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NAWC WARMINSTER
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Stream Monitoring First Quarterly Report

Unnamed Tributary to Little Neshaminy Creek

Area A Sites Naval Air Warfare Center (NAWC) Warminster, Pennsylvania

Naval Air Warfare Center
Warminster, Pennsylvania

Northern Division
Naval Facilities Engineering Command
Contract No. N62472-90-D-1298
Contract Task Order 0252

November 1999

TETRA TECH NUS, INC.

STREAM MONITORING
FIRST QUARTERLY REPORT
FOR
UNNAMED TRIBUTARY TO LITTLE NESHAMINY CREEK
AREA A SITES
NAVAL AIR WARFARE CENTER
WARMINSTER, PENNSYLVANIA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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Submitted by:
Tetra Tech NUS
600 Clark Avenue, Suite 3
King of Prussia, Pennsylvania 19406-1433

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SUBMITTED BY:

GARTH GLENN
PROJECT MANAGER
TETRA TECH NUS

APPROVED BY:

JOHN J. TREPANOWSKI, P.E.
PROGRAM MANAGER
TETRA TECH NUS

TABLE OF CONTENTS

SECTION		PAGE
1.0	**INTRODUCTION**	**1-1**
1.1	OBJECTIVES	1-1
2.0	**BACKGROUND INFORMATION**	**2-1**
2.1	FACILITY BACKGROUND	2-1
2.2	SITE BACKGROUND	2-5
3.0	**FIELD SAMPLING AND ANALYSIS**	**3-1**
3.1	SAMPLING OBJECTIVES	3-1
3.2	FIRST QUARTERLY MONITORING	3-1
3.2.1	Surface Water Sampling	3-3
3.2.2	Sediment Sampling	3-3
3.2.3	Surface Soil Sampling	3-3
3.2.4	Macroinvertebrate Sampling	3-4
3.2.5	Stream Flow Monitoring	3-4
4.0	**SAMPLING RESULTS**	**4-1**
4.1	ANALYTICAL RESULTS	4-1
4.2	BIOLOGICAL RESULTS	4-7
5.0	**CONCLUSIONS AND RECOMMENDATIONS**	**5-1**

FIGURES

2-1	**Site Location Map**	**2-2**
2-2	**Approximate Location of Areas Of Concern**	**2-3**
2-3	**Area A Map**	**2-4**
3-1	**Biological Chemical Monitoring Program – Sampling Locations**	**3-2**

TABLES

3-1	**Stream Flow Monitoring Results**	**3-5**
4-1	**Analytical Results for Surface Water and Sediment**	**4-2**
4-2	**Surface Soil Sampling Results**	**4-8**
4-3	**Surface Water Quality Parameters**	**4-9**
4-4	**Benthic Macroinvertebrate Community**	**4-10**
4-5	**Similarity Between Benthic Macroinvertebrate Samples**	**4-11**

APPENDICES

A	**Survey Data**	**A-1**
B	**Stream Flow Calculations**	**B-1**
C	**Sample Logs**	**C-1**
D	**Data Packages**	**D-1**

1.0 INTRODUCTION

This Stream Monitoring First Quarterly Report has been prepared by Tetra Tech NUS, Incorporated (TtNUS) under Contract Task Order (CTO) 252 for the Northern Division (NORTHDIV) Naval Facilities Engineering Command (NAVFAC) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298. The work was conducted in accordance with the Stream Monitoring Work Plan prepared by TtNUS in August 1999. The work was performed as part of the Installation Restoration Program (IRP) being implemented by the Navy at the former Naval Air Warfare Center (NAWC) Warminster, Pennsylvania. The work is also in support of actions being taken by the Navy under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

1.1 OBJECTIVES

The objective of the stream monitoring program is to provide a baseline and then 3 years of long-term monitoring data to determine the impact, if any, of the Navy operations on the unnamed tributary to Little Neshaminy Creek. Specifically, the Navy will evaluate the results of the monitoring program to determine the need for additional monitoring and/or the scope of additional remedial actions within the area.

The scope of the work to be conducted under this plan consists of the collection and evaluation of surface water, sediment, and biological (benthic macroinvertebrate) samples from an unnamed tributary to Little Neshaminy Creek. The study area is located within and adjacent to the northern boundary of NAWC. The stream is located near three former Navy disposal sites that have been studied through the remedial investigation (RI) process and have been the subject of removal actions overseen by the Navy.

2.0 BACKGROUND

2.1 FACILITY BACKGROUND

The former NAWC Warminster is located in Warminster Township, Bucks County, Pennsylvania. The facility lies in a populated suburban area surrounded by private homes, various commercial/industrial activities, and a golf course. Figure 2-1 shows the general facility location. The facility, approximately 820 acres in size, is being parceled off and transferred to the private sector. Four areas of study (Areas A, B, C, and D) have been identified within the original facility. These areas were identified based on groupings of suspected disposal sites, contamination, geographic boundaries, common sources and receptors, and facility characteristics. Figure 2-2 presents these four major areas of concern. The focus of the biomonitoring program is an unnamed tributary to Little Neshaminy Creek located within Area A.

Area A is located in the northwestern corner of NAWC, between Jacksonville Road and the off-base railroad tracks west of the base. This area contains Sites 1, 2, and 3. Figure 2-3 depicts the approximate locations of these sites.

Site 1 is located at the northwestern border of NAWC. This site was reportedly operated as a burn pit from 1948 to 1950. Various waste materials such as paints, oils, asphalt, roofing material, solvents, scrap metal, and unspecified chemicals were reportedly burned within this pit. Historical aerial photographs indicate that this area may also have been used for the placement of fill material.

Site 2 is located southeast of and adjacent to Site 1. This site reportedly received sludge material from the industrial wastewater treatment facility from 1965 to 1970. It is reported that the sludge material was buried within this area.

Site 3 is located immediately northwest of Jacksonville Road. This site was reportedly used as a burn pit from 1955 to 1965. It has been reported that the pit was used to burn solvents, paints, roofing material, and other unspecified chemicals. Historical information suggests that the pit was backfilled and regraded with soils from the base upon closure. The area now consists of a gravel and asphalt parking lot.

Area A soils have been sampled under several RIs and numerous supplemental investigations. The most comprehensive sampling investigations conducted in the area were performed under

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DRAWN BY A.S.M. DATE 11/24/1998	Tetra Tech NUS Inc.	CONTRACT NO. N62472-90-D-1298	OWNER NO. CTO 0252
CHECKED BY DATE	SITE LOCATION MAP FORMER NAWC WARMINSTER WARMINSTER, PENNSYLVANIA	APPROVED BY DATE 6/29/99	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE 1 in.=2000 ft.		DRAWING NO. FIGURE 2-1	REV. 0

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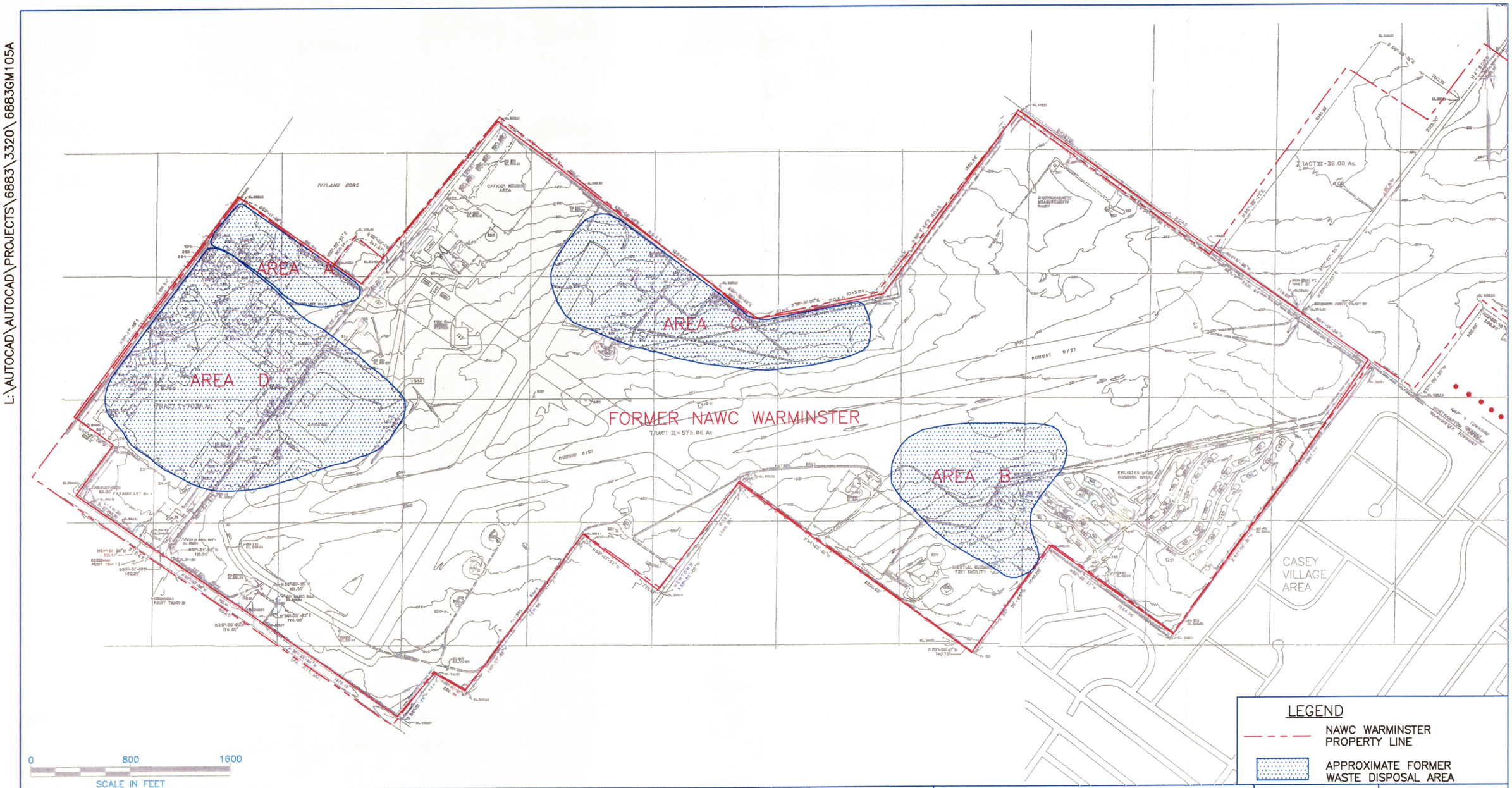

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SCALE 1 in. = 800 ft.

Tetra Tech NUS, Inc.

APPROXIMATE LOCATION OF AREAS OF CONCERN
FORMER NAWC, WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. N62472-90-D-1298
OWNER NO. CTO 0252
APPROVED BY DATE
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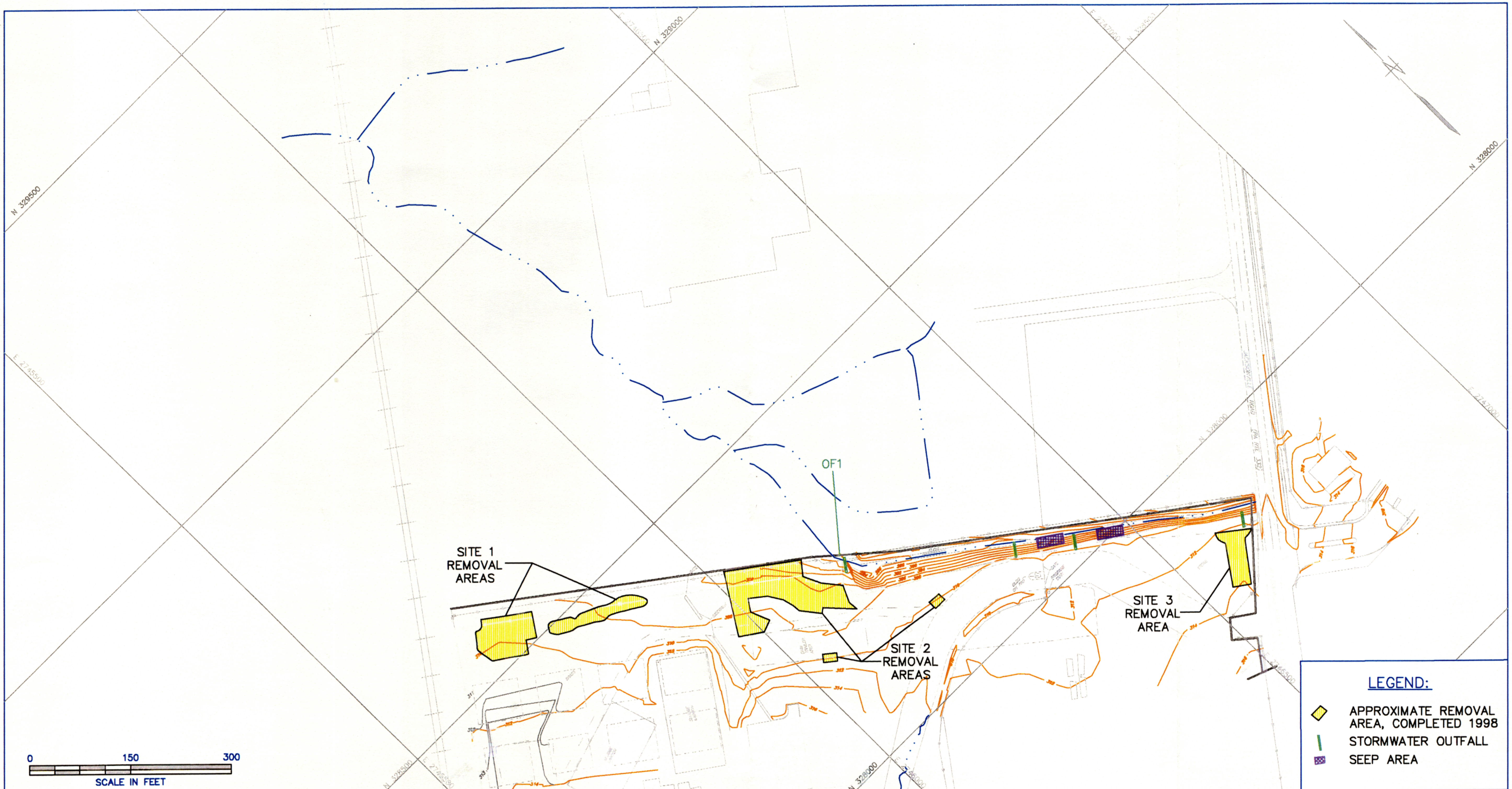

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SCALE: 1" = 150'

Tetra Tech NUS, Inc.

AREA A
UNNAMED TRIBUTARY TO LITTLE NESHAMINY CREEK
STUDY AREA
NAWC, WARMINSTER, PA

CONTRACT NO. N62472-90-D-1298
OWNER NO. 6883
APPROVED BY / DATE
APPROVED BY / DATE
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the Phase III RI [Draft Phase III RI, Media Other Than Groundwater, Brown & Root Environmental (B&RE), 1996]. Supplemental sampling investigations that were completed after the Phase III RI were summarized and reported in a series of letter reports (Results from Additional Site 1 Soil Investigation, July 10, 1998 B&RE; Results from Additional Site 2 Soil Investigations, July 21, 1998 TtNUS; Supplemental Subsurface Soils at Site 3, July 23, 1998 B&RE; Results from Additional Site 2 Subsurface Soil Investigation, July 28, 1998 B&RE; Preliminary Results from Verification and Supplemental Sampling Area A Site 2, October 29, 1998 TtNUS; Characterization Sampling Results Area A Site 1B, November 12, 1998 TtNUS) issued by the Navy and reviewed by the BRAC Closure Team (BCT).

The results of the RIs and supplemental investigations were evaluated by the Navy and formed the basis for removal actions completed by the Navy. The Navy completed removal actions in 1998. In general, the actions consisted of the excavation and off-site disposal of contaminated soils. Two excavations were conducted at Site 1. These excavations extended to bedrock and continued laterally until visual and analytical evidence indicated that no additional contamination existed. Site 2 removal actions consisted of three excavations. The largest was immediately adjacent to the northern property line and immediately upgradient of the unnamed tributary that flows near this boundary. Both surface and subsurface soils were removed from this area based on potential risks to human health and the environment. Excavations were extended at depth and laterally until visual and analytical evidence indicated that no contamination in excess of clean-up goals remained. Similarly, Site 3 removal actions consisted of the removal of surface soils adjacent to Jacksonville Road. This excavation was also extended until evidence confirmed that the target clean-up levels had been attained. The Site 3 excavation extended to about 30 feet from the unnamed tributary to Little Neshaminy Creek at Jacksonville Road.

2.2 SITE BACKGROUND

An unnamed tributary to Little Neshaminy Creek is located north of Area A (Figure 2-3). This stream originates from a stormwater culvert under Jacksonville Road and flows from the southeast to the northwest before turning north, away from NAWC Warminster. Between the base boundary and Bristol Road, the stream flows north under Mearns Road through pastures and small woodlots to its confluence with Little Neshaminy Creek. Surface water drainage from portions of the airfield and hangar area discharges from a culvert where the stream originates. Surface water runoff from Area A and adjacent areas also enters this stream. A major stormwater discharge culvert (OF1 on Figure 2-3) is located at the point where the stream turns to the north and exits the NAWC property.

The stream adjacent to Area A is a small urban headwater reach that appears to be perennial. The portion of the stream within the NAWC property is channeled with a very high (10 to 12 feet) and steeply sloped (4:1 to 5:1) southern bank. Sites 2 and 3 are located immediately above this southern bank, and approximately one-third to one-half of the area is paved with asphalt paving material. The stream channel in this area averages about 4 feet in width and 1/2 foot in depth. Several small pool areas with depths up to 1 to 2 feet exist within this stretch. In general, the streambed is rocky and gravelly. The deeper, slower moving pools contain a layer of finer sediment.

In addition to the major stormwater discharge (OF1) noted at the property boundary, three other surface water stormwater discharge pipes exist in the upper reaches of the stream adjacent to Sites 2 and 3 (see Figure 2-3). Flow from these pipes is limited to the collection of stormwater. The major discharge pipe, OF1, contains flow most of the year. Historical aerial photographs indicate that another unnamed tributary existed in this area of NAWC, flowing from the south to the north, and discharged in the approximate area of OF1. It is believed, from reviewing these photographs and other historical documents, that the stream was enclosed and now discharges through OF1.

Several seep areas have been identified in addition to the stormwater discharge pipes located on the southern bank of the stream. These seep areas are noted on Figure 2-3. The upper or easternmost seep was evident but not flowing during a March 1999 field inspection. The other two seeps were notable and appeared to flow into the stream over a relatively wide sheet type of discharge rather than a well-defined discharge point. These areas were defined by the presence of wet soils, orange to rusty discoloring of the soils, and the presence of wet soil-type plant species.

Three sampling events were performed in the unnamed tributary to Little Neshaminy Creek during the completion of the RI phases. In general, the surface water and sediment sample analytical results revealed low-level contamination with metals and polycyclic aromatic hydrocarbons (PAHs). The source of the contamination, especially PAHs was not well defined.

A screening-level ecological risk assessment (ERA) was performed as part of the Phase III RI. Surface water and sediment analytical results were compared to conservative Benchmark Toxicity Values to estimate the potential ecological risks associated with the contaminant concentrations. The ERA concluded that surface water contamination presented a low to moderate potential for adverse ecological impacts. Sediment contamination was estimated to present a moderate to high potential for adverse impacts. The ERA recommended further site-

specific data collection and analysis to define potential ecological impacts. The EPA Biological Technical Assistance Group (BTAG) concurred with this recommendation and suggested the implementation of a long-term chemical and benthic macroinvertebrate monitoring program at the site.

3.0 FIELD SAMPLING AND ANALYSIS

3.1 SAMPLING OBJECTIVES

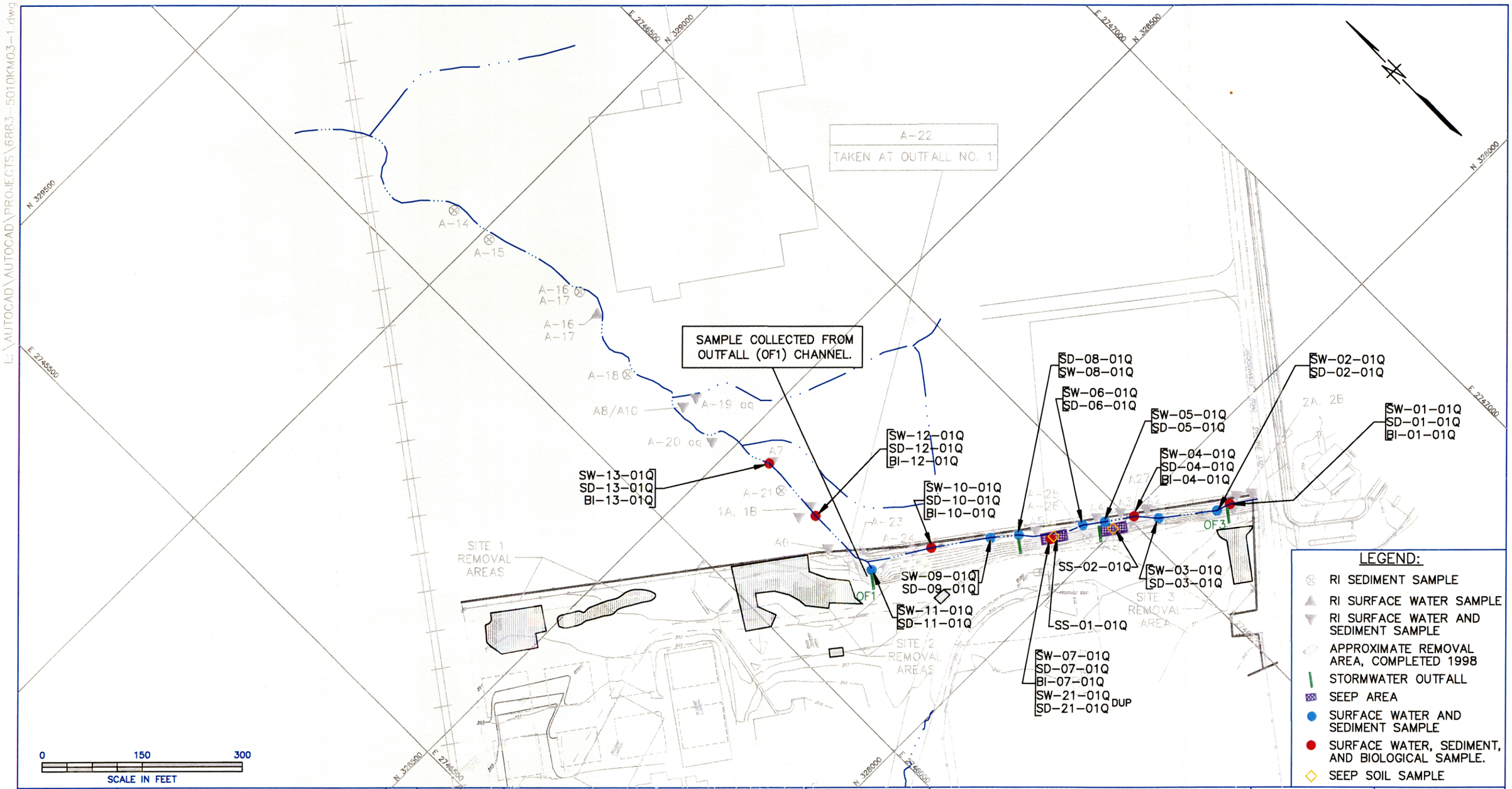
The sampling objectives of this program are as follows:

- Establish baseline chemical and benthic macroinvertebrate conditions of the unnamed tributary to Little Neshaminy Creek.
- Collect analytical and biological data over time to determine if the stream conditions vary over the established period of monitoring.
- Collect analytical and biological data to determine the cause, if present, of impacts to the stream community.
- Collect analytical and biological data to determine the source, if present, of contamination.

3.2 FIRST QUARTERLY MONITORING

TtNUS collected surface water, sediment and macroinvertebrate samples along the unnamed tributary to the Neshaminy Creek adjacent to Area A sites 2 and 3 and the discharge area for several surface water runoff pipes from the property. Samples were collected at 13 previously identified and surveyed reference locations (ST-01 through ST-13) along the unnamed tributary (Figure 3-1). Appendix A presents survey data for these locations. In addition, two surface soil samples (SS-01 and SS-02) were collected from leachate outbreaks at or near the tributary (Figure 3-1). Sampling was performed on September 14, 1999 and September 15, 1999. Details of sampling procedures may be found in the Stream Monitoring Work Plan prepared by TtNUS in August 1999.

It should be noted that during the time of the first quarter sampling, the region was in a severe drought condition.



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES
2	01/17/99	SAMPLE LOCATIONS REVISED PER FIELD COORDINATES.	LDL			

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COST/SCHED-AREA
SCALE 1" = 150'

Tetra Tech NUS, Inc.

AREA A
BIOLOGICAL/CHEMICAL MONITORING PROGRAM
UNNAMED TRIBUTARY TO LITTLE NESHAMINY CREEK
NAWC, WARMINSTER, PA

CONTRACT NO 6883
OWNER NO 5130
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3.2.1 Surface Water Sampling

Surface water samples were collected from each of the 13 reference locations on the unnamed tributary. Sample bottles were filled at a mid-depth point in the main stream channel at each sampling location. The farthest downstream location (ST-13) was collected first with subsequent samples proceeding upstream to ST-01 which was collected last. This technique limits the influence of sediment and water disturbance on the downstream sample. At each sample location, water quality parameters including temperature, pH, conductivity, turbidity, dissolved oxygen and salinity were recorded. In addition, stream flow was calculated for each sample station. All surface water samples were analyzed for PAHs, TAL (target analyte list) metals, low concentration mercury and total organic carbon (TOC); however, analyses for PAHs for locations ST-01 (SW-01), ST-02 (SW-02), and ST-05 (SW-05) are not available. Results are discussed in Section 4.0. Sample log sheets for each location are presented in Appendix C.

3.2.2 Sediment Sampling

Sediment samples were collected from the 13 reference locations on the unnamed tributary. Sediment from the top 0.2 feet of the stream channel was collected using a stainless steel trowel for transfer of the sediment into the sample container. The sediment samples were collected after the surface water samples to limit potential impact of sediments on the surface waters. Sediment samples were also collected to limit the amount of rock, gravel, and vegetative material sent to the laboratory for analysis. Samples were analyzed for PAHs, TAL metals, low concentration mercury, TOC, and grain size; however, results for TAL metals are not available for sample locations ST-02 (SD-02). ST-03 (SD-03), ST-12 (SD-12), ST-13 (SD-13), and the duplicate sample to ST-07 (SW-21). Results are discussed in Section 4.0. Sample log sheets for each location are presented in Appendix C.

3.2.3 Surface Soil Sampling

Surface soils were collected from the locations of two previously observed leachate outbreaks. One outbreak was observed along the toe of the steep embankment within approximately 3 feet of the unnamed tributary. Sample SS-01 was from soils within the leach area noted about 3 feet from the unnamed tributary. The other outbreak, where sample SS-02 was collected, was observed on the bank of the unnamed tributary. The surface soils were collected from the top 0.5 feet from these locations. Soil samples were collected to limit the amount of rocks, gravel, and vegetative material. The samples were analyzed for PAHs, TAL metals, low concentration

mercury, TOC, and grain size. Results are discussed in Section 4.0. Sample log sheets for each location are presented in Appendix C.

3.2.4 Macroinvertebrate Sampling

Macroinvertebrate sampling was conducted at six of the 13 stream locations. The six locations (ST-01, ST-04, ST-07, ST-10, ST-12, and ST-13) were identified by Navy, EPA, and TtNUS personnel based on locations of discharge pipes and seeps which could potentially impact the stream. The samples were collected using a Surbur bottom sampler. Samples were collected from the most downstream station to the most upstream location to avoid unnecessary sediment disturbance. After placing the sampler on the streambed, the sediment was agitated to a depth of 0.5 feet with the resulting material being swept into the net. At each sample location two samples (replicates) were collected and composited. The material in the net was then collected for laboratory analysis and preserved with a 95% ethanol solution. The samples were analyzed for species level taxonomy identification, Shannon-Weiner Index, MBI, and Index of Community Similarity. For additional information see sample log sheets in Attachment C.

3.2.5 Stream Flow Monitoring

Stream depth and width measurements were taken and recorded during at each sampling station. Stream flow measurements (velocity) were also be collected and recorded. Stream flow measurements were obtained using a portable in-stream flow monitoring and recording device manufactured specifically for low-flow streams. Results for each location are presented in Table 3-1. Stream cross-sections and calculations may be found in Appendix B.

TABLE 3-1
STREAM FLOW MONITORING RESULTS
FIRST QUARTERLY MONITORING
NAWC WARMINSTER, PENNSYLVANIA

LOCATION	STREAM WIDTH (ft)	STREAM DEPTH (ft)	CROSS-SECTION AREA (ft^2)	VELOCITY (ft/sec)	FLOW RATE (cfs)
ST-01	3.3	0.45	1.49	0.41	0.62
ST-02	3.3	0.35	1.16	0.73	0.84
ST-03	4.4	0.60	2.64	0.55	1.35
ST-04	6.0	0.30	1.80	0.23	0.42
ST-05	2.5	0.31	0.775	0.69	0.53
ST-06	2.1	0.35	0.735	1.46	1.07
ST-07	5.2	0.21	1.10	0.83	0.91
ST-08	6.2	0.20	1.24	0.31	0.38
ST-09	5.2	0.80	4.16	0.15	0.62
ST-10	6.0	0.20	1.20	0.45	0.54
ST-11	1.7	0.23	0.39	0.93	0.36
ST-12	9.0	0.24	2.16	0.15	0.32
ST-13	2.3	0.23	0.759	0.75	0.57

cfs = cubic feet per second
Cross-section area = Width X Depth
Flow Rate = Cross-section area X Velocity

4.0 SAMPLING RESULTS

Section 3.0 details the number, types, and locations or samples collected during the first quarter monitoring program.

4.1 ANALYTICAL RESULTS

During the first quarterly sampling, aqueous and sediment samples were collected from the 13 reference stations (ST-01 through ST-13). Figure 3-1 shows the sampling stations and associated sample identification number. It should be noted that at the time of the sampling, the region was in a severe drought.

Aqueous samples (SW-01-01Q through SW-13-01Q) were analyzed for TAL metals, low concentration mercury, PAHs, and hardness. In addition, field parameters (flow rate, temperature, pH, specific conductivity, dissolved oxygen, turbidity, and salinity) were recorded for each location. Sediment samples (SD-01-01Q through SD-13-01Q) were analyzed for TAL metals, low concentration mercury, PAHs, TOC, and grain size. Two surface soil samples (SS-01-01Q and SS-02-01Q) were also collected from seep areas and analyzed for TAL metals, low concentration mercury, PAHs, and TOC. Duplicate samples to location ST-07 were also collected and identified as SW-21-01Q and SD-21-01Q.

Table 4-1 presents the analytical data for each stream sample location. Results exceeding ecological screening values are bolded in the tables. Several metals were detected at levels exceeding ecological benchmarks; however the levels were generally comparable to the upstream location (ST-01). Exceptions include mercury (SW-02-01Q; 0.0142 ug/l and SD-11-01Q; 0.195 L mg/kg) and zinc (SD-11-01Q; 704 mg/kg). Levels of PAHs were significantly higher than the upstream location and greater than the ecological benchmarks in the majority of downstream sampling locations with the exception of stations ST-06 and ST-09. The highest levels of PAHs were detected at ST-08, ST-11, and ST-12. PAHs were primarily detected in sediment samples, but were also found at levels above ecological benchmarks in the aqueous sample from ST-04.

Table 4-1
Analytical Results
NAWC Warminster

	NOAA ER-L (1)	AWQC (1) Freshwater Chronic Screening	SW-01-01Q 09/15/99		SW-02-01Q 09/15/99		SW-03-01Q 09/14/99		SW-04-01Q 09/15/99		SW-05-01Q 09/14/99		SW-06-01Q 09/14/99	
			RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
INORGANICS	mg/kg	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Aluminum	NA	87	350	B	**1050**		138	B	**773**		41	U	41	U
Antimony	2	NA	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
Arsenic	8.2	8.1	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U
Barium	NA	3.9 (2)	34.2	B	42.3	B	100	B	58.9	B	87.3	B	102	B
Beryllium	NA	5.1 (2)	0.37	UL	0.37	UL	0.65	B	1.1	B	0.37	UL	0.37	UL
Cadmium	1.2	2.2	0.43	UL	0.43	UL	0.43	UL	0.43	UL	0.43	UL	0.43	UL
Calcium	NA	NA	5180	B	8980	J	29100	J	12900		27700	J	31600	J
Chromium	81	74/11	6.2		5.4	U	15.4		19.6		5.4	U	5.4	
Cobalt	NA	3 (2)	5.2	U	5.2	U	12.6	B	12	B	5.2	U	**5.2**	U
Copper	34	9	10.7	B	9.1	B	13	B	20.5	B	3.8	U	6.5	B
Iron	NA	1000	683		**1800**	J	136	B	**1430**		149	B	97.1	B
Lead	46.7	2.5	**78.8**		**119**		2.7	U	**56.9**		2.7	U	**2.7**	U
Magnesium	NA	NA	2030	K	3040	J	11200	J	5320	K	10300	J	11800	J
Manganese	NA	80 (2)	32	B	**86.4**	J	32.3	B	78.9		46.8	J	53	J
Mercury	0.15	0.012	0.01		**0.0142**		0.0017		0.0112		0.0021		0.0009	
Nickel	20.9	52.0	6.3	UL	6.3	UL	16.5	B	18	B	6.3	UL	6.3	UL
Potassium	NA	NA	1040	B	1090	B	2130	J	1820	J	1630	J	1830	J
Selenium	NA	5	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U
Silver	1	NA	3.7	UJ	4	B	7.2	B	3.7	UJ	5.2	B	3.7	UJ
Sodium	NA	NA	3110	K	4730	J	17600	J	7180	K	16700	J	19300	J
Thallium	NA	NA	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U
Vanadium	NA	19 (2)	2.8	B	5.7	B	12.8	B	19.7	B	2.8	U	4	B
Zinc	150	120	47.1		82.1		32.4	B	52.6		12.8	B	15.3	B
MISCELLANEOUS PARAMETERS			mg/L		mg/L		mg/L		mg/L		mg/L		mg/L	
Hardness as CaCO3			21.3		34.9		119		54.2		111		128	
Total Organic Carbon			5		7.7		3.1		9		2.9		3.6	
SEMIVOLATILES	ug/kg	ug/L					ug/L		ug/L				ug/L	
Acenaphthene	16	24 (2,3)	NA		NA		0.5	U	0.5	U	NA		0.5	U
Acenaphthylene	44	24 (2,3)	NA		NA		1	U	1	U	NA		1	U
Anthracene	85.3	24 (2,3)	NA		NA		0.05	U	0.05	U	NA		0.05	U
Benz(a)anthracene	261	0.014 (2,4)	NA		NA		0.05	U	**0.056**		NA		0.05	U
Benzo(a)pyrene	430	0.014 (2)	NA		NA		0.05	U	0.06		NA		0.05	U
Benzo(b)fluoranthene	430 (2)	0.014 (2,4)	NA		NA		0.1	U	0.1	U	NA		0.1	U
Benzo(g,h,i)perylene	430 (2)	0.014 (2,4)	NA		NA		0.1	U	0.11		NA		0.1	U
Benzo(k)fluoranthene	430 (2)	0.014 (2,4)	NA		NA		0.05	U	0.05	U	NA		0.05	U
Chrysene	384	0.014 (2,4)	NA		NA		0.05	U	**0.085**		NA		0.05	U
Dibenz(a,h)anthracene	63.4	0.014 (2,4)	NA		NA		0.025	U	0.03	U	NA		0.025	U
Fluoranthene	600	3.9 (2,5)	NA		NA		0.1	U	0.2		NA		0.1	U
Fluorene	19	3.9 (2)	NA		NA		0.1	U	0.1	U	NA		0.1	U
Indeno(1,2,3-cd)pyrene	430 (2)	0.014 (2,4)	NA		NA		0.05	U	**0.065**		NA		0.05	U
Naphthalene	160	24 (2)	NA		NA		0.5	U	0.5	U	NA		0.5	U
Phenanthrene	240	24 (2,3)	NA		NA		0.05	U	0.086		NA		0.05	U
Pyrene	665	24 (2,3)	NA		NA		0.05	U	0.13		NA		0.05	U

(1) 1997 ES/ER/TM-95/R4. Toxicological Benchmarks for Screening COPCs for Effects on Sediment Associated Biota.
(2) December 10, 1998. Ambient Water Quality Critieria (AWQC). Freshwater CCC.

Table 4-1
Analytical Results
NAWC Warminster

	NOAA	AWQC (1)	SW-07-01Q		SW-08-01Q		SW-09-01Q		SW-10-01Q		SW-11-01Q		SW-12-01Q		SW-13-01Q	
	ER-L (1)	Freshwater	09/15/99		09/14/99		09/14/99		09/15/99		09/14/99		09/15/99		09/15/99	
		Chronic Screening														
			RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
INORGANICS	mg/kg	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Aluminum	NA	87	41	U	140	B	149	B	262	B	71.3	B	41	U	41	U
Antimony	2	NA	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
Arsenic	8.2	8.1	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U
Barium	NA	3.9 (2)	83.2	B	98.5	B	97.6	B	121	B	199	J	112	B	90	B
Beryllium	NA	5.1 (2)	0.37	UL	0.37	UL	0.49	B	0.81	B	0.37	UL	0.37	UL	0.37	UL
Cadmium	1.2	2.2	0.43	UL	0.43	UL	0.43	UL	0.43	UL	0.43	UL	1		0.43	U
Calcium	NA	NA	26500		32200	J	29800	J	31300		58300	J	36600	J	32400	J
Chromium	81	74/11	5.4	U	5.4	U	11.6		16.2		5.4	U	5.4	U	5.4	U
Cobalt	NA	3 (2)	5.2	U	5.2	U	9.6	B	11.4	B	5.4	B	5.2	U	5.2	U
Copper	34	9	3.8	U	3.8	U	11.4	B	19.7	B	6.8	B	5.9	B	3.8	U
Iron	NA	1000	258	J	553	J	418	J	1550		3190	J	1380	J	270	J
Lead	46.7	2.5	2.7	U	3.2		2.7	U	4.4		4.1		2.7	U	2.7	U
Magnesium	NA	NA	9845	J	11700	J	11100	J	12000		23800	J	14000	J	12400	J
Manganese	NA	80 (2)	77.5	J	158	J	164	J	208		746	J	244	J	139	J
Mercury	0.15	0.012	0.0015		0.0017		0.006		0.01		0.004		0.002		0.001	
Nickel	20.9	52.0	6.3	UL	6.7	B	16.5	B	16.9	B	6.7	B	6.3	UL	6.3	UL
Potassium	NA	NA	1425	J	1630	J	1920	J	2190	J	2400	J	1570	J	1360	J
Selenium	NA	5	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U
Silver	1	NA	3.7	UJ	3.7	UJ	4.9	B	3.7	UJ	6.8	B	3.7	UJ	3.7	UJ
Sodium	NA	NA	15450	J	19700	J	18700	J	19500		49100	J	27100	J	23400	J
Thallium	NA	NA	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U
Vanadium	NA	19 (2)	2.8	U	5.4	B	11.5	B	14.4	B	2.8	U	2.8	U	2.8	U
Zinc	150	120	19.7	B	22.9	B	30.5	B	30.3	B	34	B	78.4		12.1	B
MISCELLANEOUS PARAMETERS			mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L	
Hardness as CaCO3			107		129		120		127		244		149		132	
Total Organic Carbon			3.1		3		2.5		2.3		3.3		4.5		3.9	
SEMIVOLATILES	ug/kg	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Acenaphthene	16	24 (2,3)	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Acenaphthylene	44	24 (2,3)	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Anthracene	85.3	24 (2,3)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Benz(a)anthracene	261	0.014 (2,4)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Benzo(a)pyrene	430	0.014 (2)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Benzo(b)fluoranthene	430 (2)	0.014 (2,4)	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Benzo(g,h,i)perylene	430 (2)	0.014 (2,4)	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Benzo(k)fluoranthene	430 (2)	0.014 (2,4)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Chrysene	384	0.014 (2,4)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Dibenz(a,h)anthracene	63.4	0.014 (2,4)	0.03	U	0.025	U	0.025	U	0.03	U	0.025	U	0.025	U	0.025	U
Fluoranthene	600	3.9 (2,5)	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Fluorene	19	3.9 (2)	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Indeno(1,2,3-cd)pyrene	430 (2)	0.014 (2,4)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Naphthalene	160	24 (2)	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Phenanthrene	240	24 (2,3)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Pyrene	665	24 (2,3)	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U

(1) 1997 ES/ER/TM-95/R4. Toxicological Benchmarks for Screening COPCs for Effects on Sediment Associated Biota.
(2) December 10, 1998. Ambient Water Quality Critieria (AWQC). Freshwater CCC.

Table 4-1
Analytical Results
NAWC Warminster

	NOAA	AWQC (1)	SD-01-01Q		SD-02-01Q		SD-03-01Q		SD-04-01Q		SD-05-01Q		SD-06-01Q	
	ER-L (1)	Freshwater	09/15/99		09/15/99		09/14/99		09/15/99		09/14/99		09/14/99	
		Chronic Screening												
			RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
INORGANICS	mg/kg	ug/L	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Aluminum	NA	87	7900		NA		NA		7760		7110		7440	
Antimony	2	NA	5.1	K	NA		NA		0.53	K	0.73	J	1.1	J
Arsenic	8.2	8.1	0.36	UL	NA		NA		2.8	L	5.3	L	0.73	L
Barium	NA	3.9 (2)	85.8		NA		NA		85.1		73	J	104	J
Beryllium	NA	5.1 (2)	0.95	J	NA		NA		1.3	J	1.1	J	1.1	J
Cadmium	1.2	2.2	0.85	UL	NA		NA		0.05	UL	0.05	UL	0.95	UL
Calcium	NA	NA	24100		NA		NA		12200		15300	J	10200	J
Chromium	81	74/11	494		NA		NA		28.1		34.8	J	30.5	J
Cobalt	NA	3 (2)	9.2	K	NA		NA		10.1	K	10.1	K	8.6	K
Copper	34	9	65.8		NA		NA		46		30.3	J	32	J
Iron	NA	1000	67200		NA		NA		28000		26100	J	52100	J
Lead	46.7	2.5	69.1		NA		NA		52.7		199		50.3	
Magnesium	NA	NA	9480		NA		NA		8550		11100	J	7640	J
Manganese	NA	80 (2)	6220		NA		NA		737		676	J	1040	J
Mercury	0.15	0.012	0.0087	L	0.0277	L	0.0336	L	0.017	L	0.0115	L	0.188	L
Nickel	20.9	52.0	17.9	L	NA		NA		19	L	17.2	L	21.2	L
Potassium	NA	NA	2020	K	NA		NA		1830		1960	J	1980	J
Selenium	NA	5	4.2	U	NA		NA		2.6	U	4.7	UR	4.7	UR
Silver	1	NA	3.5	K	NA		NA		1.6	B	1.4	B	2.8	B
Sodium	NA	NA	322	B	NA		NA		1270		818	J	678	J
Thallium	NA	NA	8.7	U	NA		NA		0.55	U	0.49	U	0.49	U
Vanadium	NA	19 (2)	264		NA		NA		34.2		39.3		44.2	K
Zinc	150	120	132		NA		NA		230		125		142	
MISCELLANEOUS PARAMETERS			mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Hardness as CaCO3			NA		NA		NA		NA		NA		NA	
Total Organic Carbon			13400		3070		8670		6230		5770		11000	
SEMIVOLATILES	ug/kg	ug/L			ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
Acenaphthene	16	24 (2,3)	95	UJ	190	U	110	U	110	UJ	110	U	110	U
Acenaphthylene	44	24 (2,3)	190	UJ	380	U	210	U	220	UJ	210	U	210	U
Anthracene	85.3	24 (2,3)	29	J	220		91		36	J	95		32	
Benz(a)anthracene	261	0.014 (2,4)	200	J	1000		440		350	J	11	U	260	
Benzo(a)pyrene	430	0.014 (2)	220	J	950		430		320	J	870		240	
Benzo(b)fluoranthene	430 (2)	0.014 (2,4)	200	J	970		370		380	J	800		200	
Benzo(g,h,i)perylene	430 (2)	0.014 (2,4)	120	J	680		400		300	J	660		240	
Benzo(k)fluoranthene	430 (2)	0.014 (2,4)	54	J	550		200		190	J	500		56	
Chrysene	384	0.014 (2,4)	190	J	900		360		320	J	940		260	
Dibenz(a,h)anthracene	63.4	0.014 (2,4)	19	UJ	34	J	21		22	UJ	18	J	14	J
Fluoranthene	600	3.9 (2,5)	410	J	2600		870		640	J	2100		580	
Fluorene	19	3.9 (2)	19	UJ	90		21	U	22	UJ	21	U	21	U
Indeno(1,2,3-cd)pyrene	430 (2)	0.014 (2,4)	130	J	490		230		190	J	380		130	
Naphthalene	160	24 (2)	95	UJ	190	U	110	U	110	UJ	110	U	110	U
Phenanthrene	240	24 (2,3)	160	J	1000		360		180	J	430		230	
Pyrene	665	24 (2,3)	290	J	1600		700		410	J	1600		400	

(1) 1997 ES/ER/TM-95/R4. Toxicological Benchmarks for Screening COPCs for Effects on Sediment Associated Biota.
(2) December 10, 1998. Ambient Water Quality Critieria (AWQC). Freshwater CCC.

Table 4-1
Analytical Results
NAWC Warminster

	NOAA	AWQC (1)	SD-07-01Q		SD-08-01Q		SD-09-01Q		SD-10-01Q		SD-11-01Q		SD-12-01Q		SD-13-01Q	
	ER-L (1)	Freshwater	09/15/99		09/14/99		09/14/99		09/15/99		09/14/99		09/15/99		09/15/99	
		Chronic Screening														
			RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
INORGANICS	mg/kg	ug/L	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Aluminum	NA	87	6530		6890		9500		6900		7700		NA		NA	
Antimony	2	NA	1.8	K	1.9	J	1	J	0.84	K	1.1	J	NA		NA	
Arsenic	8.2	8.1	5.5	L	2.5	L	2.4	L	3.1	L	3.1	L	NA		NA	
Barium	NA	3.9 (2)	84		78.4	J	72	J	159		143	J	NA		NA	
Beryllium	NA	5.1 (2)	1	J	0.9	J	1.1	J	0.81	J	0.96	J	NA		NA	
Cadmium	1.2	2.2	0.05	UL	0.32	J	0.05	UL	0.46	J	2.9	J	NA		NA	
Calcium	NA	NA	12700		6050	J	28300	J	9160		6510	J	NA		NA	
Chromium	81	74/11	29.8		84.1	J	43.3	J	41.6		57.3	J	NA		NA	
Cobalt	NA	3 (2)	10.4	K	7.8	K	8.3	K	9.7	K	6.5	K	NA		NA	
Copper	34	9	65.3		23.3	J	21.3	J	46.8		44	J	NA		NA	
Iron	NA	1000	38200		17500	J	23700	J	24700		20800	J	NA		NA	
Lead	46.7	2.5	61.3		118		83.1		106		188		NA		NA	
Magnesium	NA	NA	9550		5290	J	18900	J	6890		4770	J	NA		NA	
Manganese	NA	80 (2)	755		335	J	399	J	654		578	J	NA		NA	
Mercury	0.15	0.012	0.0128	L	0.0591	L	0.0321	L	0.018	L	0.195	L	0.0684	L	0.0375	L
Nickel	20.9	52.0	23.7	L	16	L	15.2	L	20.8	L	12.5	L	NA		NA	
Potassium	NA	NA	2090		1570	J	2530	J	1370		1450	J	NA		NA	
Selenium	NA	5	4.5	U	2.6	UR	2.4	UR	2.6	U	2.3	UR	NA		NA	
Silver	1	NA	1.7	B	1.3	B	1.1	B	1.1	B	1.7	B	NA		NA	
Sodium	NA	NA	534	K	678	J	1830	J	622	K	801	J	NA		NA	
Thallium	NA	NA	0.47	U	0.54	U	0.51	U	0.54	U	0.47	U	NA		NA	
Vanadium	NA	19 (2)	37.4		30.9		40.1		33.4		34		NA		NA	
Zinc	150	120	127		146		101		176		704		NA		NA	
MISCELLANEOUS PARAMETERS			mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Hardness as CaCO3			NA		NA		NA		NA		NA		NA		NA	
Total Organic Carbon			5260		15100		9000		7640		19500		3760		3610	
SEMIVOLATILES	ug/kg	ug/L	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
Acenaphthene	16	24 (2,3)	100	UJ	1100	U	110	U	100	UJ	1700	U	490	U	110	U
Acenaphthylene	44	24 (2,3)	200	UJ	2200	U	210	U	200	UJ	3300	U	980	U	210	U
Anthracene	85.3	24 (2,3)	68	J	680		40		58	J	2000		800		120	
Benz(a)anthracene	261	0.014 (2,4)	310	J	3700		200		420	J	6800		2000		640	
Benzo(a)pyrene	430	0.014 (2)	340	J	2600		210		390	J	5700		2000		640	
Benzo(b)fluoranthene	430 (2)	0.014 (2,4)	340	J	3200		180		510	J	6500		2100		670	
Benzo(g,h,i)perylene	430 (2)	0.014 (2,4)	265	J	2700		100		370	J	4400		1300		680	
Benzo(k)fluoranthene	430 (2)	0.014 (2,4)	120	J	1700		54		220	J	2900		1200		360	
Chrysene	384	0.014 (2,4)	355	J	4000		210		440	J	7600		2200		670	
Dibenz(a,h)anthracene	63.4	0.014 (2,4)	52		110	J	21	U	20	UJ	240	J	200		34	
Fluoranthene	600	3.9 (2,5)	820	J	7900		480		850	J	20000		5600		1300	
Fluorene	19	3.9 (2)	26.5	J	220	U	21	U	20	UJ	330	U	390		21	U
Indeno(1,2,3-cd)pyrene	430 (2)	0.014 (2,4)	110	J	1600		99		240	J	2800		970		420	
Naphthalene	160	24 (2)	100	UJ	1100	U	110	U	100	UJ	1700	U	490	U	110	U
Phenanthrene	240	24 (2,3)	370	J	3200		210		380	J	8900		3700		590	
Pyrene	665	24 (2,3)	620	J	6900		370		750	J	17000		5200		1100	

(1) 1997 ES/ER/TM-95/R4. Toxicological Benchmarks for Screening COPCs for Effects on Sediment Associated Biota.
(2) December 10, 1998. Ambient Water Quality Critieria (AWQC). Freshwater CCC.

Table 4-1
Analytical Results
NAWC Warminster

Data Qualifiers:
B -- Positive result is considered to be an artifact of blank contamination, and should not be considered present.
J -- Value is considered estimated due to exceedance of technical quality control criteria or because result is less than the Contract Required Quantitation Limit (CRQL).
K -- Positive result is considered biased high due to exceedance of technical quality control criteria.
L -- Positive result is considered biased low due to exceedance of technical quality control criteria.
U -- Value is a non-detected result as reported by the laboratory.
UJ -- Non-detected result is considered estimated due to exceedance of technical quality control criteria.
UL -- Non-detected result is considered biased low due to exceedance of technical quality control criteria.
UR -- Non-detected result is considered unusable due to exceedance of technical quality control criteria.
NA -- No result is available/applicable for this parameter in this sample.
Results for samples SW-07-01Q and SW-07-01Q are averaged with the duplicate sample.

Database source file: C:\123\K18252_RES.DBF data retrieved on: 11/19/99

Table 4-2 presents surface soil results in relation to site background. Several metals were detected at levels above background including cadmium (low levels detected at SS-01 and SS-02), copper (SS-02), manganese (SS-01), nickel (SS-01) and zinc (SS-01 and SS-02). Levels of PAHs were greater in the sample from SS-02 than SS-01. The PAH levels in SS-01 were comparable or slightly higher than background, while PAHs were two to three times greater than background in SS-02. The concentrations are similar to those noted in the upstream (reference) sediment Amples.

Grain size analysis is shown is Appendix D along with the chemical analytical data validation reports.

4.2 BIOLOGICAL RESULTS

Benthic macroinvertebrate samples were collected in September 1999 at six locations in the unnamed tributary of Little Neshaminy Creek as part of biomonitoring activities (Figure 3-1). The locations were ST-01 (sample BI-01-01Q), ST-04 (sample BI-04-01Q), ST-07 (sample BI-07-01Q), ST-10 (sample BI-10-01Q), ST-12 (sample BI-012-01Q), and ST-13 (sample BI-13-01Q).

The biomonitoring is being conducted to assess the impacts, if any, to the tributary from the Area A Sites. Sampling and sample analyses were conducted in accordance with the biomonitoring work plan (TtNUS, 1999). This report presents the results of the benthic macroinvertebrate community analyses. As per the quarterly report format described in the work plan, this report contains only limited data interpretation. A more detailed treatment of the benthic macroinvertebrate data, in concert with the surface water, sediment, and seep soil chemistry data, will be provided in the annual biomonitoring reports.

Surface water quality data are presented in Table 4-3. The results of the benthic macroinvertebrate community analysis by individual sample on Table 4-4. Analysis of the similarity of the macroinvertebrate communities among samples is provided on Table 4-5.

TABLE 4-2
SURFACE SOIL SAMPLING RESULTS
NAWC WARMINSTER

Substance	Background Data: Freq. of Detection	Background Data: Range of Positive Detection Min.	Background Data: Range of Positive Detection Max.	Background Data: Mean of All Data	Surface Soil Sampling Results: SS-01 QTR. 1	SS-01 QTR. 2	SS-01 QTR. 3	SS-01 QTR. 4	SS-02 QTR. 1	SS-02 QTR. 2	SS-02 QTR. 3	SS-02 QTR. 4
METALS (mg/kg)												
aluminum	31/31	4780	18100	13400	8240				12200			
antimony	1/22	13.6	13.6	3.75	0.81 K				1.6 K			
arsenic	27/31	0.28	12.1	3.88	3.2 L				4.6 L			
barium	27/29	34.1	225	61.6	246				153			
beryllium	27/31	0.31	1.7	0.806	0.66 B				1.2 J			
cadmium	0/31	-			0.82 J				0.53 J			
calcium	25/29	240	1910	664	3740				3010			
chromium	31/31	7.9	35.3	19.4	34.4				28.5			
cobalt	27/30	1.6	22.1	8.9	25.1 K				7.6 K			
copper	29/31	3.6	30.6	11.8	15.3				53.6			
iron	31/31	6980	410500	33100	23700				26000			
lead	31/31	1.6	96.5	11.7	39.4				97.5			
magnesium	27/31	518	4960	1980	1920				2840			
manganese	31/31	30.9	2010	424	6000				372			
mercury	1/28	0.37	0.37	0.0436	0.29 L				0.192 L			
nickel	20/27	4.1	21.7	10.5	47.9				14.6 L			
potassium	27/29	89.1	3050	706	608 J				1030 J			
selenium	0/20	-			0.71 B				ND			
silver	0/17	-			3.6 B				6 K			
sodium	5/20	55.2	86.7	102	171 B				218 B			
thallium	3/31	0.37	0.42	0.378	ND				ND			
vanadium	31/31	15.4	45	29.7	30.6				48.4			
zinc	27/29	9	60	27.7	850				117			
PAHs (ug/kg)												
acenaphthene	0/11	-			ND				ND			
acenaphthylene	0/11	-			ND				ND			
anthracene	0/11	-			ND				65 J			
benz(a)anthracene	0/11	-			130 J				380 J			
benzo(a)pyrene	0/11	-			200 J				420 J			
benzo(b)fluoranthene	1/11	58	58	185	190 J				380 J			
benzo(g,h,i)perylene	0/11	-			170 J				270 J			
benzo(k)fluoranthene	1/11	46	46	184	71 J				170 J			
chrysene	1/11	51	51	185	230 J				400 J			
dibenz(a,h)anthracene	0/11	-			11 J				ND			
fluoranthene	1/11	92	92	188	350 J				830 J			
fluorene	0/11	-			ND				32 J			
indeno(1,2,3-cd)pyrene	0/11	-			120 J				250 J			
naphthalene					ND				ND			
phenanthrene	1/11	51	51	185	150 J				380 J			
pyrene					260 J				700 J			
TOC (mg/kg)					19100				7300			

Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95 % UCL, which is presented in a s
Frequency of detection refers to number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 4-3
SURFACE WATER QUALITY PARAMETERS
UNNAMED TRIBUTARY TO LITTLE NESHAMINY CREEK - AREA A SITES
NAWC WARMINSTER, PENNSYLVANIA

Sampling Station	Flow Rate (cubic feet/s)	Temperature (C)	pH	Specific Conductivity	Dissolved Oxygen (mg/L)	Turbidity (NTUs)	Salinity (%)
ST-01	0.62	20.1	6.80	0.209	6.60	5.0	0.00
ST-02	0.84	20.1	6.88	0.232	7.85	2.0	0.00
ST-03	1.35	20.7	7.06	0.268	7.15	14.0	0.01
ST-04	0.42	20.1	7.01	0.216	7.89	1.0	0.00
ST-05	0.53	20.5	6.97	0.267	7.45	0.0	0.01
ST-06	1.07	20.7	7.07	0.275	7.63	0.0	0.01
ST-07	0.91	20.1	7.08	0.214	6.98	3.0	0.00
ST-08	0.38	20.5	7.08	0.282	5.76	21.0	0.01
ST-09	0.62	20.5	7.28	0.295	7.51	39.0	0.00
ST-10	0.54	19.2	7.29	0.271	7.65	7.0	0.01
ST-11	0.36	19.6	6.87	0.622	6.60	28.0	0.02
ST-12	0.32	19.2	7.18	0.419	8.09	4.0	0.01
ST-13	0.57	19.5	7.13	0.366	8.44	0.0	0.01

TABLE 4-4
BENTHIC MACROINVERTEBRATE COMMUNITY
UNNAMED TRIBUTARY TO LITTLE NESHAMINY CREEK - AREA A SITES
NAWC WARMINSTER, PENNSYLVANIA

Taxon	TV[1,2]	FFG[3]	Sampling Station					
			ST-01	ST-04	ST-07	ST-10	ST-12	ST-13
PLATYHELMINTHES								
Turbellaria								
Tricladida								
Planariidae								
Dugesia tigrina			1					
MOLLUSCA								
Gastropoda								
Basommatophora								
Physidae								
Physa sp.	9	CG			2			
ANNELIDA								
Oligochaeta								
Haplotaxida		CG						
Lumbricidae				1				
Tubificidae w.o.h.c.	10	CG			2	2		
ARTHROPODA								
Insecta								
Trichoptera								
Hydroptilidae								
Hydroptila sp.	2	PI						1
Coleoptera								
Psephenidae								
Psephenus herricki	4	SC						1
Diptera								
Chironomidae								
Chaetocladius sp.	6	CG			1			
Cricotopus sp.	8	CG						1
Dicrotendipes sp.	6	CG			10	1	1	1
Orthocladius sp.	4	CG			1			
Tanytarsus sp.	7	FC			1			
Psychodidae								
Pericoma sp.	4	CG			1			
Tipulidae								
Tipula sp.	4	SH			3			
TOTAL NO. OF ORGANISMS			**1**	**1**	**21**	**3**	**1**	**4**
TOTAL NO. OF TAXA			**1**	**1**	**8**	**2**	**1**	**4**
BIOTIC INDEX					**6.24**	**8.67**	**6**	**5**
SHANNON DIVERSITY			**0**	**0**	**2.394**	**0.918**	**0**	**2**

1 Hilsenhoff Tolerance Values (TVs) used when North Carolina Tolerance Values are not available

2 North Carolina Tolerance Values range from 0 for organisms very intolerant of organic wastes to 10 for organisms very tolerant of organic wastes

3 FFG-Functional Feeding Group: CG=Collector/Gatherer, FC=Filtering/Collectors, SC=Scrapers, SH=Shredders, P=Predators and PI=Piercer

TABLE 4-5
SIMILARITY BETWEEN BENTHIC MACROINVERTEBRATE SAMPLES
UNNAMED TRIBUTARY OF LITTLE NESHAMINY CREEK - AREA A SITES
NAWC WARMINSTER, PENNSYLVANIA

Jaccard Coefficient						
Sample Location	Sample Location					
	ST-01	ST-04	ST-07	ST-10	ST-12	ST-13
ST-01		0	0	0	0	0
ST-04	0		0	0	0	0
ST-07	0	0		0.25	0.125	0.091
ST-10	0	0	0.25		0.5	0.2
ST-12	0	0	0.125	0.5		0.25
ST-13	0	0	0.091	0.2	0.25	
Percent Similarity						
Sample Location	Sample Location					
	ST-01	ST-04	ST-07	ST-10	ST-12	ST-13
ST-01		0	0	0	0	0
ST-04	0		0	0	0	0
ST-07	0	0		42.9	47.6	25
ST-10	0	0	42.9		33.3	25
ST-12	0	0	47.6	33.3		25
ST-13	0	0	25	25	25	

For the most part, the total number of organisms and taxa were low, including only one organism collected at each of stations ST-01, ST-04, and ST-12 (Table 4-4). Stations ST-10 and ST-13 had only 3 and 4 organisms per sample, respectively. This limits the interpretability of the data and calculated metrics/indices. In contrast, the diversity and abundance of benthic macroinvertebrates was much higher at station ST-07. Although considerable effort was made to match the microhabitat among all sampling stations, station ST-07 contained some of the best habitat in the stream. However, it is also located immediately downgradient of the largest seep along the Area A sites. Thus, it would be expected to have the greatest influence from Area A-related contaminants.

The low overall diversity and abundance of organisms among the samples could be due to the drought conditions that were present prior to the sampling. The area surrounding and including NAWC Warminster had experienced a severe drought, which resulted in low flow rates in the stream (Table 4-3). The stream was nearly dry in some areas during this time. The presence of only one organism in the upgradient sample reinforces this possibility.

Due to these extraordinary conditions prior to the first round of sampling, changes to the sampling regime are not recommended at this time. If hydrological conditions are more conducive to benthic life leading up to and during the next round of sampling, and diversity and abundance are still low, changes to the sampling regime may be recommended at that time. This could include the identification and sampling of a reference stream for comparative purposes. It should be noted also that subsequent to the first round of sampling, Hurricane Floyd passed over the area. The hurricane dropped near record amounts of rainfall on the area, which resulted in major flooding and scouring of certain portions of the tributary along Area A. This could have a lasting temporal effect on the biotic community of the stream. A discussion of temporal changes, if any, in both the surface water/sediment chemistry data and benthic macroinvertebrate community will be provided in the next report.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The results presented are for the first sampling event; therefore, there is inadequate data to evaluate trends and present conclusions. In addition, the effects of the drought prior to the sampling event, and the impacts of the significant rainfall event due to Hurricane Floyd immediately after the sampling event will need to be evaluated over the course of the study. Therefore, no changes to the sampling program are recommended. The next sampling round is scheduled for November 1999 and will be for chemical analysis only.

Appendix A

Survey Data

Job Number / 9-8144 Tetra Tech

C.L.E.A.N. Irons Location

Iron #	NORTHING	EASTING
Iron(1)	327,904.6945	2,746,623.4928
Iron(2)	327,911.7293	2,746,602.5731
Iron(3)	327,966.6498	2,746,531.9856
Iron(4)	327,995.0506	2,746,507.6208
Iron(5)	328,020.5948	2,746,470.2593
Iron(6)	328,040.9440	2,746,442.8313
Iron(7)	328,060.4397	2,746,393.5344
Iron(8)	328,099.4571	2,746,363.0882
Iron(9)	328,126.7726	2,746,329.6965
Iron(10)	328,178.5301	2,746,256.4672
Iron(11)	328,218.7371	2,746,168.9253
Iron(12)	328,337.1570	2,746,166.5844

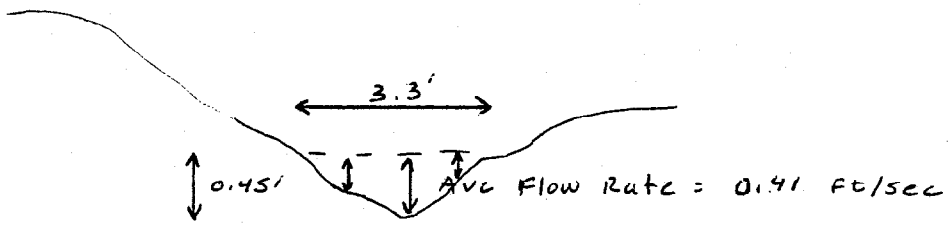
Appendix B

Stream Flow Calculations

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster		CTO 253	
SUBJECT			
Flow Rate Calculations Station 01			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross sectional Area

0.45' feet x 3.3 feet = 1.49 sq/ft

Flow Rate Calculation

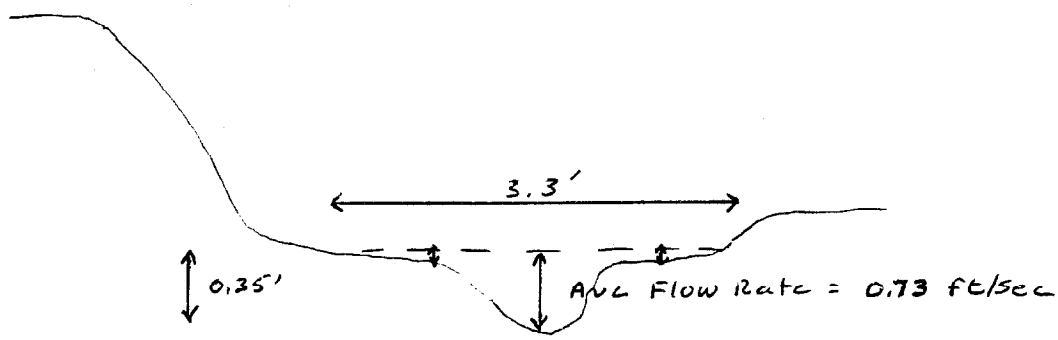
1.49 sq/ft x 0.41 ft/sec = 0.62 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT	JOB NUMBER
NAWC Warminster	CTO 253
SUBJECT	
Flow Rate Calculation Station 02	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.35 feet x 3.3 feet = 1.16 sq/ft

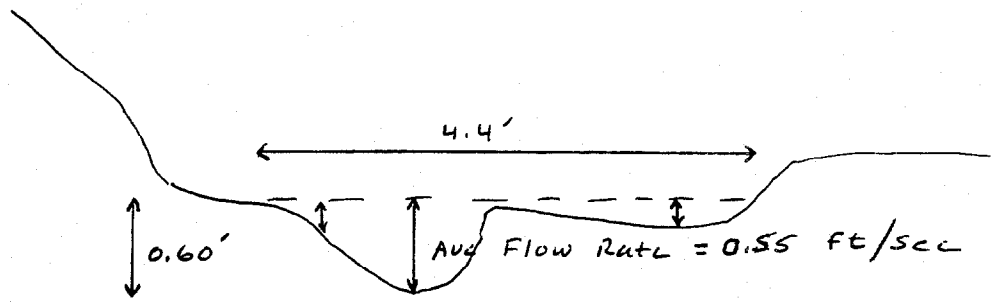
Flow Rate Calculation

1.16 sq/ft x 0.73 ft/sec = 0.84

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster			
SUBJECT			
Flow Rate Calculation Station 03			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross sectional Area

0.60 feet X 4.4 feet = 2.64 sq/ft

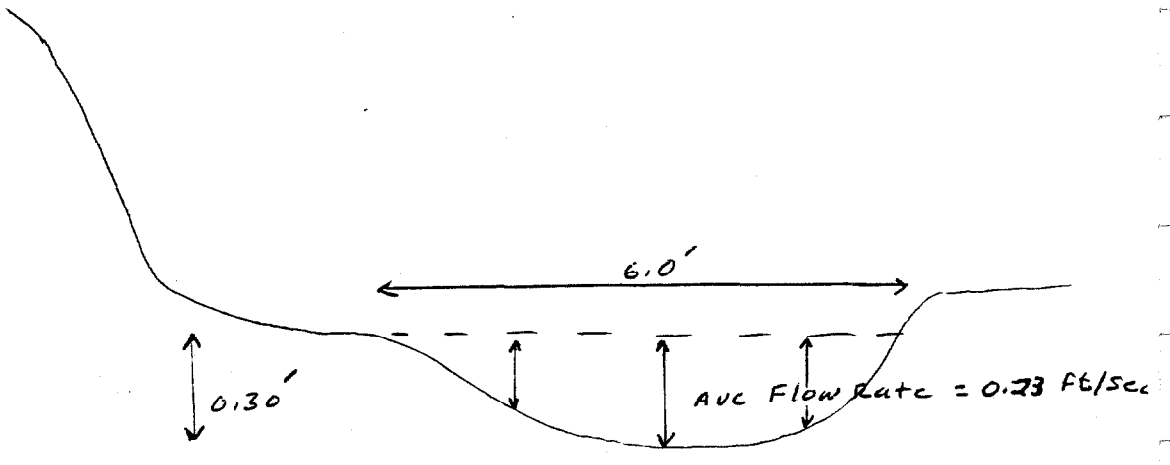
Flow Rate Calculation

2.46 sq/ft x 0.55 ft/sec = 1.35 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster		CTO 253	
SUBJECT			
Flow Rate Calculation Station 04			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.30 feet x 6.0 feet = 1.8 sq/ft

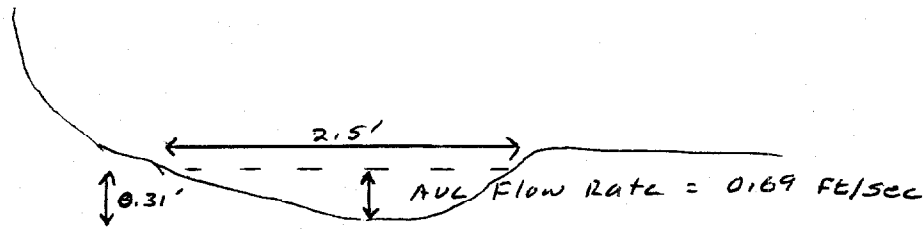
Flow Rate Calculation

1.8 sq/ft x 0.23 ft/sec = 0.42 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster			
SUBJECT			
Flow Rate Calculation Station 05			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.31 feet x 2.5 feet = 0.775 sq/ft

Flow Rate Calculation

0.775 sq/ft x 0.69 ft/sec = 0.53 CFS

CALCULATION WORKSHEET

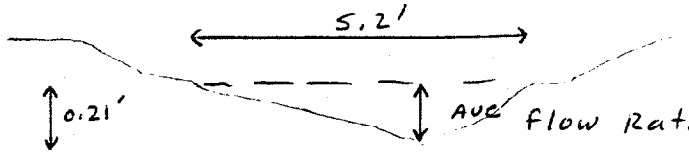
PAGE _____ OF _____

CLIENT	JOB NUMBER
NAWC Warminster	

SUBJECT	
Flow Rate Calculation Station 07	

BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE



Flow Rate 0.83 ft/sec

Cross Sectional Area

0.21 feet x 5.2 feet = 1.1 sq/ft

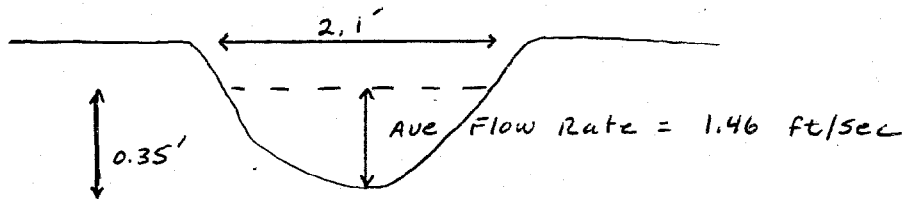
Flow Rate Calculations

1.1 sq/ft x 0.83 ft/sec = 0.91 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster			
SUBJECT			
Flow Rate Calculation 06			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.35 feet x 2.1 feet = 0.735 sq/ft

Flow Rate Calculation

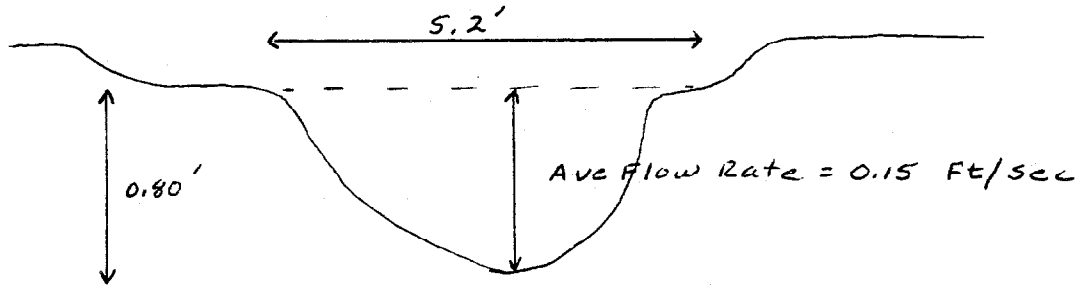
0.735 sq/ft x 1.46 ft/sec = 1.07 CFS.

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT	JOB NUMBER
NAWC Warminster	
SUBJECT	
Flow Rate Calculation Station 09	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.80 feet x 5.2 feet = 4.16 sq/ft

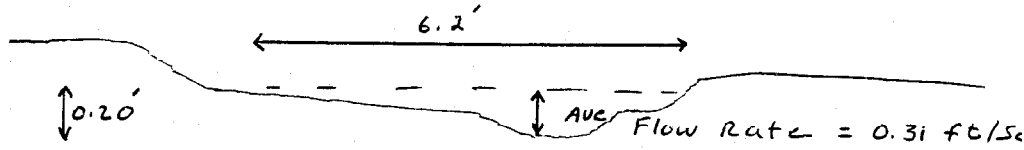
Flow Rate Calculation

4.16 sq/ft x 0.15 ft/sec = 0.62 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster			
SUBJECT			
Flow Rate Calculation Station 08			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.20 feet x 6.2 feet = 1.24 sq/ft

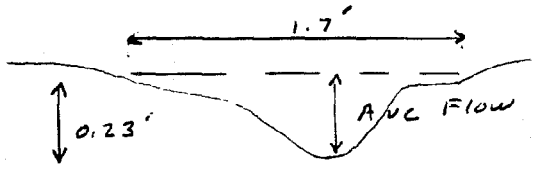
Flow Rate Calculation

1.24 sq/ft x 0.31 ft/sec = 0.38 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster			
SUBJECT			
Flow Rate Calculation Station 11			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Ave Flow Rate = 0.93 ft/sec

Cross Sectional Area

0.23 feet x 1.7 feet = 0.39 sq/ft

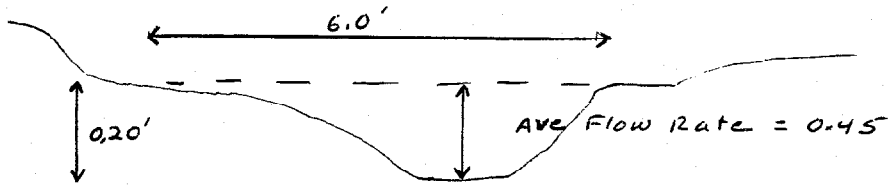
Flow Rate Calculation

0.39 sq/ft x 0.93 ft/sec = 0.36 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster			
SUBJECT			
Flow Rate Calculation Station 10			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.20 feet x 6.0 feet = 1.2 sq/ft

Flow Rate Calculation

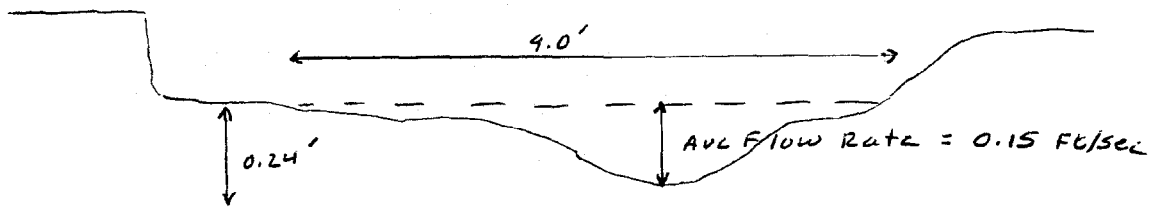
1.2 sq/ft x 0.45 ft/sec = 0.54 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT	JOB NUMBER
NAWC Warminster	CTO 253
SUBJECT	
Flow Rate Calculation Station 12	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.24 feet x 9.0 feet = 2.16 sq/Ft

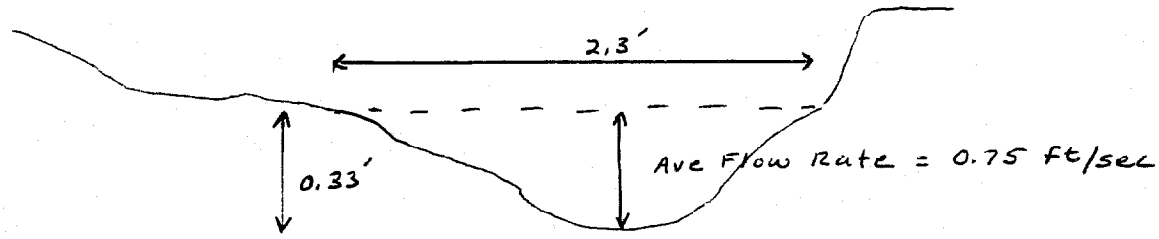
Flow Rate Calculation

2.16 sq ft x 0.15 ft sec = 0.32 CFS

CALCULATION WORKSHEET

PAGE _____ OF _____

CLIENT		JOB NUMBER	
NAWC Warminster		CTO 253	
SUBJECT			
Flow Rate Calculation Station 13			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE



Cross Sectional Area

0.33 feet x 2.3 feet = 0.759 sq/ft

Flow Rate

0.759 sq/ft x 0.75 ft/sec = 0.57 CFS

Appendix C

Sample Logs

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-13-01Q
Sample Location: ST-13
Sampled By: CM
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 9/15/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Time: 0920								
Depth: 0.5'	Clear	7.13	.366	19.5	0	8.44	0.01	0.57 CFS
Method: Sample Bottle								

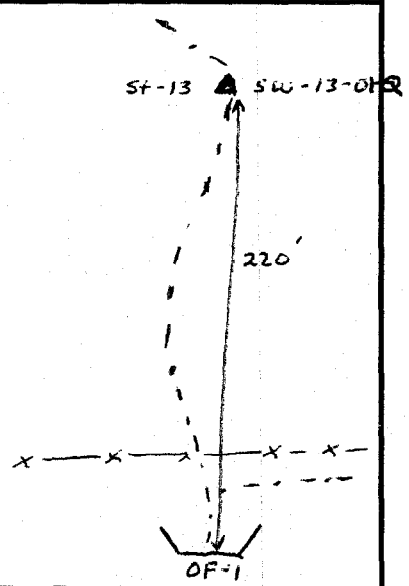
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

No odors noted rain showers starting

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-13-01Q
Sample Location: ST-13
Sampled By: LM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 0930 Method: S.S. Trowel Monitor Reading (ppm):	0-0.2'	Brown to Black	Medium to coarse grained sand and rock frag

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[] Sediment
[x] Other: Macro Invertibrate
[] QA Sample Type:

Sample ID No.: BI-13-01Q
Sample Location: ST-13
Sampled By: PD
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 0935 Method: S/S Trowel Monitor Reading (ppm):	0 - 0.2'	Brown to Black	Rocks and medium to coarse grained sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Macro Invertibrate	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

The sample was collected using the sulbur sampler at two locations on the stream bed

MAP:

see SW-13-01Q Sample Log Sheet

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: W-12-01Q
Sample Location: ST-12
Sampled By: CM
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Date: 9/15/99								
Time: 0955								
Depth: 0.5'								
Method: Sample Bottle	Clear	7.18	.419	19.2	4	8.09	0.01	0.32 CFS

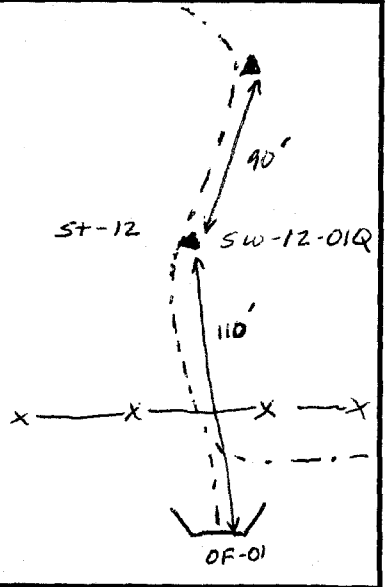
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

Gray suspended solid somewhat like iron bacteria. No odors were noted

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-12-01Q
Sample Location: SD-12
Sampled By: CM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 0955 Method: S.S. Trowel Monitor Reading (ppm):	0-0.2'	Brown to Black	Medium to Coarse Grained sand and rock fragments

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Sample Log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[] Sediment
[■] Other: Macro Invertibrate
[] QA Sample Type:

Sample ID No.: BI-12-01Q
Sample Location: ST-12
Sampled By: PD
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1015 Method: S/S Trowel Monitor Reading (ppm):	0 - 0.2'	Brown TO Black	medium to Coarse grained Sand with Rocks

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Macro Invertibrate	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

The sample was collected used the Sobur sampler at two locations on the stream bed

MAP:

See SW-12-01Q Log Sheet

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-11-01Q
Sample Location: ST-11
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 9/14/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Time: 1225								
Depth: 0.5	light							
Method: Sample bottles	Brown	6.87	.622	19.6	28	6.60	0.02	0.36 CFS

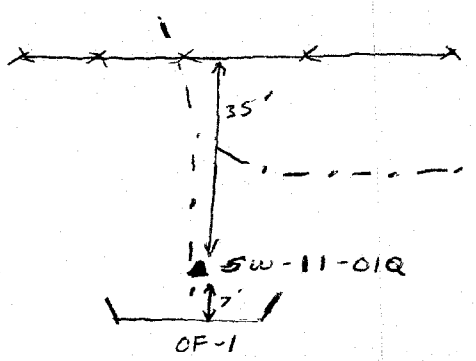
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	3
TOC	H2SO4	250 ml Poly	3
Total Metals except Hg and Hardness	HNO3	500 ml poly	3
Ultra Clean Mercury	4 C	500 ml Clear Glass	3

OBSERVATIONS / NOTES:

Orange iron bacteria on the stream bed. The water was a light brown in color with no odors.

MAP:



Circle if Applicable:

(MS/MSD) Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-11-01Q
Sample Location: ST-11
Sampled By: MS
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/14/99 Time: 1240 Method: S.S. Trowel Monitor Reading (ppm):	0.-0.2'	Brown	Fine to medium grained sand with trace course grained sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Sample Log Sheet

MAP:

Circle if Applicable:

(MS/MSD)

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-10-01Q
Sample Location: ST-10
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other Flow Rate
Date: 9/15/99								
Time: 1043								
Depth: 0.5'	light gray	7.29	.271	19.2	7	7.65	0.01	0.54 CFS
Method: Sample Bottle								

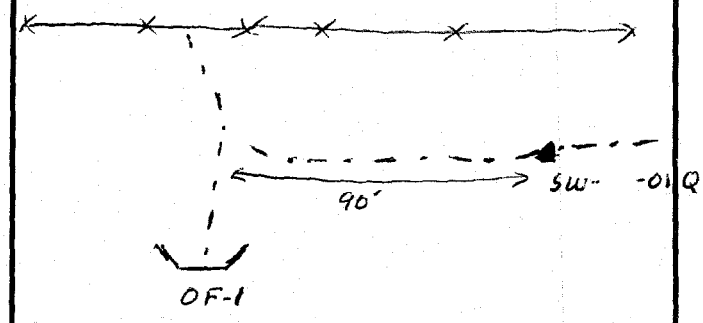
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

Rain was comming down harder there were no odors. The sample was a light gray in color

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-10-01Q
Sample Location: ST-10
Sampled By: CM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 9/15/99	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:	0 - 0.2'	Brown	Coarse grained sand to gravel
Method: S.S. Trowel			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See Sample Log Sheet for SW

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[] Sediment
[■] Other: Macro Invertibrate
[] QA Sample Type:

Sample ID No.: BI-10-01Q
Sample Location: ST-10
Sampled By: PD
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1055 Method: S/S Trowel Monitor Reading (ppm):	0 - 0.2'	Brown to Black	Coarse grained to medium grained sand and rock

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Macro Invertibrate	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

The sample was collected using the subur sampler at two locations on the stream bed

MAP:

See SW-10-01Q sample log sheet

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-09-01Q
Sample Location: ST-09
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other Flow Rate
Date: 9/14/99								
Time: 1405								
Depth: 0.5'	Brown	7.28	.295	20.5	39	7.51	0.00	0.62 cfs
Method: Sample Bottle								

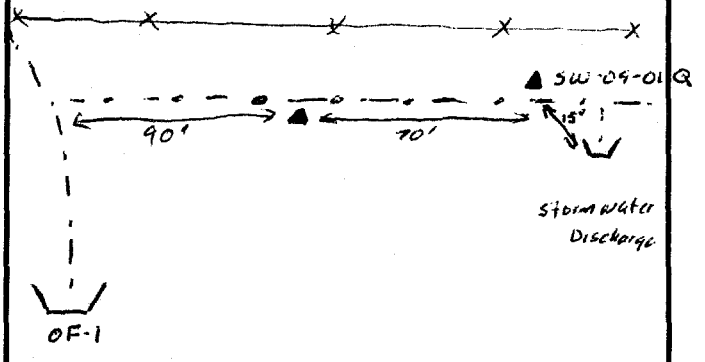
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

The sample was collected approx 15-20' down stream of the storm water discharge pipe. There were no odors but the water had a brown color.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-09-01Q
Sample Location: ST-09
Sampled By: MS
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/14/99 Time: 1413 Method: S.S. Trowel Monitor Reading (ppm):	0 - 0.2'	Brown	Fine to medium grained sand with rock frag and pebbles

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW sample Log Sheets

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-08-01Q
Sample Location: ST-08
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other Flow Rate
Date: 9/14/99								
Time: 1424								
Depth: 0.5'	Light Brown	7.08	.282	20.5	21	5.76	0.01	0.38 CFS
Method: Sample Bottle								

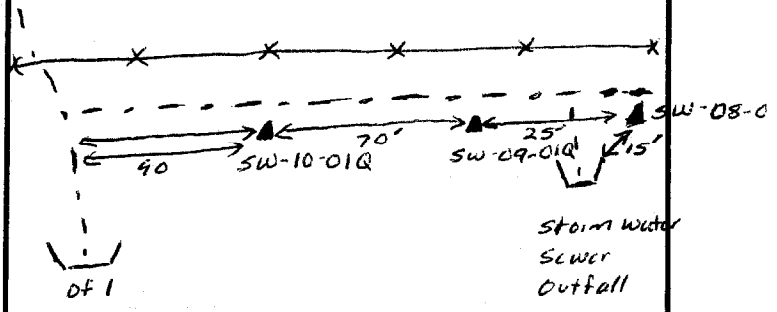
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

The sample was taken approx 15 feet upstream of the storm water sewer outfall. There were no odors

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-08-01Q
Sample Location: ST-08
Sampled By: MS
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/14/99 Time: 1429 Method: S.S. Trowel Monitor Reading (ppm):	0-0.2'	Light Brown	Fine grained silty sand with trace clay

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Sample Log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-07-01Q
Sample Location: ST-07
Sampled By: CM
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 9/15/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Time: 1110								
Depth: 0.5'	Light Brown	7.08	.214	20.1	3	6.98	0.00	0.91 CFS
Method: Sample Bottle								

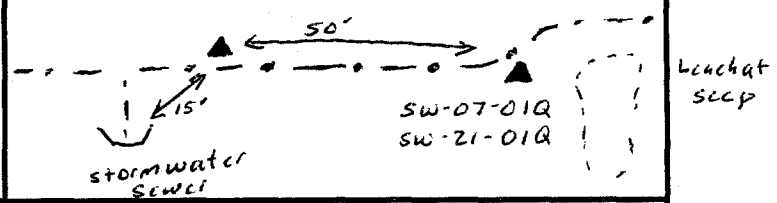
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	2
TOC	H2SO4	250 ml Poly	2
Total Metals except Hg and Hardness	HNO3	500 ml poly	2
Ultra Clean Mercury	4 C	500 ml Clear Glass	2

OBSERVATIONS / NOTES:

The sample was collected just down stream of a leachate seep located down slope of the former security shed. The leachate seep had a sheen on it but may have been caused due to stagnant water.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
	SW-21-01Q Assigned time 1605

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-07-01Q
Sample Location: ST-07
Sampled By: CM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 9/15/99	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1110	0 - 0.2'	Brown To Gray	Coarse grained sand and Rock
Method: S.S. Trowel			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See Sample Log for SW

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.: SD-21-01Q 1615

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[] Sediment
[■] Other: Macro Invertibrate
[] QA Sample Type:

Sample ID No.: BI-07-01Q
Sample Location: ST-07
Sampled By: PD
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1120 Method: S/S Trowel Monitor Reading (ppm):	0-0.2'	Brown to Gray	Course Grained Sand to Gravel

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Macro Invertibrate	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

The sample was collected using the Surbur Sampler at two locations on the stream bed

MAP:

See SW-07-01Q sample Log sheet

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-06-01Q
Sample Location: ST-06
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other Flow Rate
Date: 9/14/99								
Time: 1535								
Depth: 0.5'								
Method: Sample Bottle	Clear	7.07	.275	20.7	0	7.63	0.01	1.07 CFS

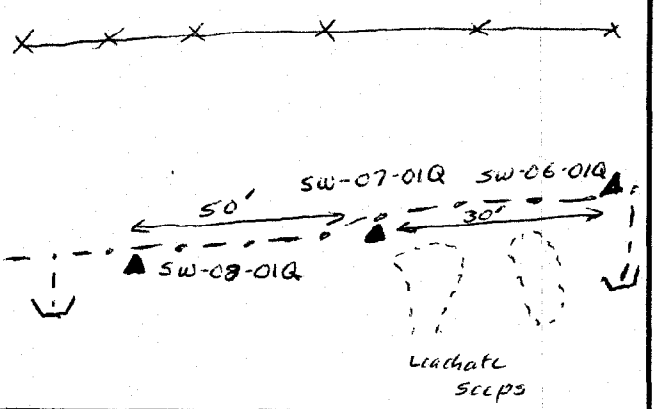
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

The sample was taken just upstream of the leachate seeps located down slope of the former security shed and downstream of an outfall pipe associated with storm water

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-06-01Q
Sample Location: ST-06
Sampled By: MS
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/14/99 Time: 1540 Method: S.S. Trowel Monitor Reading (ppm):	0 - 0.2	Brown	Coarse grained sand with Rock Frag

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Sample Log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-05-01Q
Sample Location: ST-05
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 9/14/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Time: 1615								
Depth: 0.5'	clear	6.97	.267	20.5	0	7.45	0.01	0.53 CFS
Method: Sample Bottle								

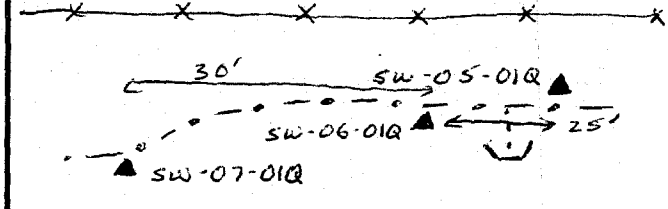
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

The sample was collected below an outfall pipe from the side of the stream bank associated with storm water.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-05-01Q
Sample Location: ST-05
Sampled By: MS
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/14/99 Time: 1625 Method: S.S. Trowel Monitor Reading (ppm):	0-0.2	Brown to Black	coarse grained sand to gravel

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW sample Log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-04-01Q
Sample Location: ST-04
Sampled By: CM
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other Flow Rate
Date: 9/15/99								
Time: 1117								
Depth: 0.5'								
Method: Sample Bottle	Light Brown	7.01	.216	20.1	1	7.89	0.00	0.42 CFS

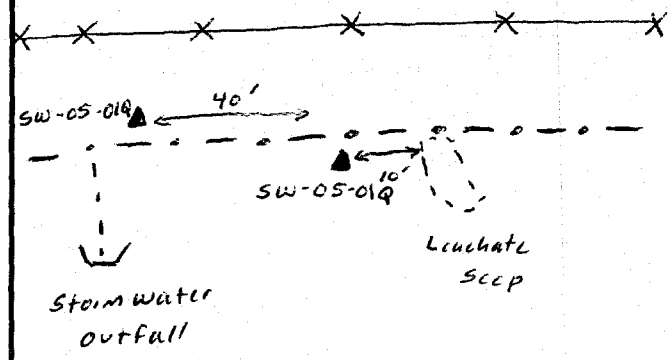
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

An orange iron bacteria leachate seep was noted approximately 10 feet up stream of the sample location. There were no odors associated with the sample

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-04-01Q
Sample Location: ST-04
Sampled By: CM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1400 Method: S.S. Trowel Monitor Reading (ppm):	0-0.2	Brown to Black	course grained sand to gravel

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW sample log sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[] Sediment
[■] Other: Macro Invertibrate
[] QA Sample Type:

Sample ID No.: BI-04-01Q
Sample Location: ST-04
Sampled By: PD
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1335 Method: S/S Trowel Monitor Reading (ppm):	0-0.2'	Brown to Black	Coarse Grained Sand and Gravel

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Macro Invertibrate	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

The sample was collected using the Surbur sampler at two locations on the stream bed

MAP:

See SW-04-01Q Sample Log Sheet

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-03-01Q
Sample Location: ST-03
Sampled By: MS
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

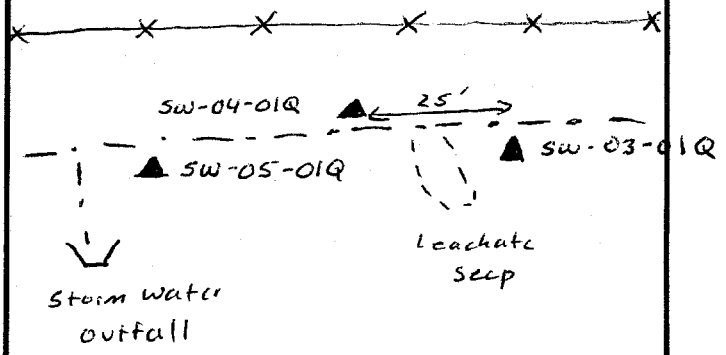
	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 9/14/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Time: 1705								
Depth: 0.5'	Light gray	7.06	.268	20.7	14.0	7.15	0.01	1.35 CFS
Method: Sample Bottle								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-03-01Q
Sample Location: ST-03
Sampled By: MS
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/14/99 Time: 1710 Method: S.S. Trowel Monitor Reading (ppm):	0 - 0.2'	Brown	Silty sand with rocks coarse grained

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW-Sample Log sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-02-01Q
Sample Location: ST-02
Sampled By: CM
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

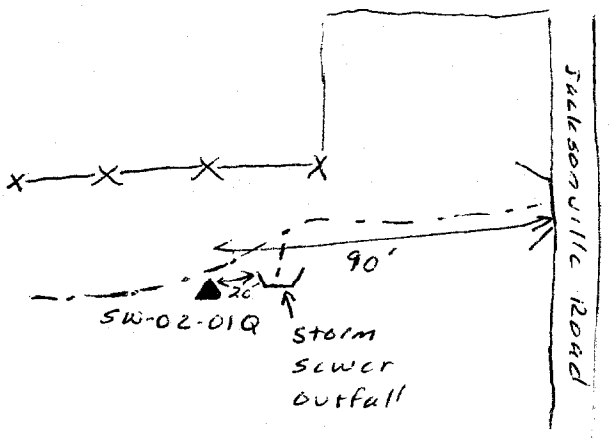
	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 9/15/99	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Time: 1125	Light	6.88	.232	20.1	2	7.85	0.00	0.84 CFS
Depth: 0.5'	Brown							
Method: Sample Bottle								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-02-01Q
Sample Location: ST-02
Sampled By: CM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1430 Method: S.S. Trowel Monitor Reading (ppm):	0 - 0.2'	Brown	coarse grained sand with trace fine grained

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Sample Log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SW-01-01Q
Sample Location: ST-01
Sampled By: CM
C.O.C. No.:

- [x] Stream
- [ ] Spring
- [ ] Pond
- [ ] Lake
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

SAMPLING DATA:

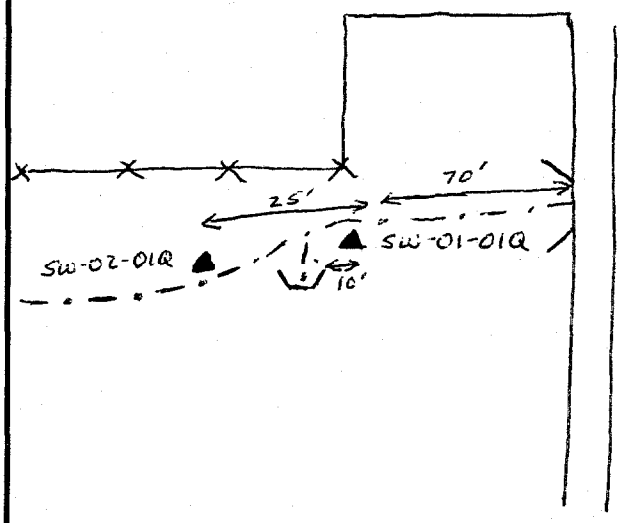
	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	Flow Rate
Date: 9/15/99								
Time: 1135								
Depth: 0.5'								
Method: Sample Bottle	clear	6.80	.209	20.1	5	6.60	0.00	0.62 CFS

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	4 C	Liter Amber Glass	1
TOC	H2SO4	250 ml Poly	1
Total Metals except Hg and Hardness	HNO3	500 ml poly	1
Ultra Clean Mercury	4 C	500 ml Clear Glass	1

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[■] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: SD-01-01Q
Sample Location: SD-01
Sampled By: CM
C.O.C. No.:

Type of Sample:
[■] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1453 Method: S.S. Trowel Monitor Reading (ppm):	0-0.2'	Brown	Mostly coarse grained sand rocks and gravel fragments

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

See SW Sample log Sheet

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

[] Surface Soil
[] Subsurface Soil
[] Sediment
[▮] Other: Macro Invertibrate
[] QA Sample Type:

Sample ID No.: BI-01-01Q
Sample Location: ST-01
Sampled By: PD
C.O.C. No.:

Type of Sample:
[▮] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	9/15/99			
Time:	1511			
Method:	S/S Trowel			
Monitor Reading (ppm):				

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Macro Invertibrate	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

The Sample was collected using the Swibur sampler at two locations on the stream bed

MAP:

see SW-01-01Q sample log sheet

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SS-01-01Q
Sample Location: SS-01
Sampled By: CM
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1520 Method: S.S. Trowel Monitor Reading (ppm):	0 - 0.5'	Gray	Silty clay with organic material

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

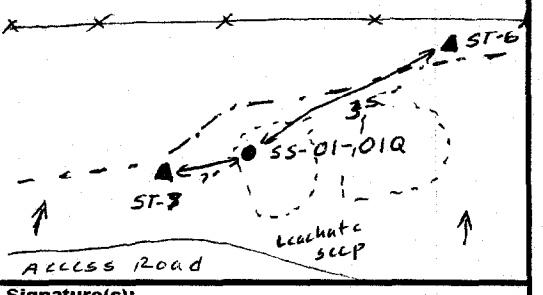
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

A slight bit of orange fixing bacteria with and sheen was present. There was no odor. The sheen may have been due to stagnant water

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: NAWC Warminster
Project No.: CTO 253

Sample ID No.: SS-02-01Q
Sample Location: SS-02
Sampled By: CM
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9/15/99 Time: 1540 Method: S.S. Trowel Monitor Reading (ppm):	0-015'	Orange to Light Brown	Silty Clay

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

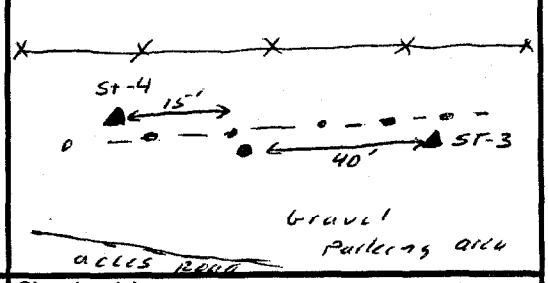
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH/Metals	8 oz Clear Glass Widemouth	1	
TOC	4 oz Clear Glass Widemouth	1	
Ultra Clean Mercury	60 ml Clear Glass Widemouth	1	
Grain Size	16 oz Clear Glass Widemouth	1	

OBSERVATIONS / NOTES:

Iron fixing bacteria was noted on the surface of the soil and sample under the surfac was a light brown silty clay. Taken at the discharge to the creek.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Appendix D

Data Packages

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-11-9-052

TO:	**G. GLENN**	**DATE:**	**NOVEMBER 10, 1999**
FROM:	**GRETCHEN A. PHIPPS**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS, TOC AND HARDNESS**
CT0 252 - NAWC WARMINSTER, PENNSYVANIA
SAMPLE DELIVERY GROUP SDG – 990827

SAMPLES: 5/Aqueous/

RB-091599 SW-01-01Q SW-04-01Q
SW-07-01Q SW-10-01Q

4/Sediments/

SD-01-01Q SD-04-01Q SD-07-01Q
SD-10-01Q

2/Soils/

SS-01-01Q SS-02-01Q

Overview

The sample set SDG 990827, NAWC Warminster, consists of four (4) aqueous, four (4) sediment and two (2) soil environmental samples. One (1) rinsate blank (RB-091599) was included within this SDG.

All samples were analyzed for target analyte list (TAL) metals. The aqueous environmental samples were also analyzed for hardness and total organic carbon (TOC). The soil and sediment environmental samples were also analyzed for TOC. The samples were collected by Tetra Tech NUS on September 15, 1999 and analyzed by Ceimic Corporation under the Naval Facilities Engineering Service Center (NFESC) Quality Assurance/ Quality Control (QA/AC) criteria. Metals analyses were conducted using SW 846 method 6010B.

Summary

All analytes were analyzed successfully. The finding in this report are based upon a general review of all available data. The data was review based on data completeness, holding times, calibration data, laboratory method/ preparation/ rinsate blanks, interference check sample (ICS) results, matrix spike/matrix spike duplicate results, laboratory duplicate results, field duplicate results, laboratory control sample (LCS) results, detection limits and analyte quanitation.

All analyses were conducted using Inductively Coupled Plasma (ICP) methodologies.

Areas of concern with respect to data quality are listed below.

Major Problems

None.

Minor Problems

- The Contract Required Detection Limit (CRDL) Percent Recoveries (%Rs) for aluminum, cobalt, calcium, magnesium and sodium were >110% quality control limit. The positive results <2X CRDL reported for aluminum, cobalt, calcium, magnesium and sodium were qualified as biased high, "K".

- The CRDL %Rs for beryllium, cadmium and nickel were <90% quality control limit. The nondetected results reported for beryllium, cadmium and nickel were qualified as biased low, "UL". The positive results <2X CRDL reported for beryllium and cadmium were qualified as either biased low, "L", or estimated, "J", as a result of conflicting noncompliances.

- The CRDL %Rs for iron, potassium and silver were both above and below the 90-110% quality control limits. The nondetected results reported for iron, potassium and silver were qualified as estimated, "UJ", as a result on the conflicting noncompliances. The positive results <2X CRDL reported for potassium were qualified as estimated, "J", as a result of the conflicting noncompliances.

- The following contaminants were detected in the laboratory method / preparation / field blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level(soil)	Action Level(aqueous)
Aluminum	130.5µg/L	65.25 mg/kg	652.5µg/L
Barium	26.6µg/L	13.3 mg/kg	133µg/L
Beryllium	0.9µg/L	0.45 mg/kg	4.5µg/L
Calcium	1085.3µg/L	542.65 mg/kg	5426.5µg/L
Cobalt	9.2µg/L	4.6 mg/kg	46.0µg/L
Copper	11.4µg/L	5.7 mg/kg	57.0µg/L
Iron	50.5µg/L	25.25 mg/kg	252.5µg/L
Magnesium	170.1µg/L	85.05 mg/kg	850.5µg/L
Manganese	8.8µg/L	4.4 mg/kg	44.0µg/L
Nickel	6.7µg/L	3.35 mg/kg	33.5µg/L
Potassium	222.6µg/L	111.3 mg/kg	1113µg/L
Selenium	4.2µg/L	2.1 mg/kg	21.0µg/L
Silver	4.7µg/L	2.35 mg/kg	23.5µg/L
Sodium	604.2µg/L	302.1 mg/kg	3021µg/L
Vanadium	9.1µg/L	4.55 mg/kg	45.5µg/L
Zinc	8.0µg/L	NA	40.0µg/L
Zinc[1]	1.300 mg/kg	6.5 mg/kg	NA

[1] Maximum concentration present in a soil preparation blank.

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, dilution factors and percent solids were taken into consideration when evaluating for blank contamination. Positive results less than the blank action level for aluminum, barium, beryllium, calcium, cobalt, copper, iron, manganese, nickel, potassium, selenium, silver, sodium, vanadium and zinc were qualified, "B", as a result of blank contamination. No validation action was required for magnesium as all results reported were greater than the blank action level. It should be noted that field blanks are not evaluated for laboratory or field blank contamination.

- The interfering analytes calcium and iron were present in sample SD-01-01Q at concentrations which were comparable to the levels of calcium and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, nickel, potassium and silver in the affected sample. The positive results reported for antimony, potassium and silver were qualified as biased high, "K". The positive result reported for nickel was qualified as biased low, "L". The nondetected result reported for arsenic was qualified as biased low, "UL". The positive result reported for beryllium was qualified as estimated, "J", as a result of conflicting noncompliances.

- The interfering analytes calcium and iron were present in sample SD-07-01Q at concentrations which were comparable to the levels of calcium and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, nickel and sodium in the affected sample. The positive results reported for antimony and sodium were qualified as biased high, "K". The positive results reported for arsenic and nickel were qualified as biased low, "L". The positive result reported for beryllium was qualified as estimated, "J", as a result of conflicting noncompliances.

- The interfering analyte iron was present in sample SD-04-01Q at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium and nickel in the affected sample. The positive result reported for antimony was qualified as biased high, "K". The positive results reported for arsenic and nickel were qualified as biased low, "L". The positive result reported for beryllium was qualified as estimated, "J", as a result of conflicting noncompliances.

- The interfering analyte iron was present in sample SD-10-01Q at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, cadmium and nickel in the affected sample. The positive result reported for antimony was qualified as biased high, "K". The positive results reported for arsenic and nickel were qualified as biased low, "L". The positive results reported for beryllium and cadmium were qualified as estimated, "J", as a result of conflicting noncompliances.

- The interfering analyte iron was present in sample SS-01-01Q at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, cadmium and potassium in the affected sample. The positive result reported for antimony was qualified as biased high, "K". The positive result reported for arsenic was qualified as biased low, "L". The positive results reported for cadmium and potassium were qualified as estimated, "J", as a result of conflicting noncompliances.

- The interfering analyte iron was present in sample SS-02-01Q at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, cadmium, nickel and silver in the affected sample. The positive results reported for antimony and silver were qualified as biased high, "K". The positive results reported for arsenic and nickel were qualified as biased low, "L". The positive results reported for beryllium and cadmium were qualified as estimated, "J", as a result of conflicting noncompliances.

- The Laboratory Control Sample (LCS) Percent Recovery (%R) for cobalt exceeded the upper quality control limit affecting the soil / sediment samples. The positive results reported for cobalt in the affected samples were qualified as biased high, "K".

Notes

The CRDL %Rs for copper, manganese, selenium, vanadium and zinc were outside the 90-110% quality control limit. However, all results reported for the above listed analytes were either nondetected, qualified as a result of blank contamination or >2X CRDL. Therefore, no validation action was required.

An ICP Serial Dilution Sample was not analyzed.

Executive Summary

Laboratory Performance: The CRDL %Rs for several analytes were outside the 90-110% quality control limit. Several analytes were present in the laboratory method / preparation blanks.

Other Factors Affecting Data Quality: Several analytes were present in the rinsate blank. The interfering analytes calcium and / or iron were present in the soil / sediment samples. The LCS %R for cobalt exceeded the upper quality control limit affecting the soil / sediment samples.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2-96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Gretchen A. Phipps

Tetra Tech NUS
Gretchen A. Phipps
Chemist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support documentation

Data Qualifier Key:

U	-	Value is nondetect as reported by laboratory.
B	-	Positive result is considered to be an artifact of blank contamination and should not be considered present.
UL	-	Nondetected result is considered biased low, "UL", as a result of validation noncompliances.
L	-	Positive result is considered biased low, "L", as a result of validation noncompliances.
K	-	Positive result is considered biased high, "K", as a result of technical noncompliances.
UJ	-	Nondetected result is considered estimated, "UJ", as a result of validation noncompliances.
J	-	Positive result is considered estimated, "J", as a result of validation noncompliances.

APPENIDX A
QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCB D% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = % Solid content is less than 30%

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SD-01-01Q			SD-04-01Q			SD-07-01Q			SD-10-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
LABORATORY ID:	990827-08			990827-07			990827-04			990827-02		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	83.3 %			79.0 %			79.6 %			78.4 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	7900			7760			6530			6900		
ANTIMONY	5.1	K	K	0.53	K	K	1.8	K	K	0.84	K	K
ARSENIC	0.36	UL	K	2.8	L	K	5.5	L	K	3.1	L	K
BARIUM	85.8			85.1			84			159		
BERYLLIUM	0.95	J	CK	1.3	J	CK	1	J	CK	0.81	J	CK
CADMIUM	0.85	UL	C	0.05	UL	C	0.05	UL	C	0.46	J	CK
CALCIUM	24100			12200			12700			9160		
CHROMIUM	494			28.1			29.8			41.6		
COBALT	9.2	K	CE	10.1	K	CE	10.4	K	K	9.7	K	CE
COPPER	65.8			46.0			65.3			46.8		
IRON	67200			28000			38200			24700		
LEAD	69.1			52.7			61.3			106		
MAGNESIUM	9480			8550			9550			6890		
MANGANESE	6220			737			755			654		
NICKEL	17.9	L	K	19.0	L	K	23.7	L	K	20.8	L	K
POTASSIUM	2020	K	K	1830			2090			1370		
SELENIUM	4.2	U		2.6	U		4.5	U		2.6	U	
SILVER	3.5	K	K	1.6	B	A	1.7	B	A	1.1	B	A
SODIUM	322	B	A	1270			534	K	CK	622	K	C
THALLIUM	8.7	U		0.55	U		0.47	U		0.54	U	
VANADIUM	264			34.2			37.4			33.4		
ZINC	132			230			127			176		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SS-01-01Q			SS-02-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	56.0 %			62.1 %			100.0 %			100.0 %		
UNITS:	MG/KG			MG/KG								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	8240			12200								
ANTIMONY	0.81	K	K	1.6	K	K						
ARSENIC	3.2	L	K	4.6	L	K						
BARIUM	246			153								
BERYLLIUM	0.66	B	A	1.2	J	CK						
CADMIUM	0.82	J	CK	0.53	J	C						
CALCIUM	3740			3010								
CHROMIUM	34.4			28.5								
COBALT	25.1	K	E	7.6	K	CE						
COPPER	15.3			53.6								
IRON	23700			26000								
LEAD	39.4			97.5								
MAGNESIUM	1920			2840								
MANGANESE	6000			372								
NICKEL	47.9			14.6	L	K						
POTASSIUM	608	J	CK	1030	J	C						
SELENIUM	0.71	B	A	2.8	U							
SILVER	3.6	B	A	6.0	K	K						
SODIUM	171	B	A	218	B	A						
THALLIUM	0.76	U		0.59	U							
VANADIUM	30.6			48.4								
ZINC	850			117								

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SW-01-01Q			SW-04-01Q			SW-07-01Q			SW-10-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
LABORATORY ID:	990827-06			990827-05			990827-03			990827-01		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	MG/L			MG/L			MG/L			MG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
HARDNESS as CaCO3	21.3			54.2			113			127		
TOTAL ORGANIC CARBON	5			9			2.7			2.3		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SD-01-01Q			SD-04-01Q			SD-07-01Q			SD-10-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	83.3 %			79.0 %			79.6 %			78.4 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
TOTAL ORGANIC CARBON	13400			6230			5180			7640		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SS-01-01Q			SS-02-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	56.0 %			62.1 %			100.0 %			100.0 %		
UNITS:	MG/KG			MG/KG								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
TOTAL ORGANIC CARBON	19100			7310								

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	RB-091599			SW-01-01Q			SW-04-01Q			SW-07-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	46.2	K	C	350	B	A	773			41.0	U	
ANTIMONY	2.6	U		2.6	U		2.6	U		2.6	U	
ARSENIC	3.6	U		3.6	U		3.6	U		3.6	U	
BARIUM	4.5	UJ	C	34.2	B	A	58.9	B	A	91.3	B	A
BERYLLIUM	0.37	UL	C	0.37	UL	C	1.1	B	A	0.37	UL	C
CADMIUM	0.43	UL	C	0.43	UL	C	0.43	UL	C	0.43	UL	C
CALCIUM	83.8	K	C	5180	B	A	12900			27800		
CHROMIUM	5.4	U		6.2			19.6			5.4	U	
COBALT	5.2	U		5.2	U		12.0	B	A	5.2	U	
COPPER	3.8	U		10.7	B	A	20.5	B	A	3.8	U	
IRON	40	UJ	C	683			1430			216	B	A
LEAD	2.7	U		78.8			56.9			2.7	U	
MAGNESIUM	119	U		2030	K	C	5320	K	C	10500		
MANGANESE	3.0	U		32.0	B	A	78.9			75.4		
NICKEL	6.3	UL	C	6.3	UL	C	18	B	A	6.3	UL	C
POTASSIUM	222	UJ	C	1040	B	A	1820	J	C	1600	J	C
SELENIUM	2.1	U		2.1	U		2.1	U		2.1	U	
SILVER	3.7	UJ	C	3.7	UJ	C	3.7	UJ	C	3.7	UJ	C
SODIUM	243	K	C	3110	K	C	7180	K	C	16200		
THALLIUM	4.4	U		4.4	U		4.4	U		4.4	U	
VANADIUM	2.8	U		2.8	B	A	19.7	B	A	4.7	B	A
ZINC	5.5	U		47.1			52.6			21.6	B	A

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SW-10-01Q											
SAMPLE DATE:	09/15/99			/ /			/ /			/ /		
QC_TYPE:	NORMAL											
% SOLIDS:	0.0 %			100.0 %			100.0 %			100.0 %		
UNITS:	UG/L											
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	262	B	A									
ANTIMONY	2.6	U										
ARSENIC	3.6	U										
BARIUM	121	B	A									
BERYLLIUM	0.81	B	A									
CADMIUM	0.43	UL	C									
CALCIUM	31300											
CHROMIUM	16.2											
COBALT	11.4	B	A									
COPPER	19.7	B	A									
IRON	1550											
LEAD	4.4											
MAGNESIUM	12000											
MANGANESE	208											
NICKEL	16.9	B	A									
POTASSIUM	2190	J	C									
SELENIUM	2.1	U										
SILVER	3.7	UJ	C									
SODIUM	19500											
THALLIUM	4.4	U										
VANADIUM	14.4	B	A									
ZINC	30.3	B	A									

NOV 2 2

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-11-9-107

TO:	**G. GLENN**	**DATE:**	**NOVEMBER 19, 1999**
FROM:	**GRETCHEN A. PHIPPS**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS, TOC AND HARDNESS**
CT0 252 - NAWC WARMINSTER, PENNSYVANIA
SAMPLE DELIVERY GROUP SDG – 990830

SAMPLES: 10/Aqueous/

SW-02-01Q	SW-03-01-Q	SW-05-01-Q
SW-06-01Q	SW-08-01Q	SW-09-01Q
SW-11-01Q	SW-12-01Q	SW-13-01Q
SW-21-01Q		

10/Sediments/

SD-05-01Q	SD-06-01Q	SD-08-01Q
SD-09-01Q	SD-11-01Q	SD-02-01Q
SD-03-01Q	SD-13-01Q	SD-21-01Q
SD-12-01Q		

Overview

The sample set SDG 990830, NAWC Warminster, consists of ten (10) aqueous and ten (10) sediment environmental samples.

All aqueous samples were analyzed for hardness and total organic carbon (TOC). The following sediment samples were analyzed for TAL metals: SD-05-01Q , SD-06-01Q , SD-08-01Q , SD-09-01Q and SD-11-01Q . All sediment samples were analyzed for TOC. The samples were collected by Tetra Tech NUS on September 14 and 15, 1999 and analyzed by Ceimic Corporation under the Naval Facilities Engineering Service Center (NFESC) Quality Assurance/ Quality Control (QA/AC) criteria. Metals analyses were conducted using SW 846 method 6010B.

Summary

All analytes were analyzed successfully. The finding in this report are based upon a general review of all available data. The data was review based on data completeness, holding times, calibration data, laboratory method/ preparation blanks, interference check sample (ICS) results, matrix spike/matrix spike duplicate results, post digestion spike results, laboratory duplicate results, laboratory control sample (LCS) results, detection limits and analyte quanitation.

All analyses were conducted using Inductively Coupled Plasma (ICP) methodologies.

Areas of concern with respect to data quality are listed below.

Major Problems

- The Matrix Spike (MS) Percent Recovery (%R) for selenium affecting the sediment samples was <30% quality control limit. The nondetected results reported for selenium in the affected samples were qualified as rejected, "UR".

Minor Problems

- The Contract Required Detection Limit (CRDL) Percent Recoveries (%Rs) for barium, potassium and silver were both above and below the 90-110% quality control limits. The positive results reported for barium and potassium were qualified as estimated, "J". The nondetected results reported for silver were qualified as estimated, "UJ". The direction of bias could not be determined.

- The CRDL %Rs for cadmium, nickel and beryllium were <90% quality control limit. The nondetected results reported for beryllium, cadmium and nickel were qualified as biased low, "UL". The positive results <2X CRDL reported for beryllium and cadmium were qualified as estimated, "J", as a result of conflicting noncompliances. The positive results <2X CRDL reported for nickel were qualified biased low, "L".

- The CRDL %Rs for cobalt, magnesium and sodium were >110% quality control limits. The positive results <2X CRDL reported for magnesium and sodium were qualified as estimated, "J", as a result of the conflicting noncompliances. The positive results reported for cobalt were qualified as biased high, "K".

- The following contaminants were detected in the laboratory method / preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level(sediment)	Action Level(aqueous)
Aluminum	130.5µg/L	65.25 mg/kg	652.5µg/L
Barium	26.6µg/L	13.3 mg/kg	133µg/L
Beryllium	0.9µg/L	0.45 mg/kg	4.5µg/L
Calcium	1085.2µg/L	542.6 mg/kg	4526µg/L
Cobalt	9.2µg/L	4.6 mg/kg	46.0µg/L
Copper	11.4µg/L	5.7 mg/kg	57.0µg/L
Iron	50.5µg/L	25.25 mg/kg	252.5µg/L
Magnesium	170.1µg/L	85.05 mg/kg	850.5µg/L
Manganese	8.8µg/L	4.4 mg/kg	44.0µg/L
Nickel	6.7µg/L	3.35 mg/kg	33.5µg/L
Potassium	222.6µg/L	111.3 mg/kg	1113µg/L
Selenium	4.2µg/L	2.1 mg/kg	21.0µg/L
Silver	4.7µg/L	2.35 mg/kg	23.5µg/L
Sodium	604.2µg/L	30.21 mg/kg	3021µg/L
Vanadium	9.1µg/L	4.55 mg/kg	45.5µg/L
Zinc	8.0µg/L	NA	40.0µg/L
Zinc[1]	1.300 mg/kg	6.5 mg/kg	NA

(1) Maximum concentration present in a soil preparation blank.

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, dilution factors and percent solids were taken into consideration when evaluating for blank contamination. Positive results less than the blank action level for aluminum, barium, beryllium, cobalt, copper, iron, manganese, nickel, potassium, silver, vanadium and zinc were qualified, "B", as a result of blank contamination. No validation action was required for the remaining analytes as all results reported were either greater than the blank action level or nondetected.

- The interfering analytes calcium and iron were present in sample SD-05-01Q at concentrations which were comparable to the levels of calcium and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and vanadium were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium and nickel in the affected sample. The positive results reported for antimony and beryllium were qualified as estimated, "J", as a result of conflicting noncompliances. The positive results reported for arsenic and nickel were qualified as biased low, "L".

- The interfering analytes calcium, magnesium and iron were present in sample SD-09-01Q at concentrations which were comparable to the levels of calcium, magnesium and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and vanadium were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium and nickel in the affected sample. The positive results reported for antimony and beryllium were qualified as estimated, "J", as a result of conflicting noncompliances. The positive results reported for arsenic and nickel were qualified as biased low, "L".

- The interfering analyte iron was present in sample SD-06-01Q at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and vanadium were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, nickel, silver and vanadium in the affected sample. The positive results reported for antimony, beryllium and silver were qualified as estimated, "J", as a result of conflicting noncompliances. The positive results reported for arsenic and nickel were qualified as biased low, "L". The positive result reported for vanadium was qualified as biased high, "K".

- The interfering analyte iron was present in samples SD-08-01Q and SD-11-01Q at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and vanadium were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, cadmium and nickel in the affected samples. The positive results reported for antimony, beryllium and cadmium were qualified as estimated, "J", as a result of conflicting noncompliances. The positive results reported for arsenic and nickel were qualified as biased low, "L".

- The MS %Rs for chromium, copper and sodium affecting the sediment samples were <30% quality control limit. The positive results reported for chromium, copper and sodium in the affected samples were qualified, "J", as a result of conflicting noncompliances.

- The MS %Rs for antimony, barium and cadmium affecting the sediment samples were <75% quality control limit. The positive results reported for antimony, barium and cadmium in the affected samples were qualified as estimated, "J", as a result of conflicting noncompliances. The nondetected results reported for cadmium in the affected samples were qualified as biased low, "UL".

- The MS %R for magnesium affecting the sediment samples was >125% quality control limit. The positive results reported for magnesium in the affected samples were qualified as estimated, "J", as a result of conflicting noncompliances.

- The ICP Serial Dilution Percent Differences (%Ds) for calcium, iron, magnesium, manganese and sodium affecting the aqueous samples were >10% quality control limit. The positive results reported for calcium, iron, magnesium, manganese and sodium in the affected samples were qualified as estimated, "J". The direction of bias could not be determined.

- The ICP Serial Dilution Percent Differences (%Ds) for barium, cadmium, calcium, chromium, iron, magnesium, manganese and potassium affecting the sediment samples were >10% quality control limit. The positive results reported for barium, cadmium, calcium, chromium, iron, magnesium, manganese and potassium in the affected samples were qualified as estimated, "J". The direction of bias could not be determined.

Notes

The CRDL %Rs for aluminum, cadmium, copper, iron, manganese, vanadium and zinc were outside the 90-110% quality control limit. However, all results reported for the above listed analytes were either nondetected, qualified as a result of blank contamination or >2X CRDL. Therefore, no validation action was required.

The Post Digestion Spike %Rs for barium, cadmium, nickel and selenium were <75% quality control limit. However, no validation action was required.

Executive Summary

Laboratory Performance: The CRDL %Rs for several analytes were outside the 90-110% quality control limit. Several analytes were present in the laboratory method / preparation blanks.

Other Factors Affecting Data Quality: The interfering analytes calcium and / or iron and / or magnesium were present in the sediment samples. The MS %Rs for several analytes affecting the sediment samples were <75% quality control limit. The ICP Serial Dilution %Ds for several analytes were >10% quality control limit affecting both the sediment and aqueous samples.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2-96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Gretchen A Phipps

Tetra Tech NUS
Gretchen A. Phipps
Chemist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support documentation

Data Qualifier Key:

U	-	Value is nondetect as reported by laboratory.
B	-	Positive result is considered to be an artifact of blank contamination and should not be considered present.
UL	-	Nondetected result is considered biased low, "UL", as a result of validation noncompliances.
L	-	Positive result is considered biased low, "L", as a result of validation noncompliances.
K	-	Positive result is considered biased high, "K", as a result of technical noncompliances.
UJ	-	Nondetected result is considered estimated, "UJ", as a result of validation noncompliances.
J	-	Positive result is considered estimated, "J", as a result of validation noncompliances.

APPENIDX A
QUALIFIED ANALYTICAL RESULTS

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-08-01Q			SW-09-01Q			SW-11-01Q			SW-12-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/14/99			09/15/99		
LABORATORY ID:	990830-05			990830-03			990830-01			990830-19		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	140	B	A	149	B	A	71.3	B	A	41.0	U	
ANTIMONY	2.6	U		2.6	U		2.6	U		2.6	U	
ARSENIC	3.6	U		3.6	U		3.6	U		3.6	U	
BARIUM	98.5	B	A	97.6	B	A	199	J	C	112	B	A
BERYLLIUM	0.37	UL	C	0.49	B	A	0.37	UL	C	0.37	UL	C
CADMIUM	0.43	UL	C	0.43	UL	C	0.43	UL	C	1.0		
CALCIUM	32200	J	I	29800	J	I	58300	J	I	36600	J	I
CHROMIUM	5.4	U		11.6			5.4	U		5.4	U	
COBALT	5.2	U		9.6	B	A	5.4	B	A	5.2	U	
COPPER	3.8	U		11.4	B	A	6.8	B	A	5.9	B	A
IRON	553	J	I	418	J	I	3190	J	I	1380	J	I
LEAD	3.2			2.7	U		4.1			2.7	U	
MAGNESIUM	11700	J	I	11100	J	I	23800	J	I	14000	J	I
MANGANESE	158	J	I	164	J	I	746	J	I	244	J	I
NICKEL	6.7	B	A	16.5	B	A	6.7	B	A	6.3	UL	C
POTASSIUM	1630	J	C	1920	J	C	2400	J	C	1570	J	C
SELENIUM	2.1	U		2.1	U		2.1	U		2.1	U	
SILVER	3.7	UJ	C	4.9	B	A	6.8	B	A	3.7	UJ	C
SODIUM	19700	J	I	18700	J	I	49100	J	I	27100	J	I
THALLIUM	4.4	U		4.4	U		4.4	U		4.4	U	
VANADIUM	5.4	B	A	11.5	B	A	2.8	U		2.8	U	
ZINC	22.9	B	A	30.5	B	A	34.0	B	A	78.4		

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-13-01Q			SW-21-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
LABORATORY ID:	990830-17			990830-15								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	0.0 %			0.0 %			100.0 %			100.0 %		
UNITS:	UG/L			UG/L								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	41.0	U		66.2	B	A						
ANTIMONY	2.6	U		2.6	U							
ARSENIC	3.6	U		3.6	U							
BARIUM	90.0	B	A	75.1	B	A						
BERYLLIUM	0.37	UL	C	0.37	UL	C						
CADMIUM	0.43	U		0.43	U							
CALCIUM	32400	J	I	25200	J	I						
CHROMIUM	5.4	U		5.4	U							
COBALT	5.2	U		5.2	U							
COPPER	3.8	U		4.9	B	A						
IRON	270	J	I	258	J	I						
LEAD	2.7	U		2.7	U							
MAGNESIUM	12400	J	I	9190	J	I						
MANGANESE	139	J	I	79.5	J	I						
NICKEL	6.3	UL	C	6.3	UL	C						
POTASSIUM	1360	J	C	1250	J	C						
SELENIUM	2.1	U		2.1	U							
SILVER	3.7	UJ	C	5.5	B	A						
SODIUM	23400	J	I	14700	J	I						
THALLIUM	4.4	U		4.4	U							
VANADIUM	2.8	U		2.8	U							
ZINC	12.1	B	A	17.8	B	A						

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-05-01Q			SD-06-01Q			SD-08-01Q			SD-09-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/14/99			09/14/99		
LABORATORY ID:	990830-10			990830-08			990830-06			990830-04		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	77.7 %			81.2 %			64.5 %			78.6 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	7110			7440			6890			9500		
ANTIMONY	0.73	J	DK	1.1	J	DK	1.9	J	DK	1.0	J	DK
ARSENIC	5.3	L	K	0.73	L	K	2.5	L	K	2.4	L	K
BARIUM	73.0	J	DIK	104	J	DI	78.4	J	DI	72.0	J	DI
BERYLLIUM	1.1	J	CK	1.1	J	CK	0.90	J	CK	1.1	J	CK
CADMIUM	0.05	UL	CD	0.95	UL	CD	0.32	J	CDIK	0.05	UL	CD
CALCIUM	15300	J	I	10200	J	I	6050	J	I	28300	J	I
CHROMIUM	34.8	J	DI	30.5	J	DI	84.1	J	DI	43.3	J	DI
COBALT	10.1	K	C	8.6	K	C	7.8	K	C	8.3	K	C
COPPER	30.3	J	D	32.0	J	D	23.3	J	D	21.3	J	D
IRON	26100	J	I	52100	J	I	17500	J	I	23700	J	I
LEAD	199			50.3			118			83.1		
MAGNESIUM	11100	J	DI	7640	J	DI	5290	J	DI	18900	J	DI
MANGANESE	676	J	I	1040	J	I	335	J	I	399	J	I
NICKEL	17.2	L	K	21.2	L	K	16.0	L	K	15.2	L	K
POTASSIUM	1960	J	I	1980	J	I	1570	J	I	2530	J	I
SELENIUM	4.7	UR	D	4.7	UR	D	2.6	UR	D	2.4	UR	D
SILVER	1.4	B	A	2.8	B	A	1.3	B	A	1.1	B	A
SODIUM	818	J	CD	678	J	CDK	678	J	CD	1830	J	D
THALLIUM	0.49	U		0.49	U		0.54	U		0.51	U	
VANADIUM	39.3			44.2	K	K	30.9			40.1		
ZINC	125			142			146			101		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-11-01Q											
SAMPLE DATE:	09/14/99			/ /			/ /			/ /		
LABORATORY ID:	990830-02											
QC_TYPE:	NORMAL											
% SOLIDS:	78.2 %			100.0 %			100.0 %			100.0 %		
UNITS:	MG/KG											
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	7700											
ANTIMONY	1.1	J	DK									
ARSENIC	3.1	L	K									
BARIUM	143	J	DI									
BERYLLIUM	0.96	J	CK									
CADMIUM	2.9	J	DIK									
CALCIUM	6510	J	I									
CHROMIUM	57.3	J	DI									
COBALT	6.5	K	C									
COPPER	44.0	J	D									
IRON	20800	J	I									
LEAD	188											
MAGNESIUM	4770	J	DI									
MANGANESE	578	J	I									
NICKEL	12.5	L	K									
POTASSIUM	1450	J	I									
SELENIUM	2.3	UR	D									
SILVER	1.7	B	A									
SODIUM	801	J	CD									
THALLIUM	0.47	U										
VANADIUM	34.0											
ZINC	704											

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-02-01Q			SW-03-01Q			SW-05-01Q			SW-06-01Q		
SAMPLE DATE:	09/15/99			09/14/99			09/14/99			09/14/99		
LABORATORY ID:	990830-13			990830-11			990830-09			990830-07		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	MG/L			MG/L			MG/L			MG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
HARDNESS as CaCO3	34.9			119			111			128		
TOTAL ORGANIC CARBON	7.7			3.1			2.9			3.6		

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-08-01Q			SW-09-01Q			SW-11-01Q			SW-12-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/14/99			09/15/99		
LABORATORY ID:	990830-05			990830-03			990830-01			990830-19		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	MG/L			MG/L			MG/L			MG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
HARDNESS as CaCO3	129			120			244			149		
TOTAL ORGANIC CARBON	3			2.5			3.3			4.5		

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-13-01Q			SW-21-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
LABORATORY ID:	990830-17			990830-15								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	0.0 %			0.0 %			100.0 %			100.0 %		
UNITS:	MG/L			MG/L								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
HARDNESS as CaCO3	132			101								
TOTAL ORGANIC CARBON	3.9			3.5								

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-02-01Q	SD-03-01Q	SD-05-01Q	SD-06-01Q
SAMPLE DATE:	09/15/99	09/14/99	09/14/99	09/14/99
LABORATORY ID:	990830-14	990830-12	990830-10	990830-08
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	85.9 %	74.3 %	77.7 %	81.2 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
TOTAL ORGANIC CARBON(MG/KG)	3070			8670			5770			11000		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-08-01Q			SD-09-01Q			SD-11-01Q			SD-12-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/14/99			09/15/99		
LABORATORY ID:	990830-06			990830-04			990830-02			990830-20		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	77.5 %			78.6 %			78.2 %			81.0 %		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
TOTAL ORGANIC CARBON(MG/KG)	15100			9000			19500			3760		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-13-01Q			SD-21-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
LABORATORY ID:	990830-18			990830-16								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	79.9 %			80.5 %			100.0 %			100.0 %		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
TOTAL ORGANIC CARBON(MG/KG)	3610			5340								

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-02-01Q			SW-03-01Q			SW-05-01Q			SW-06-01Q		
SAMPLE DATE:	09/15/99			09/14/99			09/14/99			09/14/99		
LABORATORY ID:	990830-13			990830-11			990830-09			990830-07		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ALUMINUM	1050			138	B	A	41.0	U		41.0	U	
ANTIMONY	2.6	U		2.6	U		2.6	U		2.6	U	
ARSENIC	3.6	U		3.6	U		3.6	U		3.6	U	
BARIUM	42.3	B	A	100	B	A	87.3	B	A	102	B	A
BERYLLIUM	0.37	UL	C	0.65	B	A	0.37	UL	C	0.37	UL	C
CADMIUM	0.43	UL	C	0.43	UL	C	0.43	UL	C	0.43	UL	C
CALCIUM	8980	J	I	29100	J	I	27700	J	I	31600	J	I
CHROMIUM	5.4	U		15.4			5.4	U		5.4		
COBALT	5.2	U		12.6	B	A	5.2	U		5.2	U	
COPPER	9.1	B	A	13.0	B	A	3.8	U		6.5	B	A
IRON	1800	J	I	136	B	A	149	B	A	97.1	B	A
LEAD	119			2.7	U		2.7	U		2.7	U	
MAGNESIUM	3040	J	CI	11200	J	I	10300	J	I	11800	J	I
MANGANESE	86.4	J	I	32.3	B	A	46.8	J	I	53.0	J	I
NICKEL	6.3	UL	C	16.5	B	A	6.3	UL	C	6.3	UL	C
POTASSIUM	1090	B	A	2130	J	C	1630	J	C	1830	J	C
SELENIUM	2.1	U		2.1	U		2.1	U		2.1	U	
SILVER	4.0	B	A	7.2	B	A	5.2	B	A	3.7	UJ	C
SODIUM	4730	J	CI	17600	J	I	16700	J	I	19300	J	I
THALLIUM	4.4	U		4.4	U		4.4	U		4.4	U	
VANADIUM	5.7	B	A	12.8	B	A	2.8	U		4.0	B	A
ZINC	82.1			32.4	B	A	12.8	B	A	15.3	B	A

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCB D% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = % Solid content is less than 30%

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-11-9-053

TO:	**G. GLENN**	**DATE:**	**NOVEMBER 5, 1999**
FROM:	**TERRI L. SOLOMON**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – MERCURY**
CTO 252 - NAWC WARMINSTER, WARMINSTER, PENNSYLVANIA
SDG – BRL01

SAMPLES: 16/Sediments/ Soils

SD-01-01Q	SD-02-01Q	SD-03-01Q	SD-04-01Q
SD-05-01Q	SD-06-01Q	SD-07-01Q	SD-08-01Q
SD-09-01Q	SD-10-01Q	SD-11-01Q	SD-12-01Q
SD-13-01Q	SD-21-01Q	SS-01-01Q	SS-02-01Q

15/Aqueous/

RB-091599	SW-01-01Q	SW-02-01Q	SW-03-01Q
SW-04-01Q	SW-05-01Q	SW-06-01Q	SW-07-01Q
SW-08-01Q	SW-09-01Q	SW-10-01Q	SW-11-01Q
SW-12-01Q	SW-13-01Q	SW-21-01Q	

Overview

The sample set for CTO 252, NAWC Warminster, SDG BRL01, NAWC Warminster, Warminster, Pennsylvania, consists of sixteen (16) sediment/soil environmental samples, fourteen (14) aqueous environmental samples and one (1) rinsate blank (RB-091599). No field duplicate pairs were included within this SDG.

The above samples were analyzed for mercury. The samples were collected by Tetra Tech NUS on September 14 and 15, 1999 and analyzed by Brooks Rand LTD. under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Mercury analyses were conducted using EPA method 1631.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/preparation/field blanks, matrix spike results, laboratory duplicate results, laboratory control sample (LCS) results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Major Problems - None.

Minor Problems

- The matrix spike (MS) percent recovery (%R) for mercury affecting the sediment/soil samples was < 75% % quality control limit. The positive results reported for mercury in the affected samples were qualified as biased low, "L".

Notes

Mercury was present in the soil preparation sample at an average concentration of 0.286 ug/g. However, no validation actions are required as the sample results are corrected for blank contamination.

Soil samples were reported in units of ng/g. Aqueous samples were reported in units of ng/L.

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: The MS %R for mercury affecting the sediment/soil samples was < 75% quality control limit.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Terri L. Solomon

TetraTech NUS
Terri L. Solomon
Chemist

Gretchen A. Phipps for

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Data Qualifier Key:

U - Value is a nondetect as reported by the laboratory.

L - Positive result is considered biased low as a result of validation noncompliances.

APPENDIX A
Qualified Analytical Results

CTO252 - NAWC WARMINSTER
WATER DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	RB-091599			SW-01-01Q			SW-02-01Q			SW-03-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
LABORATORY ID:	99BR208-09			99BR208-01			99BR208-19			99BR208-11		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	NG/L			NG/L			NG/L			NG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	0.1	U		10			14.2			1.7		

CTO252 - NAWC WARMINSTER
WATER DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SW-04-01Q			SW-05-01Q			SW-06-01Q			SW-07-01Q		
SAMPLE DATE:	09/15/99			09/14/99			09/14/99			09/15/99		
LABORATORY ID:	99BR208-18			99BR207-09			99BR207-07			99BR208-16		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	NG/L			NG/L			NG/L			NG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	11.2			2.1			0.90			2.0		

CTO252 - NAWC WARMINSTER
WATER DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SW-08-01Q			SW-09-01Q			SW-10-01Q			SW-11-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/15/99			09/14/99		
LABORATORY ID:	99BR207-05			99BR207-03			99BR208-14			99BR207-01		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	NG/L			NG/L			NG/L			NG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	1.7			6.2			10.3			4.0		

CTO252 - NAWC WARMINSTER
WATER DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SW-12-01Q			SW-13-01Q			SW-21-01Q					
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			/ /		
LABORATORY ID:	99BR208-12			99BR208-10			99BR208-07					
QC_TYPE:	NORMAL			NORMAL			NORMAL					
% SOLIDS:	0.0 %			0.0 %			0.0 %			100.0 %		
UNITS:	NG/L			NG/L			NG/L					
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	2.1			1.4			1.4					

CTO252 - NAWC WARMINSTER
SOIL DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SD-01-01Q			SD-02-01Q			SD-03-01Q			SD-04-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/14/99			09/15/99		
LABORATORY ID:	99BR208-04			99BR208-03			99BR207-12			99BR208-02		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	71.0 %			81.5 %			60.7 %			82.9 %		
UNITS:	NG/G			NG/G			NG/G			NG/G		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	8.7	L	D	27.7	L	D	33.6	L	D	17.0	L	D

CTO252 - NAWC WARMINSTER
SOIL DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SD-05-01Q			SD-06-01Q			SD-07-01Q			SD-08-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/15/99			09/14/99		
LABORATORY ID:	99BR207-10			99BR207-08			99BR208-17			99BR207-06		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	60.4 %			84.0 %			80.3 %			76.1 %		
UNITS:	NG/G			NG/G			NG/G			NG/G		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	11.5	L	D	188	L	D	11.2	L	D	59.1	L	D

CTO252 - NAWC WARMINSTER
SOIL DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SD-09-01Q			SD-10-01Q			SD-11-01Q			SD-12-01Q		
SAMPLE DATE:	09/14/99			09/15/99			09/14/99			09/15/99		
LABORATORY ID:	99BR207-04			99BR208-15			99BR207-02			99BR208-13		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	78.6 %			79.6 %			76.4 %			81.0 %		
UNITS:	NG/G			NG/G			NG/G			NG/G		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	32.1	L	D	18.0	L	D	195	L	D	68.4	L	D

CTO252 - NAWC WARMINSTER
SOIL DATA
BROOKS RAND LTD
SDG: BRL01

SAMPLE NUMBER:	SD-13-01Q			SD-21-01Q			SS-01-01Q			SS-02-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
LABORATORY ID:	99BR208-11			99BR208-08			99BR208-05			99BR208-06		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	81.3 %			81.3 %			52.1 %			68.9 %		
UNITS:	NG/G			NG/G			NG/G			NG/G		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
MERCURY	37.5	L	D	14.4	L	D	290	L	D	192	L	D

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCB D% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = % Solid content is less than 30%

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**MR. G. GLENN**	**DATE:**	**NOVEMBER 5, 1999**
FROM:	**LINDA KARSONOVICH**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION- PAH CTO 252, NAWC WARMINSTER SDG 990827**		

SAMPLES: 4/Aqueous/

RB-091599 SW-04-01Q SW-07-01Q
SW-10-01Q

6/Solid/

SD-01-01Q SD-04-01Q SD-07-01Q
SD-10-01Q SS-01-01Q SS-02-01Q

OVERVIEW

The sample set for CTO 252, SDG 990827, NAWC Warminster consists of one (1) field quality control blank, three (3) aqueous environmental samples, and six (6) surface soil/sediment environmental samples. All samples were analyzed for polynuclear aromatic hydrocarbons (PAHs). No field duplicate pairs were included in the SDG.

The samples were collected by TetraTech NUS on September 15, 1999 and were analyzed by Ceimic. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Method 8310 analytical and reporting protocols.

All samples were successfully analyzed. The findings offered in this report are based upon a general review of all available data including: data completeness, system performance and tuning, holding times, initial/continuing calibrations, laboratory method blank results, surrogate spike recoveries, internal standard recoveries, matrix spike/matrix spike duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- The surface soil and sediment samples were extracted nine days after sample collection. Positive and nondetected results were qualified as estimated, J and UJ.
- Surrogate recovery fell below 60% for carbazole in samples SD-07-01Q and SS-01-01Q. Nondetected and positive results were qualified as estimated, UJ and J.
- Positive results below the CRQL were qualified as estimated, J, due to uncertainty near the detection limit. The direction of bias cannot be determined.

Notes

The following compounds were detected in the field quality control blank:

Compound	Maximum Concentration	Blank Action Level
Benzo(a)anthracene	0.021 µg/L	3.5 µg/Kg
Benzo(a)pyrene	0.019 µg/L	3.17 µg/Kg
Benzo(k)fluoranthene	0.027 µg/L	4.5 µg/Kg

Sample aliquot, percent solids, and dilution factors were taken into consideration when applying the blank action limit. No qualifiers were assigned on this basis.

The surface soil and sediment samples were analyzed at a 2-5X dilution factor due to the presence of target compounds. This accounts for the elevated reporting limits for these samples.

Several transcription errors were noted. The electronic deliverable was amended to reflect the results reported on the Form 1s.

EXECUTIVE SUMMARY

Laboratory Performance Issues:. The surface soil and sediment samples were extracted outside of holding time. Several surrogate recoveries were less than the quality control limit.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy Installation Restoration Program Laboratory Quality Assurance Guide" (February, 1996). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

TetraTech NUS

Linda Karsonovich
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	RB-091599			SW-04-01Q			SW-07-01Q			SW-10-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
LABORATORY ID:	990827-11			990827-05			990827-03			990827-01		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	0.5	U		0.5	U		0.5	U		0.5	U	
ACENAPHTHYLENE	1	U		1	U		1	U		1	U	
ANTHRACENE	0.05	U		0.05	U		0.05	U		0.05	U	
BENZO(A)ANTHRACENE	0.021	J	P	0.056			0.05	U		0.05	U	
BENZO(A)PYRENE	0.019	J	P	0.06			0.05	U		0.05	U	
BENZO(B)FLUORANTHENE	0.1	U		0.1	U		0.1	U		0.1	U	
BENZO(G,H,I)PERYLENE	0.1	U		0.11			0.1	U		0.1	U	
BENZO(K)FLUORANTHENE	0.027	J	P	0.05	U		0.05	U		0.05	U	
CHRYSENE	0.05	U		0.085			0.05	U		0.05	U	
DIBENZO(A,H)ANTHRACENE	0.03	U		0.03	U		0.03	U		0.03	U	
FLUORANTHENE	0.1	U		0.2			0.1	U		0.1	U	
FLUORENE	0.1	U		0.1	U		0.1	U		0.1	U	
INDENO(1,2,3-CD)PYRENE	0.05	U		0.065			0.05	U		0.05	U	
NAPHTHALENE	0.5	U		0.5	U		0.5	U		0.5	U	
PHENANTHRENE	0.05	U		0.086			0.05	U		0.05	U	
PYRENE	0.05	U		0.13			0.05	U		0.05	U	

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SD-01-01Q			SD-04-01Q			SD-07-01Q			SD-10-01Q		
SAMPLE DATE:	09/15/99			09/15/99			09/15/99			09/15/99		
LABORATORY ID:	990827-08			990827-07			990827-04			990827-02		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	89.0 %			77.0 %			81.0 %			81.0 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	95	UJ	H	110	UJ	H	100	UJ	HR	100	UJ	H
ACENAPHTHYLENE	190	UJ	H	220	UJ	H	200	UJ	HR	200	UJ	H
ANTHRACENE	29	J	H	36	J	H	64	J	HR	58	J	H
BENZO(A)ANTHRACENE	200	J	H	350	J	H	230	J	HR	420	J	H
BENZO(A)PYRENE	220	J	H	320	J	H	220	J	HR	390	J	H
BENZO(B)FLUORANTHENE	200	J	H	380	J	H	250	J	HR	510	J	H
BENZO(G,H,I)PERYLENE	120	J	H	300	J	H	170	J	HR	370	J	H
BENZO(K)FLUORANTHENE	54	J	H	190	J	H	120	J	HR	220	J	H
CHRYSENE	190	J	H	320	J	H	230	J	HR	440	J	H
DIBENZO(A,H)ANTHRACENE	19	UJ	H	22	UJ	H	20	UJ	HR	20	UJ	H
FLUORANTHENE	410	J	H	640	J	H	650	J	HR	850	J	H
FLUORENE	19	UJ	H	22	UJ	H	33	J	HR	20	UJ	H
INDENO(1,2,3-CD)PYRENE	130	J	H	190	J	H	120	J	HR	240	J	H
NAPHTHALENE	95	UJ	H	110	UJ	H	100	UJ	HR	100	UJ	H
PHENANTHRENE	160	J	H	180	J	H	340	J	HR	380	J	H
PYRENE	290	J	H	410	J	H	440	J	HR	750	J	H

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990827

SAMPLE NUMBER:	SS-01-01Q			SS-02-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
LABORATORY ID:	990827-09			990827-10								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	46.0 %			71.0 %			100.0 %			100.0 %		
UNITS:	UG/KG			UG/KG								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	70	UJ	HR	120	UJ	H						
ACENAPHTHYLENE	140	UJ	HR	230	UJ	H						
ANTHRACENE	7	UJ	HR	65	J	H						
BENZO(A)ANTHRACENE	130	J	HR	380	J	H						
BENZO(A)PYRENE	200	J	HR	420	J	H						
BENZO(B)FLUORANTHENE	190	J	HR	380	J	H						
BENZO(G,H,I)PERYLENE	170	J	HR	270	J	H						
BENZO(K)FLUORANTHENE	71	J	HR	170	J	H						
CHRYSENE	230	J	HR	400	J	H						
DIBENZO(A,H)ANTHRACENE	11	J	HPR	23	UJ	H						
FLUORANTHENE	350	J	HR	830	J	H						
FLUORENE	14	UJ	HR	32	J	H						
INDENO(1,2,3-CD)PYRENE	120	J	HR	250	J	H						
NAPHTHALENE	70	UJ	HR	120	UJ	H						
PHENANTHRENE	150	J	HR	380	J	H						
PYRENE	260	J	HR	700	J	H						

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-11-9-123

TO:	**MR. G. GLENN**	**DATE:**	**NOVEMBER 17, 1999**
FROM:	**JUSTIN ORBICH**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – PAH CTO252, NAWC WARMINSTER SDG 990830**		

SAMPLES: 10/Sediment

SD-02-01Q	SD-03-01Q
SD-05-01Q	SD-06-01Q
SD-08-01Q	SD-09-01Q
SD-11-01Q	SD-13-01Q
SD-21-01Q	SD-12-01Q

7/Surface Water

SW-03-01Q	SW-06-01Q
SW-08-01Q	SW-09-01Q
SW-11-01Q	SW-12-01Q
SW-13-01Q	

OVERVIEW

The sample set for CTO 252, SDG 990830, Naval Air Warfare Center (NAWC) Warminster consists of ten (10) sediment and seven (7) surface water environmental samples. The samples were analyzed for selected Polynuclear Aromatic Hydrocarbon (PAH) organic compounds. No field duplicate pairs were included in this SDG.

The samples were collected by Tetra Tech NUS, Inc. on September 14th and 15th, 1999 and analyzed by Quanterra. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria, and SW 846 Method 8330 analytical and reporting protocols.

All compounds were successfully analyzed with the exception of those compounds qualified as rejected. The findings offered in this report are based upon a general review of all available data including data completeness, holding times until extraction/analysis, initial and continuing calibration data, laboratory and field quality control blank results, surrogate spike recoveries, Matrix Spike/Matrix Spike Duplicate (MS/MSD) results, Laboratory Control Sample (LCS) results, internal standard performance, and compound identification and quantitation.

Areas of concern are listed below.

Major Problems

- None noted.

Minor Problems

- The continuing calibration Percent Difference (%D) exceeded the 15% quality control limit for dibenzo(a,h)anthracene. The positive result was qualified as estimated (J), in sample SD-11-01Q.

- Several samples contained positive results for compounds below the reporting limits. These results were qualified as estimated (J). The direction of bias is unknown.

Notes

The Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries (%Rs) was zero percent (0%) for acenaphthylene, acenaphthene, and fluorene, however, the sample was analyzed at a 75X dilution. No action was warranted since the sample was analyzed at a dilution.

It should be noted the laboratory did not analyze for carbazole and dibenzofuran as per the laboratory specification. The project manager was notified, and the reviewer validated the samples without the two aforementioned compounds.

All the samples were analyzed at a dilution due to high levels of target compounds.

Since the laboratory spiked carbazole as a surrogate and due to the presence of carbazole in the samples, the surrogate %Rs exceeded the quality control limit affecting samples: SD-02-1Q, SD-08-01Q, SD-11-01Q, SD-13-01Q, and SW-12-01Q.

It should be noted the sample identification for sample SD-12-01Q was incorrectly identified as SW-12-01Q on the Form I and the Chain of Custody (COC) in the sediment fraction. The reviewer corrected the sample identification as SD-12-01Q.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Continuing calibration %D exceeded the quality control limit for dibenzo(a,h)anthracene.

Other Factors Affecting Data Quality: Several MS/MSD %Rs were 0%. All sediment samples were analyzed at a dilution.

The data for these analyses were reviewed with reference to method-specific quality control criteria, the "National Functional Guidelines for Organic Data Evaluation" (February, 1994), as amended for use within EPA Region III, and the NFESC Interim Guidance Document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (February, 1996).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS, Inc.

Justin Orbich
Chemist/Data Validator

Tetra Tech NUS, Inc.

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCB D% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = % Solid content is less than 30%

DATA QUALIFIER DEFINITIONS:

U	-	Value is a nondetected result as reported by the laboratory and should not be considered present.
J	-	Positive result is estimated as a result of a value below the CRQL or a technical noncompliance.
UR	-	Compound was rejected due to severe technical noncompliances or as a result of calibration RRF noncompliances.

APPENDIX A

Qualified Analytical Results

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-02-01Q			SD-03-01Q			SD-05-01Q			SD-06-01Q		
SAMPLE DATE:	09/15/99			09/14/99			09/14/99			09/14/99		
LABORATORY ID:	990830-14			990830-12			990830-10			990830-08		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	86.0 %			78.0 %			79.0 %			78.0 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	190	U		110	U		110	U		110	U	
ACENAPHTHYLENE	380	U		210	U		210	U		210	U	
ANTHRACENE	220			91			95			32		
BENZO(A)ANTHRACENE	1000			440			11	U		260		
BENZO(A)PYRENE	950			430			870			240		
BENZO(B)FLUORANTHENE	970			370			800			200		
BENZO(G,H,I)PERYLENE	680			400			660			240		
BENZO(K)FLUORANTHENE	550			200			500			56		
CHRYSENE	900			360			940			260		
DIBENZO(A,H)ANTHRACENE	34	J	P	21			18	J	P	14	J	P
FLUORANTHENE	2600			870			2100			580		
FLUORENE	90			21	U		21	U		21	U	
INDENO(1,2,3-CD)PYRENE	490			230			380			130		
NAPHTHALENE	190	U		110	U		110	U		110	U	
PHENANTHRENE	1000			360			430			230		
PYRENE	1600			700			1600			400		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-08-01Q			SD-09-01Q			SD-11-01Q			SD-12-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/14/99			09/15/99		
LABORATORY ID:	990830-06			990830-04			990830-02			990830-20		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	75.0 %			80.0 %			75.0 %			84.0 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	1100	U		110	U		1700	U		490	U	
ACENAPHTHYLENE	2200	U		210	U		3300	U		980	U	
ANTHRACENE	680			40			2000			800		
BENZO(A)ANTHRACENE	3700			200			6800			2000		
BENZO(A)PYRENE	2600			210			5700			2000		
BENZO(B)FLUORANTHENE	3200			180			6500			2100		
BENZO(G,H,I)PERYLENE	2700			100			4400			1300		
BENZO(K)FLUORANTHENE	1700			54			2900			1200		
CHRYSENE	4000			210			7600			2200		
DIBENZO(A,H)ANTHRACENE	110	J	P	21	U		240	J	CP	200		
FLUORANTHENE	7900			480			20000			5600		
FLUORENE	220	U		21	U		330	U		390		
INDENO(1,2,3-CD)PYRENE	1600			99			2800			970		
NAPHTHALENE	1100	U		110	U		1700	U		490	U	
PHENANTHRENE	3200			210			8900			3700		
PYRENE	6900			370			17000			5200		

CTO252 - NAWC WARMINSTER
SOIL DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SD-13-01Q			SD-21-01Q								
SAMPLE DATE:	09/15/99			09/15/99			/ /			/ /		
LABORATORY ID:	990830-18			990830-16								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	79.0 %			81.0 %			100.0 %			100.0 %		
UNITS:	UG/KG			UG/KG								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	110	U		100	U							
ACENAPHTHYLENE	210	U		200	U							
ANTHRACENE	120			72								
BENZO(A)ANTHRACENE	640			420								
BENZO(A)PYRENE	640			460								
BENZO(B)FLUORANTHENE	670			430								
BENZO(G,H,I)PERYLENE	680			360								
BENZO(K)FLUORANTHENE	360			120								
CHRYSENE	670			480								
DIBENZO(A,H)ANTHRACENE	34			83								
FLUORANTHENE	1300			990								
FLUORENE	21	U		20	U							
INDENO(1,2,3-CD)PYRENE	420			250								
NAPHTHALENE	110	U		100	U							
PHENANTHRENE	590			400								
PYRENE	1100			800								

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-03-01Q			SW-06-01Q			SW-08-01Q			SW-09-01Q		
SAMPLE DATE:	09/14/99			09/14/99			09/14/99			09/14/99		
LABORATORY ID:	990830-11			990830-07			990830-05			990830-03		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	0.5	U		0.5	U		0.5	U		0.5	U	
ACENAPHTHYLENE	1	U		1	U		1	U		1	U	
ANTHRACENE	0.05	U		0.05	U		0.05	U		0.05	U	
BENZO(A)ANTHRACENE	0.05	U		0.05	U		0.05	U		0.05	U	
BENZO(A)PYRENE	0.05	U		0.05	U		0.05	U		0.05	U	
BENZO(B)FLUORANTHENE	0.1	U		0.1	U		0.1	U		0.1	U	
BENZO(G,H,I)PERYLENE	0.1	U		0.1	U		0.1	U		0.1	U	
BENZO(K)FLUORANTHENE	0.05	U		0.05	U		0.05	U		0.05	U	
CHRYSENE	0.05	U		0.05	U		0.05	U		0.05	U	
DIBENZO(A,H)ANTHRACENE	0.025	U		0.025	U		0.025	U		0.025	U	
FLUORANTHENE	0.1	U		0.1	U		0.1	U		0.1	U	
FLUORENE	0.1	U		0.1	U		0.1	U		0.1	U	
INDENO(1,2,3-CD)PYRENE	0.05	U		0.05	U		0.05	U		0.05	U	
NAPHTHALENE	0.5	U		0.5	U		0.5	U		0.5	U	
PHENANTHRENE	0.05	U		0.05	U		0.05	U		0.05	U	
PYRENE	0.05	U		0.05	U		0.05	U		0.05	U	

CTO252 - NAWC WARMINSTER
WATER DATA
CEIMIC CORPORATION
SDG: 990830

SAMPLE NUMBER:	SW-11-01Q	SW-12-01Q	SW-13-01Q	
SAMPLE DATE:	09/14/99	09/15/99	09/15/99	/ /
LABORATORY ID:	990830-01	990830-19	990830-17	
QC_TYPE:	NORMAL	NORMAL	NORMAL	
% SOLIDS:	0.0 %	0.0 %	0.0 %	100.0 %
UNITS:	UG/L	UG/L	UG/L	
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
ACENAPHTHENE	0.5	U		0.5	U		0.5	U				
ACENAPHTHYLENE	1	U		1	U		1	U				
ANTHRACENE	0.05	U		0.05	U		0.05	U				
BENZO(A)ANTHRACENE	0.05	U		0.05	U		0.05	U				
BENZO(A)PYRENE	0.05	U		0.05	U		0.05	U				
BENZO(B)FLUORANTHENE	0.1	U		0.1	U		0.1	U				
BENZO(G,H,I)PERYLENE	0.1	U		0.1	U		0.1	U				
BENZO(K)FLUORANTHENE	0.05	U		0.05	U		0.05	U				
CHRYSENE	0.05	U		0.05	U		0.05	U				
DIBENZO(A,H)ANTHRACENE	0.025	U		0.025	U		0.025	U				
FLUORANTHENE	0.1	U		0.1	U		0.1	U				
FLUORENE	0.1	U		0.1	U		0.1	U				
INDENO(1,2,3-CD)PYRENE	0.05	U		0.05	U		0.05	U				
NAPHTHALENE	0.5	U		0.5	U		0.5	U				
PHENANTHRENE	0.05	U		0.05	U		0.05	U				
PYRENE	0.05	U		0.05	U		0.05	U				

VALLEY
FORGE
LABORATORIES, INC.

Engineering Consultants Since 1967

SOIL LABORATORY TEST REPORT 9-6

Project No. 99183
October 7, 1999

Geotechnical Engineering

Attention: Mr. Garth Glenn
TetraTech NUS
600 Clark Avenue, Suite 3
King of Prussia, PA 19406-1433

Construction Quality Control

Re: CLEAN Contract N62472-90-D-1298, CTO No. 0252
Naval Air Warfare Center (NAWC)
Warminster, PA

Samples Received: On 9/20/99 - 14 jar samples, designated SD-01-01Q to SD-13-01Q.

Laboratory Testing

Testing Completed: (See attached Work Order)

Test	Standard
Particle-Size Analysis (Sieve and Hydrometer)	D422

NDT and Related Services

Results:

The results of the particle-size analysis are graphically depicted on the attached gradation curves. Also enclosed is the hard copy date package. If you have any questions about this report, please call.

Research and Special Studies

Sincerely,

Jeffrey W. Rosengarten
Geotechnical Engineer

Environmental Engineering

JWR:lcw

Transportation and Traffic Engineering

Fax (610) 688-8143 • 6 Berkeley Road, Devon, PA 19333-1397 • (610) 688-8517

www.valleyforgelabs.com • engineers@valleyforgelabs.com

CHAIN OF CUSTODY RECORD

PROJECT NO.: 6883 LTO 253

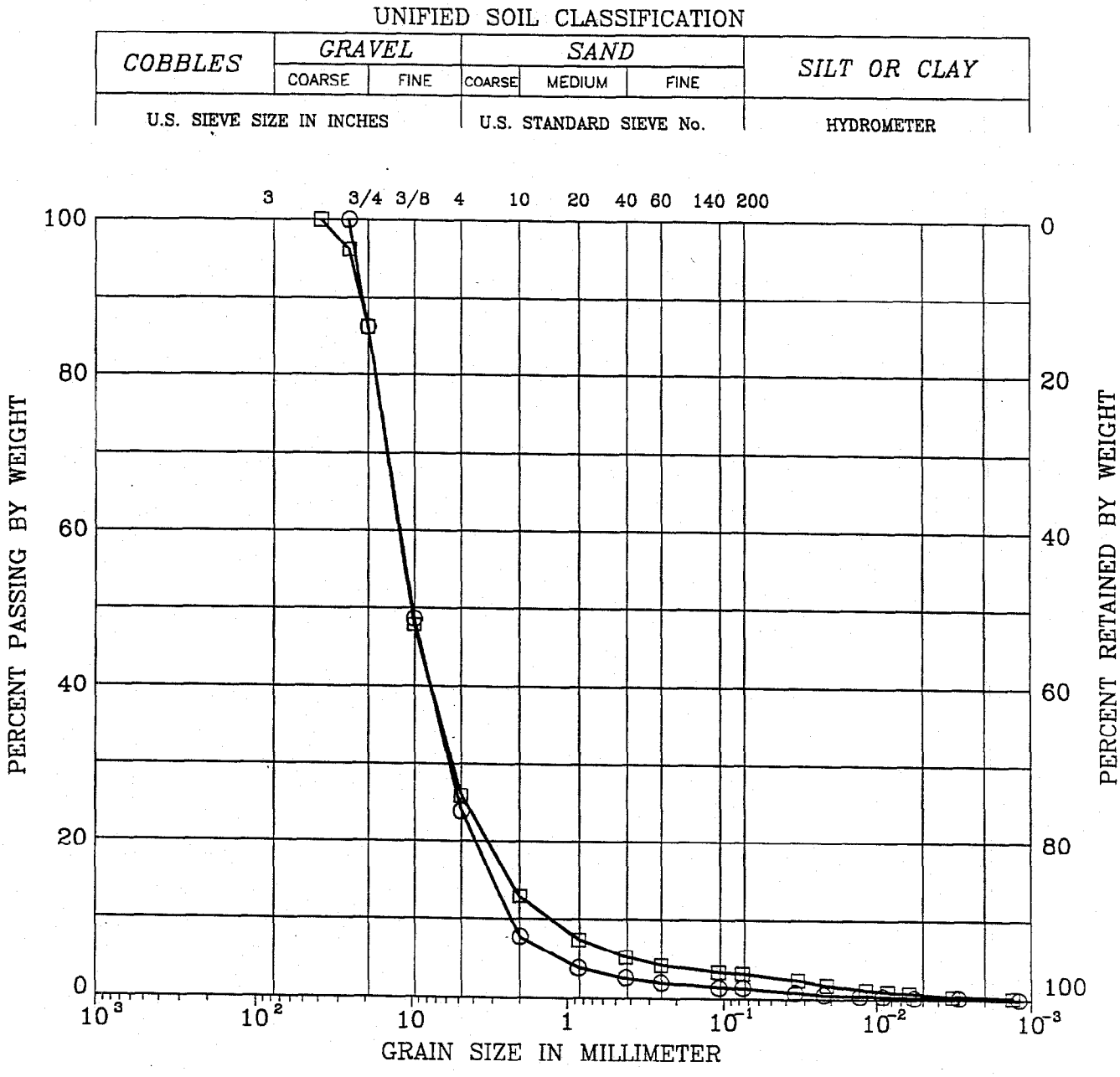
SITE NAME: NAWC Warminster

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	16 OZ clear glass Lexan size						REMARKS
	9/14/99	1240		✓	SD-11-01Q	1	1						
	9/14/99	1413		✓	SD-09-01Q	1	1						
	9/14/99	1429		✓	SD-08-01Q	1	1						
	9/14/99	1540		✓	SD-06-01Q	1	1						
	9/14/99	1625		✓	SD-05-01Q	1	1						
	9/14/99	1710		✓	SD-03-01Q	1	1						
	9/15/99	0930		✓	SD-13-01Q	1	1						
	9/15/99	1005		✓	SD-12-01Q	1	1						
	9/15/99	1050		✓	SD-10-01Q	1	1						
	9/15/99	1115		✓	SD-07-01Q	1	1						
	9/15/99	1400		✓	SD-04-01Q	1	1						
	9/15/99	1430		✓	SD-02-01Q	1	1						
	9/15/99	1453		✓	SD-01-01Q	2	2						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[signature]	9/17/99 2000				
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: Shipped Via Federal Express Airbill No 810817871954	

Order No. 70440 (0693)



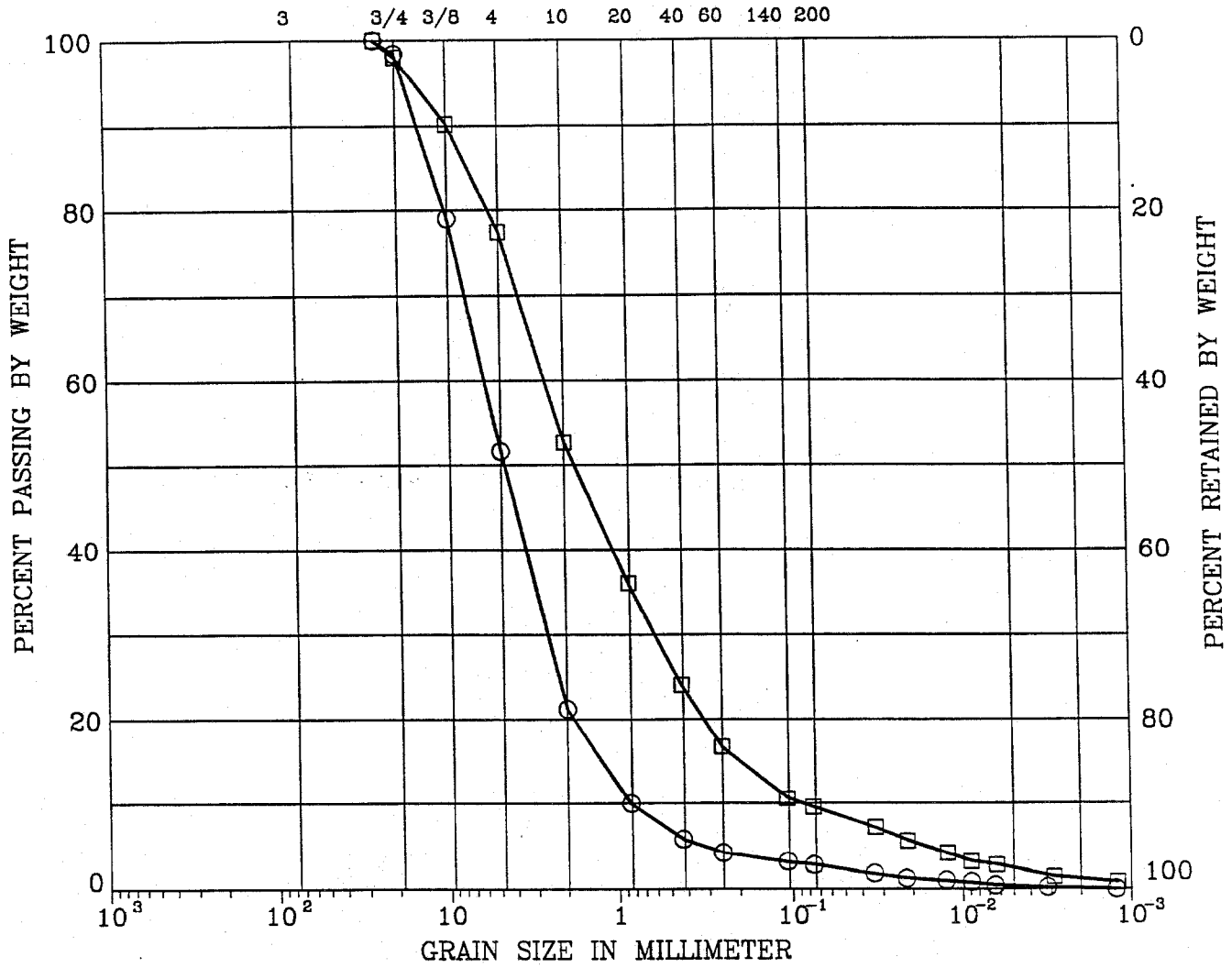
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD01-01Q				Well-Graded Gravel w/ Sand (GW, visual)
□	SD01-01Q				Well-Graded Gravel w/ Sand (GW, visual)

Remark :

Project No. 99183	NAWC Warminster, PA
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/1/99

UNIFIED SOIL CLASSIFICATION

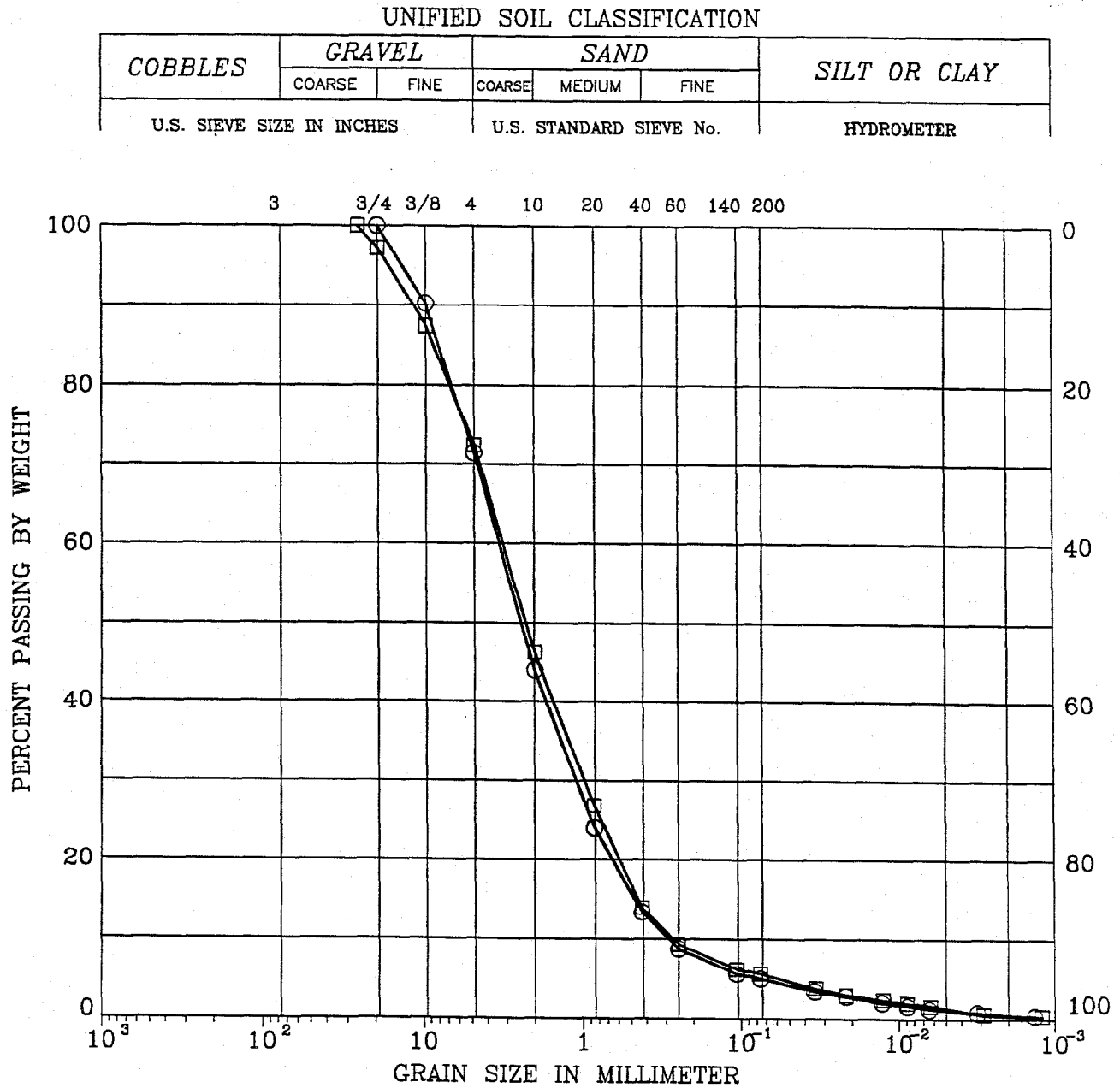
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD02-01Q				Well-Graded Sand w/ Gravel (SW, visual)
□	SD03-01Q				Well-Graded Sand w/ Silt & Gravel (SW-SM, visual)

Remark :

Project No. 99183	NAWC Warminster, PA
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/1/99



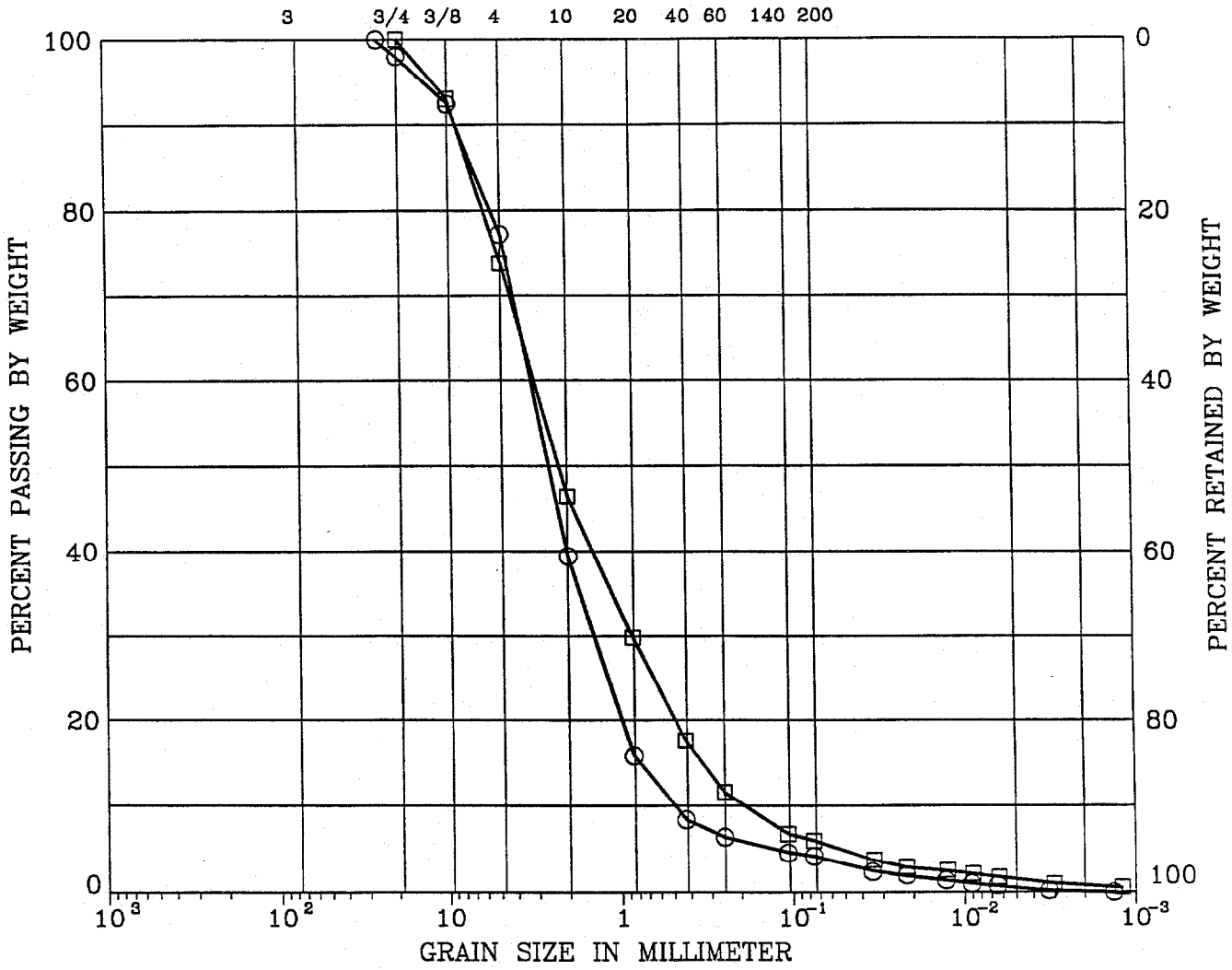
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD04-01Q				Well-Graded Sand w/ Gravel (SW, visual)
□	SD05-01Q				Well-Graded Sand w/ Silt & Gravel (SW-SM, visual)

Remark :

Project No. 99183	NAWC Warminster
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/6/99

UNIFIED SOIL CLASSIFICATION

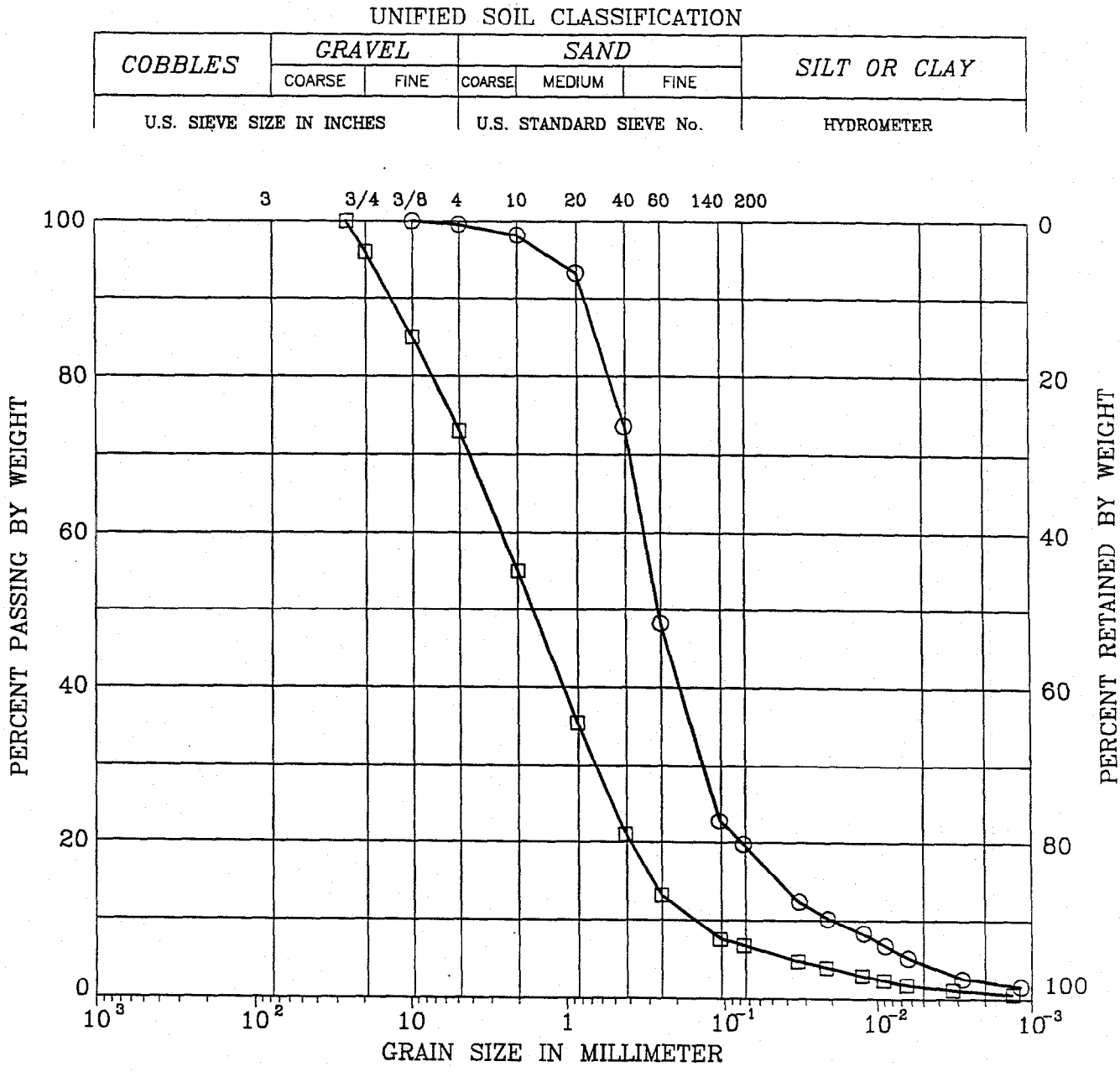
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD06-01Q				Well-Graded Sand w/ Gravel (SW, visual)
□	SD07-01Q				Well-Graded Sand w/ Silt & Gravel (SW, visual)

Remark :

Project No. 99183	NAWC Warminster
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/6/99



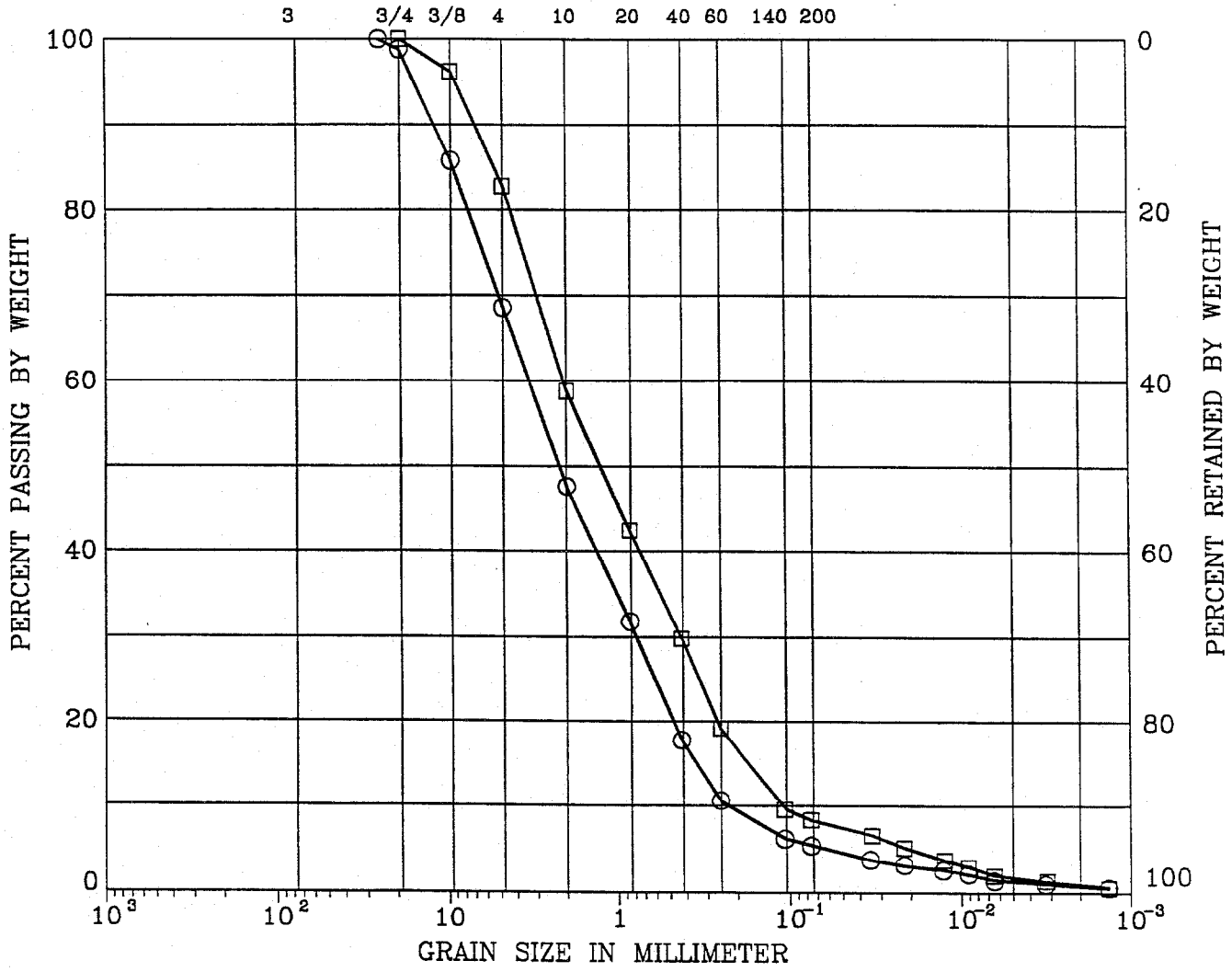
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD08-01Q				Silty Sand (SM, visual)
□	SD09-01Q				Well-Graded Sand w/ Silt & Gravel (SW-SM, visual)

Remark :

Project No. 99183	NAWC Warminster
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/6/99

UNIFIED SOIL CLASSIFICATION

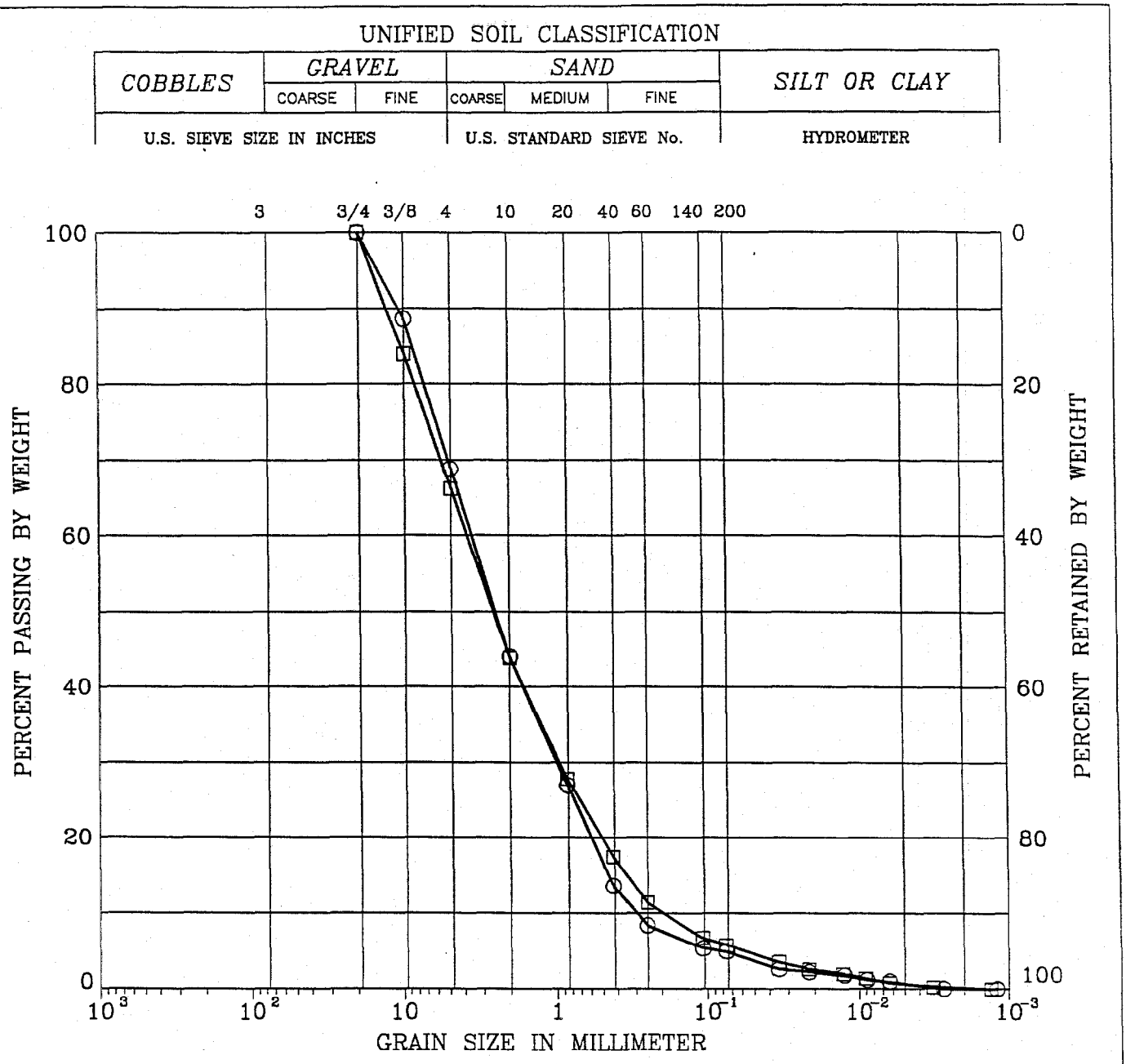
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD10-01Q				Poorly-Graded Sand w/ Silt & Gravel (SP-SM, vis.)
□	SD11-01Q				Poorly-Graded Sand w/ Silt & Gravel (SP-SM, vis.)

Remark :

Project No. 99183	NAWC Warminster
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/6/99



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	SD12-01Q				Poorly-Graded Sand w/ Gravel (SP, visual)
□	SD13-01Q				Well-Graded Sand w/ Silt & Gravel (SW-SM, visual)

Remark :

Project No. 99183	NAWC Warminster
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 10/6/99

GEOSOFT [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1	Boring SD01-01Q		Depth (ft)	
Specific Gravity of Soil		2.70	Temperature (Centigrade)	Composite Correction
Weight of Airdry Soil	(g)	37.75		
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035
Weight of Tare	(g)	0.00	29.0	1.0020

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.1	1.0055	0.0347	0.9
5.0	25.1	1.0045	0.0222	0.5
15.0	25.1	1.0042	0.0128	0.4
30.0	25.4	1.0040	0.0091	0.4
75.0	25.4	1.0035	0.0058	0.2
276.0	26.6	1.0032	0.0030	0.2
1790.0	23.5	1.0032	0.0012	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd1

GEOSOFT [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD01-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 570.100

Total Weight of Dry Soil For Fine Sieve 37.750

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	18.810	3.9
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	25.330	2.5
3/4 (inch)	78.150	86.3	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	292.830	48.6	# 60 (0.250mm)	28.140	2.0
# 4(4.75 mm)	434.080	23.9	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	30.560	1.5
#10(2.00 mm)	526.110	7.7	# 200(0.075mm)	31.300	1.3

Press [ESC] to continue ... a:sd1

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 2	Boring SD01-01Q	Depth (ft)		
Specific Gravity of Soil	2.70	Temperature (Centigrade)	Composite Correction	
Weight of Airdry Soil (g)	68.28			
Wet Weight of Soil + Tare (g)	0.00	17.3	1.0045	
Dry Weight of Soil + Tare (g)	0.00	22.0	1.0035	
Weight of Tare (g)	0.00	29.0	1.0020	

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	23.9	1.0110	0.0335	2.4
5.0	23.9	1.0090	0.0216	1.8
17.5	23.9	1.0070	0.0118	1.2
33.0	23.9	1.0065	0.0086	1.0
65.0	23.9	1.0057	0.0062	0.8
240.0	23.9	1.0047	0.0032	0.5
1484.0	24.2	1.0040	0.0013	0.3
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd1

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD01-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 622.230

Total Weight of Dry Soil For Fine Sieve 68.280

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	28.850	7.5
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	23.470	96.2	# 40 (0.425mm)	40.560	5.2
3/4 (inch)	85.470	86.3	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	325.110	47.8	# 60 (0.250mm)	45.840	4.2
# 4(4.75 mm)	461.220	25.9	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	50.160	3.4
#10(2.00 mm)	541.900	12.9	# 200(0.075mm)	51.490	3.2

Press [ESC] to continue ... a:sd1

GEOSOFT [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1	Boring SD02-01Q		Depth (ft)	
Specific Gravity of Soil		2.70	Temperature (Centigrade)	Composite Correction
Weight of Airdry Soil	(g)	99.44		
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035
Weight of Tare	(g)	0.00	29.0	1.0020

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.0	1.0080	0.0340	1.7
5.0	25.0	1.0065	0.0218	1.2
15.0	25.1	1.0055	0.0127	0.9
30.0	25.3	1.0050	0.0090	0.7
60.0	25.4	1.0042	0.0064	0.5
240.0	26.4	1.0031	0.0032	0.2
1771.0	23.5	1.0030	0.0012	-0.1
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd2

GEOSOFT [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD02-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 647.460
Total Weight of Dry Soil For Fine Sieve 99.440
Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	52.720	10.0
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	72.250	5.8
3/4 (inch)	10.520	98.4	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	135.990	79.0	# 60 (0.250mm)	79.650	4.2
# 4(4.75 mm)	313.680	51.6	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	84.750	3.1
#10(2.00 mm)	509.870	21.3	# 200(0.075mm)	85.950	2.9

Press [ESC] to continue ... a:sd2

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 2	Boring SD03-01Q	Depth (ft)		
Specific Gravity of Soil	2.70	Temperature	Composite	
Weight of Airdry Soil (g)	96.22	(Centigrade)	Correction	
Wet Weight of Soil + Tare (g)	0.00	17.3	1.0045	
Dry Weight of Soil + Tare (g)	0.00	22.0	1.0035	
Weight of Tare (g)	0.00	29.0	1.0020	

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.3	1.0110	0.0329	7.1
5.0	25.3	1.0093	0.0212	5.7
15.0	25.3	1.0076	0.0124	4.2
30.0	25.4	1.0065	0.0089	3.2
60.0	25.6	1.0060	0.0063	2.8
286.0	26.7	1.0042	0.0029	1.5
1799.0	23.8	1.0040	0.0012	0.8
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd2

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD03-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 440.960

Total Weight of Dry Soil For Fine Sieve 96.220

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	30.590	35.9
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	52.540	23.9
3/4 (inch)	8.980	98.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	43.010	90.2	# 60 (0.250mm)	65.580	16.8
# 4(4.75 mm)	99.820	77.4	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	76.780	10.6
#10(2.00 mm)	208.800	52.6	# 200(0.075mm)	78.720	9.6

Press [ESC] to continue ... a:sd2

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1	Boring SD04-01Q		Depth (ft)	
Specific Gravity of Soil		2.70	Temperature	Composite
Weight of Airdry Soil	(g)	98.63	(Centigrade)	Correction
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035
Weight of Tare	(g)	0.00	29.0	1.0020

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	23.5	1.0080	0.0346	3.4
5.0	23.5	1.0071	0.0221	2.8
15.0	23.6	1.0060	0.0129	2.0
31.0	23.6	1.0055	0.0090	1.7
61.0	23.7	1.0049	0.0064	1.2
250.0	23.8	1.0042	0.0032	0.8
1440.0	23.6	1.0037	0.0013	0.4
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd4

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD04-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve	647.570
Total Weight of Dry Soil For Fine Sieve	98.630
Sieve No. For Coarse/Fine Sieve Split	10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	44.510	24.1
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	68.490	13.4
3/4 (inch)	0.000	0.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	63.970	90.1	# 60 (0.250mm)	78.870	8.8
# 4(4.75 mm)	185.780	71.3	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	86.010	5.6
#10(2.00 mm)	363.260	43.9	# 200(0.075mm)	87.390	5.0

Press [ESC] to continue ... a:sd4

GEOSOFT [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

			Temperature (Centigrade)	Composite Correction
Curve No. 2	Boring SD05-01Q		Depth (ft)	
Specific Gravity of Soil		2.70		
Weight of Airdry Soil	(g)	102.35		
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035
Weight of Tare	(g)	0.00	29.0	1.0020

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.3	1.0080	0.0339	3.7
5.0	25.3	1.0070	0.0216	3.0
15.0	25.3	1.0060	0.0126	2.3
30.0	25.4	1.0055	0.0089	2.0
60.0	25.7	1.0050	0.0063	1.6
296.0	26.8	1.0032	0.0029	0.5
1808.0	24.0	1.0035	0.0012	0.3
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd4

GEOSOFT [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD05-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 544.600

Total Weight of Dry Soil For Fine Sieve 102.350

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	42.940	26.8
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	71.400	14.0
3/4 (inch)	15.150	97.2	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	68.280	87.5	# 60 (0.250mm)	81.590	9.4
# 4(4.75 mm)	149.880	72.5	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	88.600	6.2
#10(2.00 mm)	292.850	46.2	# 200(0.075mm)	89.950	5.6

Press [ESC] to continue ... a:sd4

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1 Boring SD06-01Q Depth (ft)

		Temperature (Centigrade)	Composite Correction
Specific Gravity of Soil	2.70	17.3	1.0045
Weight of Airdry Soil (g)	100.89	22.0	1.0035
Wet Weight of Soil + Tare (g)	0.00	29.0	1.0020
Dry Weight of Soil + Tare (g)	0.00		
Weight of Tare (g)	0.00		

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	24.0	1.0071	0.0347	2.5
5.0	24.0	1.0062	0.0221	1.9
15.0	24.0	1.0053	0.0129	1.4
30.0	23.9	1.0048	0.0092	1.1
60.0	24.1	1.0042	0.0065	0.7
245.0	24.0	1.0034	0.0032	0.2
1440.0	23.5	1.0030	0.0013	-0.1
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd6

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD06-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 471.600
Total Weight of Dry Soil For Fine Sieve 100.890
Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	60.310	15.8
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	79.290	8.4
3/4 (inch)	9.700	97.9	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	35.480	92.5	# 60 (0.250mm)	84.530	6.4
# 4(4.75 mm)	107.620	77.2	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	88.920	4.7
#10(2.00 mm)	285.780	39.4	# 200(0.075mm)	90.070	4.2

Press [ESC] to continue ... a:sd6

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 2	Boring	SD07-01Q	Depth (ft)		
Specific Gravity of Soil		2.70	Temperature	Composite	
Weight of Airdry Soil	(g)	91.26	(Centigrade)	Correction	
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045	
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035	
Weight of Tare	(g)	0.00	29.0	1.0020	

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.0	1.0075	0.0342	3.8
5.0	25.0	1.0065	0.0218	2.9
15.0	25.0	1.0060	0.0126	2.5
30.0	25.1	1.0055	0.0090	2.2
60.0	25.3	1.0050	0.0064	1.8
266.0	26.4	1.0039	0.0030	1.1
1781.0	23.5	1.0038	0.0012	0.5
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd6

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD07-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 660.970

Total Weight of Dry Soil For Fine Sieve 91.260

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	32.630	29.9
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	56.820	17.5
3/4 (inch)	0.000	0.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	45.900	93.1	# 60 (0.250mm)	68.580	11.5
# 4(4.75 mm)	172.930	73.8	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	77.890	6.8
#10(2.00 mm)	353.860	46.5	# 200(0.075mm)	79.510	6.0

Press [ESC] to continue ... a:sd6

GEOSOFT [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1	Boring SD08-01Q	Depth (ft)		
Specific Gravity of Soil		2.70	Temperature (Centigrade)	Composite Correction
Weight of Airdry Soil	(g)	97.42		
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035
Weight of Tare	(g)	0.00	29.0	1.0020

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.3	1.0105	0.0331	12.3
5.0	25.3	1.0092	0.0212	10.2
15.0	25.3	1.0080	0.0124	8.3
30.0	25.4	1.0070	0.0088	6.8
60.0	25.7	1.0060	0.0063	5.3
302.0	27.0	1.0041	0.0028	2.7
1817.0	24.2	1.0040	0.0012	1.6
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ...
a:sd8

GEOSOFT [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD08-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 440.730
Total Weight of Dry Soil For Fine Sieve 97.420
Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	4.740	93.4
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	24.310	73.6
3/4 (inch)	0.000	0.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	0.000	0.0	# 60 (0.250mm)	49.640	48.1
# 4(4.75 mm)	1.860	99.6	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	74.790	22.8
#10(2.00 mm)	8.220	98.1	# 200(0.075mm)	77.850	19.7

Press [ESC] to continue ... a:sd8

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 2	Boring SD09-01Q	Depth (ft)		
Specific Gravity of Soil	2.70	Temperature	Composite	
Weight of Airdry Soil (g)	106.61	(Centigrade)	Correction	
Wet Weight of Soil + Tare (g)	0.00	17.3	1.0045	
Dry Weight of Soil + Tare (g)	0.00	22.0	1.0035	
Weight of Tare (g)	0.00	29.0	1.0020	

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	24.0	1.0090	0.0341	4.9
5.0	24.0	1.0080	0.0218	4.0
15.0	24.0	1.0067	0.0127	3.0
30.0	24.0	1.0060	0.0090	2.4
60.0	24.0	1.0053	0.0064	1.8
240.0	24.3	1.0045	0.0032	1.2
1441.0	24.0	1.0038	0.0013	0.6
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd8

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD09-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 561.810

Total Weight of Dry Soil For Fine Sieve 106.610

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	37.820	35.5
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	65.740	21.1
3/4 (inch)	22.750	96.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	84.770	84.9	# 60 (0.250mm)	81.040	13.2
# 4(4.75 mm)	152.120	72.9	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	91.770	7.7
#10(2.00 mm)	253.020	55.0	# 200(0.075mm)	93.400	6.8

Press [ESC] to continue ... a:sd8

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1 Boring SD10-01Q Depth (ft)

Specific Gravity of Soil	2.70	Temperature (Centigrade)	Composite Correction
Weight of Airdry Soil (g)	97.65		
Wet Weight of Soil + Tare (g)	0.00	17.3	1.0045
Dry Weight of Soil + Tare (g)	0.00	22.0	1.0035
Weight of Tare (g)	0.00	29.0	1.0020

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	24.0	1.0080	0.0344	3.8
5.0	24.0	1.0071	0.0219	3.1
15.0	24.0	1.0065	0.0127	2.7
30.0	24.0	1.0058	0.0091	2.1
60.0	24.0	1.0050	0.0065	1.5
247.0	23.8	1.0045	0.0032	1.1
1440.0	23.5	1.0039	0.0013	0.6
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd10

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD10-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 655.150

Total Weight of Dry Soil For Fine Sieve 97.650

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	32.540	31.8
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	61.250	17.8
3/4 (inch)	8.220	98.7	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	93.350	85.8	# 60 (0.250mm)	76.020	10.6
# 4(4.75 mm)	206.020	68.6	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	84.820	6.3
#10(2.00 mm)	343.000	47.6	# 200(0.075mm)	86.430	5.5

Press [ESC] to continue ... a:sd10

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 2	Boring SD11-01Q	Depth (ft)		
Specific Gravity of Soil	2.70	Temperature	Composite	
Weight of Airdry Soil (g)	98.00	(Centigrade)	Correction	
Wet Weight of Soil + Tare (g)	0.00	17.3	1.0045	
Dry Weight of Soil + Tare (g)	0.00	22.0	1.0035	
Weight of Tare (g)	0.00	29.0	1.0020	

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	24.1	1.0100	0.0337	6.6
5.0	24.1	1.0085	0.0216	5.2
15.0	24.1	1.0070	0.0127	3.8
30.0	24.1	1.0062	0.0090	3.0
60.0	24.2	1.0052	0.0064	2.1
257.0	23.8	1.0045	0.0031	1.3
1440.0	23.5	1.0039	0.0013	0.7
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ...
a:sd10

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD11-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 602.420
Total Weight of Dry Soil For Fine Sieve 98.000
Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	27.500	42.3
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	48.280	29.9
3/4 (inch)	0.000	0.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	22.930	96.2	# 60 (0.250mm)	66.110	19.1
# 4(4.75 mm)	103.580	82.8	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	81.880	9.7
#10(2.00 mm)	247.970	58.8	# 200(0.075mm)	84.100	8.3

Press [ESC] to continue ... a:sd10

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 1	Boring	SD12-01Q	Depth (ft)		
Specific Gravity of Soil		2.70	Temperature	Composite	
Weight of Airdry Soil	(g)	100.23	(Centigrade)	Correction	
Wet Weight of Soil + Tare	(g)	0.00	17.3	1.0045	
Dry Weight of Soil + Tare	(g)	0.00	22.0	1.0035	
Weight of Tare	(g)	0.00	29.0	1.0020	

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	25.3	1.0065	0.0344	2.6
5.0	25.3	1.0060	0.0218	2.2
15.0	25.5	1.0052	0.0127	1.7
30.0	25.7	1.0044	0.0090	1.2
60.0	26.0	1.0040	0.0064	0.9
312.0	27.7	1.0023	0.0028	0.0
1826.0	24.4	1.0022	0.0012	-0.5
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd12

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 1 Boring SD12-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 639.860

Total Weight of Dry Soil For Fine Sieve 100.230

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	38.580	27.0
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	69.340	13.5
3/4 (inch)	0.000	0.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	72.350	88.7	# 60 (0.250mm)	81.030	8.4
# 4(4.75 mm)	199.110	68.9	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	87.760	5.5
#10(2.00 mm)	358.850	43.9	# 200(0.075mm)	88.920	5.0

Press [ESC] to continue ... a:sd12

G E O S O F T [R/GRAIN] HYDROMETER ANALYSIS (ASTM 151-H) OUTPUT SCREEN

Curve No. 2 Boring SD13-01Q 3 Depth (ft)

Specific Gravity of Soil		2.70	Temperature (Centigrade)	Composite Correction
Weight of Airdry Soil	(g)	97.44	17.3	1.0045
Wet Weight of Soil + Tare	(g)	0.00	22.0	1.0035
Dry Weight of Soil + Tare	(g)	0.00	29.0	1.0020
Weight of Tare	(g)	0.00		

Time (min)	Temp. (Cent.)	Reading	Grain Size (mm)	% Passing By Wt.
2.0	23.9	1.0080	0.0344	3.5
5.0	23.9	1.0068	0.0220	2.6
15.0	23.9	1.0060	0.0128	2.1
30.0	23.9	1.0050	0.0091	1.4
63.0	23.9	1.0042	0.0064	0.8
247.0	23.9	1.0035	0.0032	0.3
1494.0	24.2	1.0027	0.0013	-0.2
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0
0.0	0.0	0.0000	0.0000	0.0

Press [ESC] to continue ... a:sd12

G E O S O F T [R/GRAIN] SIEVE ANALYSIS (ASTM D-422-63) OUTPUT SCREEN

Curve No. 2 Boring SD13-01Q Depth (ft)

Total Weight of Dry Soil For Coarse Sieve 599.820

Total Weight of Dry Soil For Fine Sieve 97.440

Sieve No. For Coarse/Fine Sieve Split 10

U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.	U.S. Sieve Size/No.	Cumul. Wt. Retained (gm)	% Passing By Wt.
3.0 (inch)	0.000	0.0	# 16 (1.18 mm)	0.000	0.0
2.0 (inch)	0.000	0.0	# 20 (0.85 mm)	35.580	27.8
1.5 (inch)	0.000	0.0	# 30 (0.60 mm)	0.000	0.0
1.0 (inch)	0.000	0.0	# 40 (0.425mm)	58.690	17.4
3/4 (inch)	0.000	0.0	# 50 (0.300mm)	0.000	0.0
3/8 (inch)	95.400	84.1	# 60 (0.250mm)	72.150	11.4
# 4(4.75 mm)	202.720	66.2	# 100(0.150mm)	0.000	0.0
# 8(2.38 mm)	0.000	0.0	# 140(0.106mm)	82.480	6.7
#10(2.00 mm)	337.100	43.8	# 200(0.075mm)	84.420	5.9

Press [ESC] to continue ... a:sd12