Method
EPH	950. ml	1.0 ml	4/15/04	14:01	K. Turner	MADEP EPH
625	900. ml	1. ml	4/15/04		M. Ricke	625

TENTATIVELY IDENTIFIED COMPOUNDS

Compound	Concentration	Units
9-Octadecenamide, (Z)	0.015	PPM

Sample report continued . . .

TestAmerica
ANALYTICAL TESTING CORPORATION

2960 Foster Creighton Drive • Nashville, Tennessee 37204
800-765-0980 • 615-726-3404 Fax

ANALYTICAL REPORT

Laboratory Number: 04-A55870
Sample ID: MW-4C
Project:

Surrogate	% Recovery	Target Range
BTEX/GRO Surr., a,a,a-TFT	106.	70. - 124.
VPH Surr-2,5-Dibromotoluene (PID)	126.	70. - 130.
VPH surr-2,5-Dibromotoluene (FID)	97.	70. - 130.
surr-Nitrobenzene-d5	82.	12. - 135.
surr-2-Fluorobiphenyl	94.	14. - 132.
surr-Terphenyl d14	83.	11. - 142.
surr-Phenol d5	51.	5. - 79.
surr-2-Fluorophenol	54.	5. - 99.
surr-2,4,6-Tribromophenol	91.	7. - 155.
EPH SUR C-35	69.	40. - 140.
EPH SUR o-Terphenyl	84.	40. - 140.
EPH SUR 2-FLUOROBIPHENYL	82.	40. - 140.
EPH SUR 2-BROMONAPHTHALENE	91.	40. - 140.

LABORATORY COMMENTS:
ND = Not detected at the report limit.
B = Analyte was detected in the method blank.
J = Estimated Value below Report Limit.
E = Estimated Value above the calibration limit of the instrument.
# = Recovery outside Laboratory historical or method prescribed limits.

End of Sample Report.

8

REFERENCE 12

MEMORANDUM

TO: File

FROM: S. Franch, Environmental Chemist, NC Superfund

DATE: June 27, 2006

SITE: USA Reserves-Morehead City, Carteret County, NC
NC5 210 022 906

Since on-site soil metal background locations could not confidently be located, soil and sediment backgrounds from two nearby sites: the NC Maritime Museum Site, Beaufort, Carteret County, NC (NCSFN 040 7074), and the Buxton Dump Site, Buxton, Dare County, NC (NCD 981 750 425) were used. In cases where neither site had the designated metal or if the background values seemed questionable, the average NC stream-sediment geochemical data value was used (derived from the National Uranium Resource Evaluation Survey). Attached are the data pages from the two sites with their respective background values.

METALS SCAN

Facility: Buxton Dump Buxto

Program: NSF

Id/Station: BE001SD

Media: SEDIMENT

RESULTS	UNITS	ANALYTE
310J	MG/KG	ALUMINUM
0.93U	MG/KG	ANTIMONY
2U	MG/KG	ARSENIC
2U	MG/KG	BARIUM
0.03U	MG/KG	BERYLLIUM
0.09U	MG/KG	CADMIUM
1300J	MG/KG	CALCIUM
1.4J	MG/KG	CHROMIUM
0.36U	MG/KG	COBALT
3U	MG/KG	COPPER
1000	MG/KG	IRON
11J	MG/KG	LEAD
370J	MG/KG	MAGNESIUM
5.1	MG/KG	MANGANESE
0.16UJ	MG/KG	TOTAL MERCUF
0.51U	MG/KG	NICKEL
130	MG/KG	POTASSIUM
0.60U	MG/KG	SELENIUM
0.24U	MG/KG	SILVER
990	MG/KG	SODIUM
1.4U	MG/KG	THALLIUM
3.6J	MG/KG	VANADIUM
13	MG/KG	ZINC
NA	MG/KG	CYANIDE
37	%	% MOISTURE

A-average value. NA-not analyzed. NAI-interfe
K-actual value is known to be less than value gi
R-qc indicates that data unusable. compound r
C-confirmed by gcms: 1.when no value is repo

Sample 4687 FY 1998 Project

METALS SCAN

Facility: Buxton Dump Buxt

Program: NSF

Id/Station: BE010SB

Media: SUBSURFACE SOIL (> 12")

RESULTS	UNITS	ANALYTE
440J	MG/KG	ALUMINUM
0.65U	MG/KG	ANTIMONY
1U	MG/KG	ARSENIC
2U	MG/KG	BARIUM
1U	MG/KG	BERYLLIUM
0.06U	MG/KG	CADMIUM
160UJ	MG/KG	CALCIUM
1.8J	MG/KG	CHROMIUM
1U	MG/KG	COBALT
1U	MG/KG	COPPER
960	MG/KG	IRON
3.7J	MG/KG	LEAD
130U	MG/KG	MAGNESIUM
8.8	MG/KG	MANGANESE
0.10U	MG/KG	TOTAL MERCUR
1U	MG/KG	NICKEL
84	MG/KG	POTASSIUM
1U	MG/KG	SELENIUM
0.17U	MG/KG	SILVER
30.5U	MG/KG	SODIUM
0.96U	MG/KG	THALLIUM
1.9J	MG/KG	VANADIUM
6.1	MG/KG	ZINC
NA	MG/KG	CYANIDE
4	%	% MOISTURE

-average value. NA-not analyzed. NAI-interferenc
-actual value is known to be less than value given
-qc indicates that data unusable. compound may
-confirmed by gcms: 1.when no value is reported

Sample 4686 FY 1998 Projec

METALS SCAN

Facility: Buxton Dump Bux

Program: NSF

Id/Station: BE011SS

Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
560J	MG/KG	ALUMINUM
0.68U	MG/KG	ANTIMONY
1U	MG/KG	ARSENIC
2	MG/KG	BARIUM
1U	MG/KG	BERYLLIUM
0.07U	MG/KG	CADMIUM
350J	MG/KG	CALCIUM
2.5	MG/KG	CHROMIUM
1U	MG/KG	COBALT
3U	MG/KG	COPPER
1400	MG/KG	IRON
5.5J	MG/KG	LEAD
180	MG/KG	MAGNESIUM
11	MG/KG	MANGANESE
0.11U	MG/KG	TOTAL MERCUI
1U	MG/KG	NICKEL
100	MG/KG	POTASSIUM
0.44U	MG/KG	SELENIUM
0.18U	MG/KG	SILVER
32.4U	MG/KG	SODIUM
1.0U	MG/KG	THALLIUM
4.6J	MG/KG	VANADIUM
8.9	MG/KG	ZINC
NA	MG/KG	CYANIDE
9	%	% MOISTURE

A-
K-
R-
C-

A-average value. NA-not analyzed. NAI-interferer
K-actual value is known to be less than value give
R-qc indicates that data unusable. compound ma
C-confirmed by gcms: 1.when no value is reporte

Sample 4685 FY

METALS SCAN

Facility: Buxton Dump

Program: NSF

Id/Station: BE010SS

Media: SURFACE SOIL (0" - 1

RESULTS	UNITS	ANALYT
480J	MG/KG	ALUMIN
0.65U	MG/KG	ANTIMC
1U	MG/KG	ARSENI
1.9	MG/KG	BARIUM
1U	MG/KG	BERYLL
0.06U	MG/KG	CADMIU
330J	MG/KG	CALCIU
3.3	MG/KG	CHROM
1U	MG/KG	COBAL
2U	MG/KG	COPPE
1200	MG/KG	IRON
4.2J	MG/KG	LEAD
150U	MG/KG	MAGNE
21	MG/KG	MANGA
0.13	MG/KG	TOTAL
2U	MG/KG	NICKEI
79	MG/KG	POTAS
0.42U	MG/KG	SELEN
0.17U	MG/KG	SILVEI
55	MG/KG	SODIU
0.96U	MG/KG	THALL
4.7J	MG/KG	VANAI
8.9	MG/KG	ZINC
NA	MG/KG	CYANI
4	%	% MO

A-average value. NA-not analyzed.
K-actual value is known to be less th
R-qc indicates that data unusable.
C-confirmed by gcms: 1.when no v

RECOMMEND FURTHER CERCLA ACTION.
SUF 11/29/2000

FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT

NORTH CAROLINA MARITIME MUSEUM HARBORSIDE PROPERTY
BEAUFORT, CARTERET COUNTY, NORTH CAROLINA

U.S. EPA ID NO. NCSSN0407074

Revision 1

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, Georgia 30303

Contract No.	:	68-W-00-120
TDD No.	:	4T-01-10-A-024
Date Prepared	:	November 13, 2000
EPA Task Monitor	:	Samantha Urquhart-Foster
Telephone No.	:	(404) 562-8760
Prepared by	:	Tetra Tech EM Inc.
START Project Manager	:	John P. Mueller
Telephone No.	:	(828) 670-9602

Prepared by	Reviewed by	Approved by
Sandra J. Hanyan for	Paul F. Moisan	
John P. Mueller	Paul F. Moisan	R. Steve Pierce
START Project Manager	START Technical Reviewer	START Leader

TABLE 8
BUXTON DUMP SITE
NCD 981 750 425
EXPANDED SITE INSPECTION
SEDIMENT SAMPLE
ANALYTICAL RESULTS :

Sample No.	BE-001-SD	BE-101-SD	BE-002-SD	BE-012-SD	BE-003-SD	BE-004-SD	BE-005-SD	BE-006-SD	BE-007-SD	BE-008-SD	BE-009-SD
Location:	North Canal Background	Duplicate Background	North Canal (PPE)	North Canal (PPE)	North Canal Crossways Rd	North Canal Rte. 12	Pamlico Soun	Cape Creek (PPE)	Cape Creek Downstream	Buxton Creek Background	Buxton Creek Dippin' Vat Rd
VOCs (ug/kg):	[No VOCs detected.]										
SVOCs (ug/kg):	[No SVOCs detected.]										
Pesticides/PCBs (ug/kg):	[No pesticides or PCBs detected.]										
4,4'-DDD	--	--	--	--	**11**	--	**63**	**54**	--	--	--
4,4'-DDE	--	--	--	--	**35**	**7.9**	**62**	**96**	--	--	--
4,4'-DDT	--	--	--	--	--	--	--	**82**	--	--	--
(beta) Endosulfan II	--	--	--	--	--	--	**5.8**	--	--	--	--
Inorganics (mg/kg):											
Arsenic	--	--	--	--	--	--	--	**4.4**	--	--	--
Barium	--	--	--	--	--	7.9	--	2.6	8.6	--	5.6
Cadmium	--	--	--	--	--	--	--	0.35 J	0.22 J	--	--
Chromium	1.4 J	1.4 J	1.4 J	0.95 J	2 J	3.3	2.2 J	8.3	2.5 J	6.5	5.4
Copper	--	--	--	--	--	--	--	**26**	**14**	--	--
Iron	1000	900	1700	1000	3100	3900	680	3300	5100	6100	3000
Lead	11 J	5.1 J	4.9 J	5 J	8.2 J	4.7 J	14 J	41 J	36 J	14 J	5.2 J
Magnesium	370 J	320 J	300 J	--	740 J	730 J	270 J	1100 J	1300 J	540 J	840 J
Manganese	4.1	4.9	7.7	--	8	40	7	19	40	46	26
Vanadium	3.6 J	2.6 J	2.7 J	1.4 J	3.6 J	2.6 J	1.9 J	19	4.9	20 J	4.8 J
Zinc	13	12	8.4	5.9	18	20	6.3	**86**	58	20	19

Bold/shaded print indicates concentration significantly elevated above background.
J = Concentration estimated.
C = Carcinogenic
NA = Not applicable

TABLE 3
SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE SEDIMENT SAMPLES

ANALYTE (mg/kg)	SAMPLE NUMBER						
	Background		On Site				Taylor Creek
	MM-06-SD	MM-07-SD	MM-01-SD	MM-01-DSD	MM-02-SD	MM-04-SD	MM-05-SD
Aluminum	5,700	4,200	380	340	1,000	8,200	6,000
Antimony	0.71UJ	0.46UJ	0.94UJ	--	--	--	--
Arsenic	2.4J	3.6J	1.6J	1.9J	7.0J	7.7J	3.7J
Barium	18	11	24	18	73	48	47
Calcium	16,000	22,000	2,600	5,400	16,000	29,000	14,000
Chromium	17	16	3.0	5.4	6.1	28	17
Cobalt	1.9	1.5	--	--	0.82	3.0	2.5
Copper	18J	75J	280J	260J	800J	260J	230J
Iron	8,900	8,000	2,400	3,700	5,000	15,000	12,000
Lead	21J	30J	77J	84J	160J	82J	63J
Magnesium	3,800	2,800	230	390	960	5,100	3,400
Manganese	64	53	8.1	24	18	110	73
Total Mercury	0.16	0.12U	1.0	0.69	2.1	0.77	0.49
Nickel	5.6	4.9	0.94	1.2	2.5	7.3	5.7
Potassium	1,300J	880J	41J	78J	210J	1,700J	1,200J
Sodium	7,600	3,600	--	1,300	1,900	6,300	6,400
Vanadium	18	15	2.2	2.1	4.7	28	18
Zinc	54J	67J	94J	110J	230J	130J	100J

Notes:
- mg/kg — Milligram per kilogram
- SD — Sediment
- DSD — Duplicate sediment
- U — Constituent analyzed for but not detected
- J — Estimated value
- -- — Constituent analyzed for but not detected
- MM — North Carolina Maritime Museum

Shaded areas indicate elevated concentrations of constituents

TABLE 5
SUMMARY OF INORGANIC ANALYTICAL RESULTS
SUBSURFACE SEDIMENT SAMPLES

ANALYTE (mg/kg)	SAMPLE NUMBER & DEPTH					
	Background		On Site			Taylor Creek
	MM-06-SSD 2 feet bss	MM-07-SSD 2 feet bss	MM-01-SSD 1 to 2 feet bss	MM-02-SSD 1 to 2 feet bss	MM-03-SSD 2 to 4 feet bss	MM-05-SSD 1.5 to 2 feet bss
Aluminum	3,400	1,200	950	780	4,900	8,200
Antimony	0.56UJ	0.85UJ	--	130J	--	--
Arsenic	1.2UJ	0.52UJ	8.9J	8.3J	3.5J	6.1J
Barium	13	18	2,200	1,100	22	130
Cadmium	0.08U	0.08U	2.9	1.8	--	0.23
Calcium	30,000	12,000	12,000	18,000	13,000	12,000
Chromium	12	4.9	18	12	16	28
Cobalt	1.1	0.53	2.4	2.0	2.4	3.1
Copper	43J	69J	2,900J	4,400J	100J	460J
Iron	6,900	3,800	11,000	18,000	9,800	17,000
Lead	42J	48J	3,200J	3,400J	92J	170J
Magnesium	2,600	840	1,200	1,400	2,500	4,900
Manganese	46	30	47	80	71	110
Total Mercury	0.28	0.20	19	9.5	0.26	0.55
Nickel	4.6	1.4	4.1	5.8	4.8	9.8
Potassium	690J	180J	410J	240J	740J	1,700J
Silver	0.14U	0.12U	--	0.70	--	0.32
Sodium	2,800	540	1,600	2,500	1,400	6,200
Vanadium	13	5.3	3.4	3.8	16	25
Zinc	83J	90J	3,200J	1,500J	110J	260J
Cyanide	0.06U	0.06U	4.1	--	--	--

Notes:

mg/kg	Milligram per kilogram
bss	Below the surface of the sediment layer
SSD	Subsurface sediment collected from 1 to 2 feet below ground surface
U	Constituent analyzed for but not detected
J	Estimated value
--	Constituent analyzed for but not detected
MM	North Carolina Maritime Museum

Shaded areas indicate elevated concentrations of constituents

Hg, 2

A GEOCHEMICAL ATLAS OF NORTH CAROLINA

by

Jeffrey C. Reid

NORTH CAROLINA GEOLOGICAL SURVEY

BULLETIN 93

RALEIGH

MAY 1991

(REVISED 1993)

REFERENCE 13

Academic Press, 657p.

Sargent, K. A., Cook, J. R., and Fay, W. M., 1982, Data Report: North and South Carolina, National Uranium Resource Evaluation Program, Hydrochemical and stream sediment reconnaissance: E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC under contract to the U.S. Department of Energy, contract DE-AC09-76SR000001 (DPST-81-146-22; GBJX-102), 45p. plus microfiche.

GEOLOGICAL SURVEY SECTION

The Geological Survey Section examines, surveys, and maps the geology, mineral resources, and topography of the state to encourage the wise conservation and use of these resources by industry, commerce, agriculture, and government agencies for the general welfare of the citizens of North Carolina.

Table 1 - Stream sediment geochemical data for North Carolina. Table shows chemical element, atomic number, periodic chart column, number of samples represented, mean, standard deviation (Std. Dev.), and crustal abundance (Crustal Abund.).

Table 1 -- Stream-sediment geochemical data for North Carolina*.

Plate	Variable	Atomic Number	Periodic Column	N (Raw Data)	"DOT"	"M"	Not Plottable	Unplottable removed	Computed N (Final File)	N (plotted)	Plot Error	Number of Samples	Mean FINAL	Std. Dev. FINAL	Min. FINAL	Max. FINAL	90th Percentile	95th Percentile	99th Percentile	Crustal Abundance***	CUMULATIVE FREQUENCY PERCENT OF DATA PORTRAYED BY PLOTTING SYMBOL (Lowest) RANGE ONE	RANGE TWO	RANGE THREE	(Highest) RANGE FOUR
3	Li	3	IA	4677	62	0	39	39	4576	4576	0	4576	8.2	13.8	1	717	15*	20*	31*	20	26.8	48.5	72.5	100
4	Na	11	IA	6744	0	593	67	67	6084	6084	0	6084	7259	7788	100	79500	17500*	22300*	33900*	28,300	24.9	50.2	75.4	100
5	K	19	IA	4677	64	0	39	39	4574	4574	0	4574	7909	7463	500	96100	17400*	22200*	33600*	25,900	16.0	48.4	72.6	100
6	Cu	29	IB	4677	28	0	39	39	4610	4610	0	4610	7.3	7.5	1	215	15*	19*	30*	55	16.3	48.3	71.3	100
7	Ag	47	IB	4677	28	0	39	39	4610	4610	0	4610	0.25	0.18	0.05	2.5	0.6*	0.7*	0.9*	0.07	31.76	47.25	76.03	100
8	Au	79	IB	336	0	0	0	0	336	336	0	336	0.595	2.245	0.011	30.34	0.695	2.96	10.776	0.004	25.3	50	75	100
9	Be	4	IIA	4677	63	0	39	39	4575	4575	0	4575	1.1	1.5	0.2	84	N/A	2.1*	3.3*	2.8	11.2	35.6	68.8	100
10	Mg	12	IIA	4677	64	0	39	39	4574	4574	0	4574	2026	2994	100	84800	3750	5159	11950	20,900	24.8	49.4	74.6	100
11	Ca	20	IIA	4677	1286	0	39	39	3352	3352	0	3352	230	340	50	8600	600*	800*	1400*	36,300		33.0	72.5	100
12	Sr	38	IIA	4677	3428	0	39	39	1210	1210	0	1210	82	115	25	1141	183*	270*	648	375		56	74.9	100
13	Ba	56	IIA	4677	1277	0	39	39	3361	3361	0	3361	78.4	145.3	2.5	5603	215*	305*	512*	425	19.5	50.1	74.6	100
14	Zn	30	IIB	4677	28	0	39	67	4610	4610	0	4610	24.4	23.8	2.5	774	49*	61*	95*	70	19.8	48.6	74.0	100
15	Al	13	IIIA	6744	0	325	67	67	6352	6352	0	6352	38480	25813	1100	229400	67800*	77900*	131500	81,300	25.1	50.1	74.9	100
16	Sc	21	IIIB	6744	0	177	67	67	6500	6500	0	6500	9	8.4	0.2	104.3	18.7*	24	42.5*	22	25	50.1	75	100
17	Y	39	IIIB	4677	40	0	39	39	4598	4598	0	4598	26.2	74.3	2.5	2035	58*	133*	343*	33		42.4	79.3	100
18	La	57	IIIB	6744	0	1649	67	67	5028	5028	0	5028	88	145	2	1470	218	353	724	30	24.4	48.7	74.8	100
19	Sn	50	IVA	4677	50	0	39	39	4588	4588	0	4588	5.7	8.7	2.5	133	11*	25*	42	2		65	81	100
20	Pb	82	IVA	4677	42	0	39	39	4596	4596	0	4596	11	41	5	2597	21*	27*	50*	13		56.8	80.4	100
21	Ti	22	IVB	6744	0	537	67	67	6140	6140	0	6140	10000	1900	200	99600	20000*	29100*	56700*	4,400	25	49.7	74.9	100
22	Hf	72	IVB	6744	0	222	67	67	6455	6455	0	6455	55	96	1	2258	116*	185*	435	3	23.2	49.4	74.	100
23	P	15	VA	4677	53	0	39	39	4585	4585	0	4585	999	990	10	8150	1680*	3200*	6100*	1,050	23.4	48.2	70.3	100
24	As	33	VA	4677	0	1865	32	32	2780	Note 1		2780	2.1	3.1	0	40	6*	8*	17*	1.8	22.6	56.3	76.2	100
25	V	23	VB	6744	0	456	67	67	6221	6221	0	6221	78	88	10	1570	170*	230*	450*	135	17.5	42.5	71.6	100
26	Nb	41	VB	4677	59	0	39	39	4579	4579	0	4579	16.5	21.8	2	300	45*	55*	105*	20	25.4	57.7	76.8	100
27	Se	34	VIA	4677	0	1294	39	39	3344	3344	0	3344	1	1.1	0.05	20	3*	4*	6*	0.05		60.5	82.9	100
28	Cr	24	VIB	4677	51	0	39	39	4587	4587	0	4587	12.8	58.1	2.5	3010	21*	33*	90*	100	24.7	43.5	74.2	100
29	Mo	42	VIB	4677	38	0	39	39	4600	4600	0	4600	2	1.8	1	35	5*	6*	11*	1.5			83.9	100
30	W	74	VIB	4677	40	0	39	39	4598	4598	0	4598	1	4	1	250	N/A	3*	7*	1.5		84.4	96.4	100
31	Mn	25	VIIB	6744	0	404	67	67	6273	6273	0	6273	762	892	20	11620	1670*	2340*	4340	950	24.5	50.1	74.8	100
32	Fe	26	VIIIB	6744	0	347	67	67	6330	6330	0	6330	30676	29077	2500	358100	62400*	79900*	150000	50,000	25.1	49.9	61.7	100
33	Co	27	VIIIB	4677	26	0	39	39	4612	4612	0	4612	8.6	7.9	2.5	72	19*	26*	42*	25		49.8	66	100
34	Ni	28	VIIIB	4677	29	0	39	39	4609	4609	0	4609	7.6	11	2.5	422	16*	22	39*	75		43.3	73.2	100
35	Ce	58	LAN	6744	0	359	67	67	6318	6318	0	6318	168	387	4	8266	381*	682*	1552	60	24.8	49.8	74.8	100
36	Sm	62	LAN	6744	0	1718	67	67	4959	4959	0	4959	22	61	1	1610	50*	85	257	6.0	13.9	47.8	74.5	100
37	Eu	63	LAN	6744	0	1088	67	67	5589	5589	0	5589	1.8	2.4	0.2	51.7	4.2*	5.9*	10.8*	1.2	50.3	54	73.8	100
38	Dy	66	LAN	6744	0	1515	67	67	5162	5162	0	5162	8.7	16.2	0.1	388.9	18.7*	31.9*	67	3.0	23.6	49	75.1	100
39	Yb	70	LAN	6744	0	3167	41	41	3536	3536	0	3536	7.5	7.9	0.5	102.2	14.9*	20.5*	40.9*	3.4	24.5	48.7	74.5	100
40	Lu	71	LAN	6744	0	1423	59	59	5262	5262	0	5262	0.8	1.	0.1	15.6	1.9*	2.6*	5*	0.5	20.4	57	76.3	100
41	Th	90	ACT	6744	0	411	60	60	6273	Note 2		6272	35	89	0.5	2252	80*	145*	358	7.2	26.5	51.7	76.1	100
42	U	92	ACT	6744	0	158	67	67	6519	6519	0	6519	7.4	12.6	0.1	237.8	15.5*	25.2*	57	1.8	23.4	49.5	74.7	100
43	UX	92	ACT	4677	1305	0	39	39	3333	3333	0	3333	1.4	2.6	0.05	56.2	2.6*	3.8*	13.9		24.7	47.9	70.5	100
44	pH (acid==>basic)			6744	0	456	67	67	6221	6221	0	6221	6.8	0.9	2.9	12.2	7.8*	7.9*	8.4*		24.4	47.5	68.5	100
	pH (basic==>acid)**			6744	0	456	67	67	6221								5.3*	4.7*	4*					
45	Conductivity (low==>high)			6744	0	385	67	67	6292	6292	0	6292	72	219	1	13300	121*	151*	325*		25.1	49.9	73.8	100
	Conductivity (high==>low)			6744	0	385	67	67	6292								17*	12*	8*					
	Total points plotted==>>									185745														

* Denotes upward rounding to next unique analysis. Typically this is less than 0.5 cumumulative frequency percent.

DOT = the background was high, and an accurate determination of the minimum detection limit could not be made, a (.) indicates that the element was not detected and the detection limit was unusually high.

M= missing data.

Lacking Coordinates = Data points for which coodinates are lacking in the NURE database.

** Sorted from most basic to most acidic.

***From American Geological Institute Data Sheets, 1982, Data Sheet 42.1. American Geological Institute, Falls Church, VA.

Note 1: A total of 627 sampling points with analyses reported as "0" were not plotted. Thus all points are accounted for. Statistics included these "0" analyses.

Note 2: One point was lost during data processing and cannot be located.

REFERENCE 14

Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E. Director
Division of Water Quality

June 4, 2004

Ms. Michell Hook
US Army Corps of Engineers
Attention AFRC-CAL-NS-EN
Building 1300 Jackson Blvd.
Fort Jackson, South Carolina 29207

Subject: Soil and Groundwater Remediation
Army Reserve Center
Morehead City, North Carolina
Carteret, County
Incident# 13066

Dear Ms. Hook:

The Division of Water Quality received the quarterly monitoring report for groundwater samples obtained from wells at the Morehead City, North Carolina Army Reserve Center Report dated May 25, 2004 Thank you very much for providing us with this report.

As with previous reports dated March 2001, November 24, 2003, and February 18, 2004 there was no petroleum contamination in excess of state groundwater standards found in groundwater taken from the six wells sampled. Thus, because groundwater conditions have been compliant with state standards for the last four sampling events, no further action is required at this site. Should you choose to do so, the monitoring well array can be abandoned at this time.

The Division appreciates the efforts which have been expended at the Morehead City property over the past several years to bring this facility into compliance. Should you have questions concerning the site please contact me at (910) 395-3900.

Yours very truly,

Charles F. Stehman, P.G., Ph. D.
Environmental Regional Supervisor

CFS/
cc: WiRO-GWS

s:\gws\cfs\Morehead Reserve Center.march04.wpd