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FREE PHASE PRODUCT ASSESSMENT REPORT SITE 6 NCBC GULFPORT MS
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ABB

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FREE-PHASE PRODUCT ASSESSMENT REPORT

SITE 6, FIRE FIGHTING TRAINING AREA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

Unit Identification No. N62604

Contract Task Order No. 096

Contract No. N62467-89-D-0317

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July 1994

FOREWORD

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA); the 1976 Resource Conservation and Recovery Act (RCRA), as augmented by the 1984 Hazardous and Solid Waste Amendments (HSWA); and as directed in Executive Order 12580 of January 1987, the Department of Defense (DOD) conducts an Installation Restoration (IR) program for evaluating and remediating problems related to releases and disposal of toxic and hazardous materials at DOD facilities.

The Naval Assessment and Control of Installation Pollutants (NACIP) program was developed by the Navy to implement the IR program for all naval and Marine Corps facilities. The NACIP program was originally conducted in three phases: (1) Phase I, Initial Assessment Study, (2) Phase II, Confirmation Study (including a Verification Step and a Characterization Step), and (3) Phase III, Planning and Implementation of Remedial Measures. This three-phase IR program was modified and updated in 1992 to be congruent with the CERCLA, SARA, RCRA, and HSWA driven DOD IR program and is called the Navy IR program.

The updated nomenclature for the Navy IR program process is:

- Preliminary Assessment and Site Inspection
- Remedial Investigation
- Feasibility Study
- planning and implementation of remedial design and remedial action

This report discusses the findings and results of the Free-Phase Product Assessment at Site 6, the former Fire-fighting Training Area. Investigations at this site are being implemented under the Navy IR program in response to possible releases of hazardous substances into the soil and groundwater. This assessment report includes: delineation of the free-phase product; characterization of the groundwater, subsurface soils, and aquifer; and an evaluation of remediation technologies.

Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), has the responsibility for implementation of the Navy and Marine Corps IR program in the southeastern and midwestern United States. Questions regarding this report should be addressed to the SOUTHNAVFACENGCOM Remedial Project Manager, Mr. Marshall Knight at (803) 743-0515.

EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES), under contract to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), has prepared this Free-Phase Product Assessment (F-PPA) report for Site 6, Fire-fighting Training Area, located at Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. This F-PPA report was prepared under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) Contract No. N62467-89-D-0317 as Contract Task Order No. 096.

Site 6 is an uncontrolled hazardous waste site with the Mississippi Department of Environmental Quality overseeing the interim measure activities.

The horizontal and vertical extent of the free-phase product was delineated during the Hydropunch™ II field investigation. While delineating the extent of the free-phase product, a second plume was discovered north of the original plume. This second plume likely is the result of the northern fire-fighting training pit. The two plumes commingle and together extend nearly 170 feet north to south and 110 feet east to west. The commingled plumes, henceforth referred to as the plume, have migrated approximately 75 feet west of the fire-fighting training pits. Product thicknesses varied from a trace near the edge of the plume to maximums of 1 foot in the northern part of the plume and 2.5 feet in the southern part of the plume. A fingerprint analysis of the free-phase product indicated diesel and heavier fuel oils. Dissolved-phase contamination was discovered in groundwater and soil samples collected between Building 383, Building 391, and Colby Avenue. This contamination did not extend to the clay layer, which is 35 to 47 feet below land surface (bls) in this area.

Groundwater flow is generally westward at Site 6 except along the western edge where the gradient is reversed, probably as a result of groundwater mounding near the ditch. This reversal of groundwater flow near the ditch may explain why further westward migration of the plume has not occurred.

Aquifer properties were calculated from slug testing and a pumping test. Results of these tests indicated hydraulic conductivities on the order of 10^{-3} centimeters per second (cm/sec) down to 12 to 15 bls and 10^{-2} cm/sec to the clay layer, and transmissivity values of approximately 1,000 cubic feet per day. Storativity (specific yield in an unconfined aquifer) values obtained were not acceptable due to the short duration of the pumping test. The capture zone produced during the pumping test was not large enough to adequately remediate the free-phase product plume. The current data indicate additional recovery wells, piezometers, or recovery trenches may be necessary to remediate the plume. These options are evaluated in Chapter 5.0. The recovery trench was determined to be the best option based on the modeling used to screen three applicable technologies.

A wide range of volatile organic compounds were detected in the soil and groundwater including benzene (71 micrograms per liter [$\mu g/\ell$] maximum), toluene (43 $\mu g/\ell$ maximum), and xylene (190 $\mu g/\ell$ maximum) in the groundwater. Semivolatile organic compounds were detected as well, such as 2-methylnaphthalene (770 $\mu g/\ell$ maximum) in the groundwater. Inorganics were detected in both soil and groundwater with highest concentrations of aluminum, iron, and lead. Herbicides were not detected in any groundwater samples and only the duplicate sample of

well GPT-6-4 detected any pesticides (0.14 $\mu g/\ell$ of alpha-chlordane). Trace amounts of octachlorodibenzodioxin were found in groundwater samples from GPT-6-4 and GPT-6-6. The highest detection was well below maximum contamination levels for this compound.

The recommended interim removal action for the free-phase product combines product recovery with groundwater treatment for organic compounds. An oil-water separator will separate the product and groundwater. The product will be transferred to a tank for recycling. A diffused aerator will remove the volatile organic compounds from the groundwater before the groundwater is discharged to the Harrison County Publicly Owned Treatment Works.

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GLOSSARY

1,2,3,7,8-PCDD	1,2,3,7,8-pentachlorodibenzo-*p*-dioxin
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-*p*-dioxin
2,4-D	2,4-dichlorophenoxyacetic acid
4,4'-DDD	4,4'-dichlorodiphenyldichloroethane
4,4'-DDE	4,4'-dichlorodiphenyldichloroethylene
4,4'-DDT	4,4'-dichlorodiphenyltrichloroethane
2,4-DP	dichlorprop
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	silvex
$\Delta(h_o\text{-}h)$	drawdown per log cycle of time (feet)
ABB-ES	ABB Environmental Services, Inc.
ARAR	Applicable and Relevant or Appropriate Requirement
B	blank contamination
BHC	benzene hexachloride
bls	below land surface
BOD_5	biological oxygen demand (5-day)
BOW	bottom of well
BTEX	benzene, toluene, ethylbenzene, and xylene
$CaCO_3$	calcium carbonate
CL	clay
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action, Navy
CLP	Contract Laboratory Program
CLP-RAS	Contract Laboratory Program - Routine Analytical Services
cm/sec	centimeters per second
COD	chemical oxygen demand
CRDL	contract required detection limit
CRQL	Contract Required Quantitation Limit
D	duplicate samples
DB	distilled water blank
DI	distilled or deionized water field blank
DNAPL	dense nonaqueous phase liquid
DOD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
ER	equipment rinsate blank
ETP	engineering treatability parameter
F-PPA	Free-Phase Product Assessment
FID	flame ionization detector
ft	feet
ft/ft	feet per foot
ft/min	feet per minute
ft^2/day	square feet per day

ft^3/day	cubic feet per day
GC	gas chromatograph
GC/MS	gas chromatograph and mass spectroscopy
GE	ground elevation
gpm	gallons per minute
GPT	Gulfport
GW	groundwater sample
G6	the third and fourth characters of a sampling event indicating "Gulfport NCBC Site 6 site"
HLA	Harding Lawson Associates
HSWA	Hazardous and Solid Waste Amendment
I.D.	identification
ID	inside diameter
IDW	investigation-derived waste
IR	Installation Restoration
J	estimated value
K	hydraulic conductivity value
LNAPL	light nonaqueous phase liquid
µg/kg	micrograms per kilogram
µg/ℓ	micrograms per liter
MCL	maximum contamination level
meq/100g	milliequivalent per 100 grams
mg/kg	milligrams per kilogram
mg/ℓ	milligrams per liter
MPC	maximum possible concentration
MS	mass spectroscopy
MS/MSD	matrix spike and matrix spike duplicate
MSDEQ	Mississippi Department of Environmental Quality
msl	mean sea level
NA	not analyzed
NACIP	Naval Assessment and Control of Installation Pollutants
NCBC	Naval Construction Battalion Center
NCED	Naval Construction Equipment Depot
NCF	Naval Construction Force
NCR	Naval Construction Regiment
ND	not detected
NEESA	Naval Energy and Environmental Support Activity
NMCB	Naval Mobile Construction Battalion
NPDES	National Pollution Discharge Elimination System
NR	no response
NS	not sampled
OCDD	octachlorodibenzodioxin

OD	outside diameter
PA	product areal extent
PAH	polynuclear aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, completeness, and comparability
PB	potable water blank
PCB	polychlorinated biphenyl
PCDD/PCDF	polychlorinated dibenzo-*p*-dioxin and dibenzofuran
PEST/PCB	pesticides and polychlorinated biphenyls
pg/ℓ	picograms per liter (parts per quadrillion)
pg/g	picograms per gram
PI	potable water field blank
POTW	Publicly Owned Treatment Works
PPE	personal protective equipment
ppm	parts per million
PQL	practical quantitation limits
PT	product thickness
PV	product volume
PVC	polyvinyl chloride
Q	flow rate
QA	quality assurance
QA/QC	quality assurance and quality control
QAL	Quality Analytical Laboratories, Inc.
QC	quality control
r	radial distance to the pumping well
r_o	distance at 0 drawdown
R	rejected
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act (RCRA) Facility Investigation
s	storativity
SARA	Superfund Amendments and Reauthorization Act
SB	subsurface soil boring field blank
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SOW	Statement of Work
SP	sand
SS	suspended solids
SVOA	semivolatile organic analysis
SVOC	semivolatile organic compound
T	transmissivity
t_o	time at 0 drawdown
TAL	target analyte list
TAL-CLP	target analyte list - USEPA Contract Laboratory Program
TBS	to be sampled
TCDD	tetrachlorodibenzodioxin
TCL	target compound list

TCL-CLP	target compound list - USEPA Contract Laboratory Program
TDS	total dissolved solids
TE	Toxicity Equivalency
TEF	Toxicity Equivalency Factor
TKN	total kjeldahl nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSS	total suspended solids
u	well function value
U	undetected
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UV	ultraviolet
UV/oxidation	Ultraviolet light and oxidation
VOA	volatile organic analysis
VOC	volatile organic compound
X	sample collected
XF	full suite of analyses
XL	only VOAs, SVOAs, TPH, and TOC
XO	only VOAs, SVOAs, and TPH
XP	only VOAs
XT	only TOC

CHAPTER 1.0

1.0 INTRODUCTION

ABB Environmental Services, Inc., (ABB-ES) was contracted by Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), to conduct a Free-Phase Product Assessment (F-PPA) report for Site 6, Fire-fighting Training Area, located at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. This F-PPA report was prepared under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) Contract No. N62467-89-D-0317 as Contract Task Order No. 096.

Site 6 is an uncontrolled hazardous waste site with the Mississippi Department of Environmental Quality (MSDEQ) overseeing the activities.

The F-PPA involved characterization of the free-phase product to determine the horizontal and vertical extent of free-phase product. This F-PPA report presents the findings of the field investigation, hydrogeologic conditions, and results of chemical and physical analyses.

1.1 PROJECT GOAL AND OBJECTIVE. The goal of this project is to recover free-phase product to the extent practical at Site 6. This goal will be achieved by completion of the following objectives:

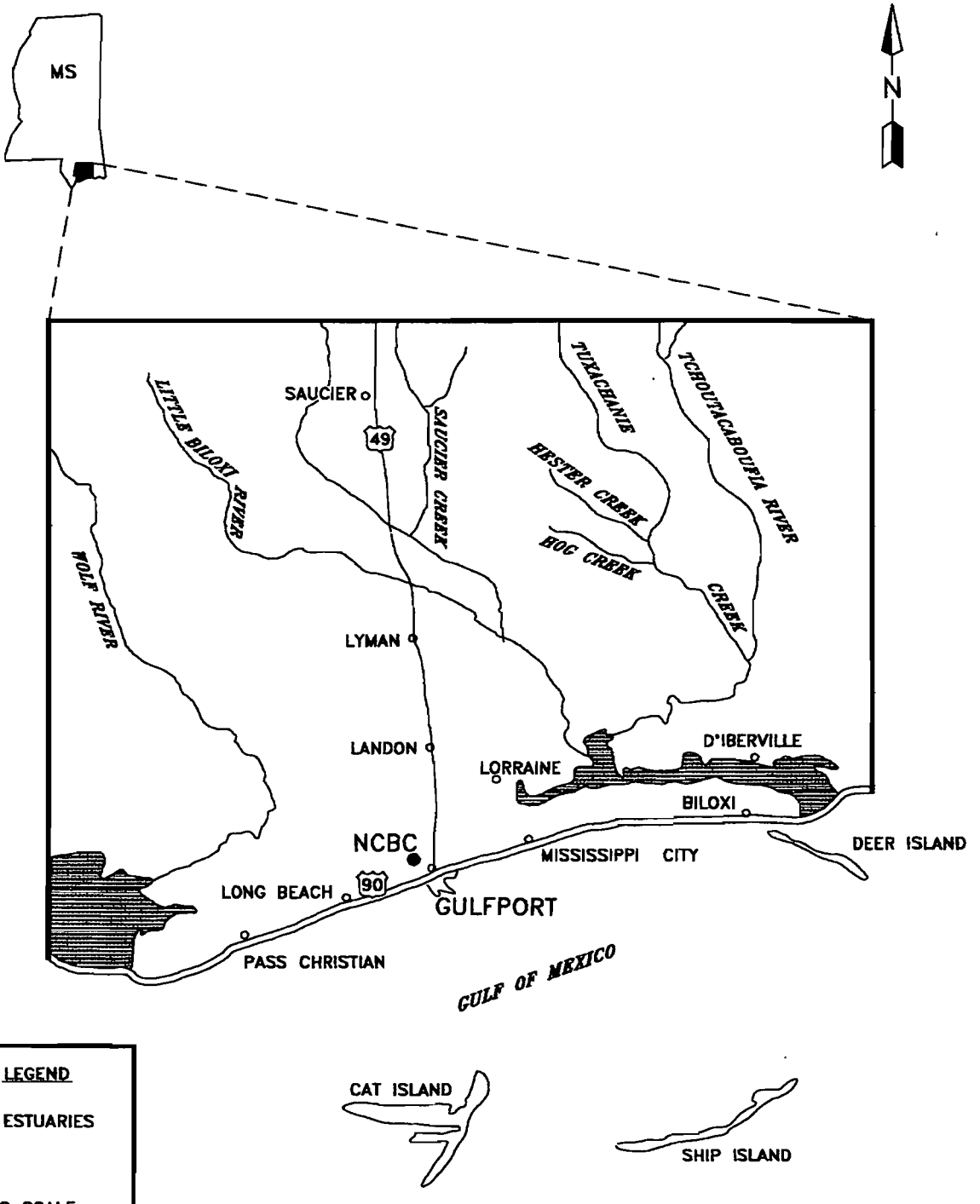
- characterize the extent of free-phase product in the water table aquifer,
- gather site-specific data to support technology and interim action assessment,
- prepare an interim action design, and
- construct and operate the interim action.

Additional investigations and actions may be required to address contamination of soil and groundwater. These media will be appropriately addressed in the future, if necessary.

This project is proceeding in two phases. Phase I addresses the F-PPA and technology selection. Phase II addresses the interim action design. The objective of the F-PPA (Phase I) is to delineate the vertical and horizontal extent of free-phase product, determine the source of contamination, characterize the contaminants, determine aquifer properties, and select the technology for the interim action design. The purpose of the Interim Action Design (Phase II) is to design for the removal of free-phase product.

1.2 FACILITY INFORMATION.

1.2.1 Location NCBC Gulfport is located in the City of Gulfport, in Harrison County, in the southeastern corner of the State of Mississippi (Figure 1-1). A U.S. Geological Survey (USGS) topographic map of the NCBC vicinity is provided in Figure 1-2. NCBC Gulfport occupies 1,100 acres in the western part of Gulfport, immediately south of 28th Street (Figure 1-3). Biloxi, the county's largest city, is located 7 miles to the east of Gulfport, and Pass Christian is located 7 miles to the west. The primary purpose of NCBC Gulfport is the support



LEGEND

ESTUARIES

NOT TO SCALE

FIGURE 1-1

NCBC LOCATION VICINITY

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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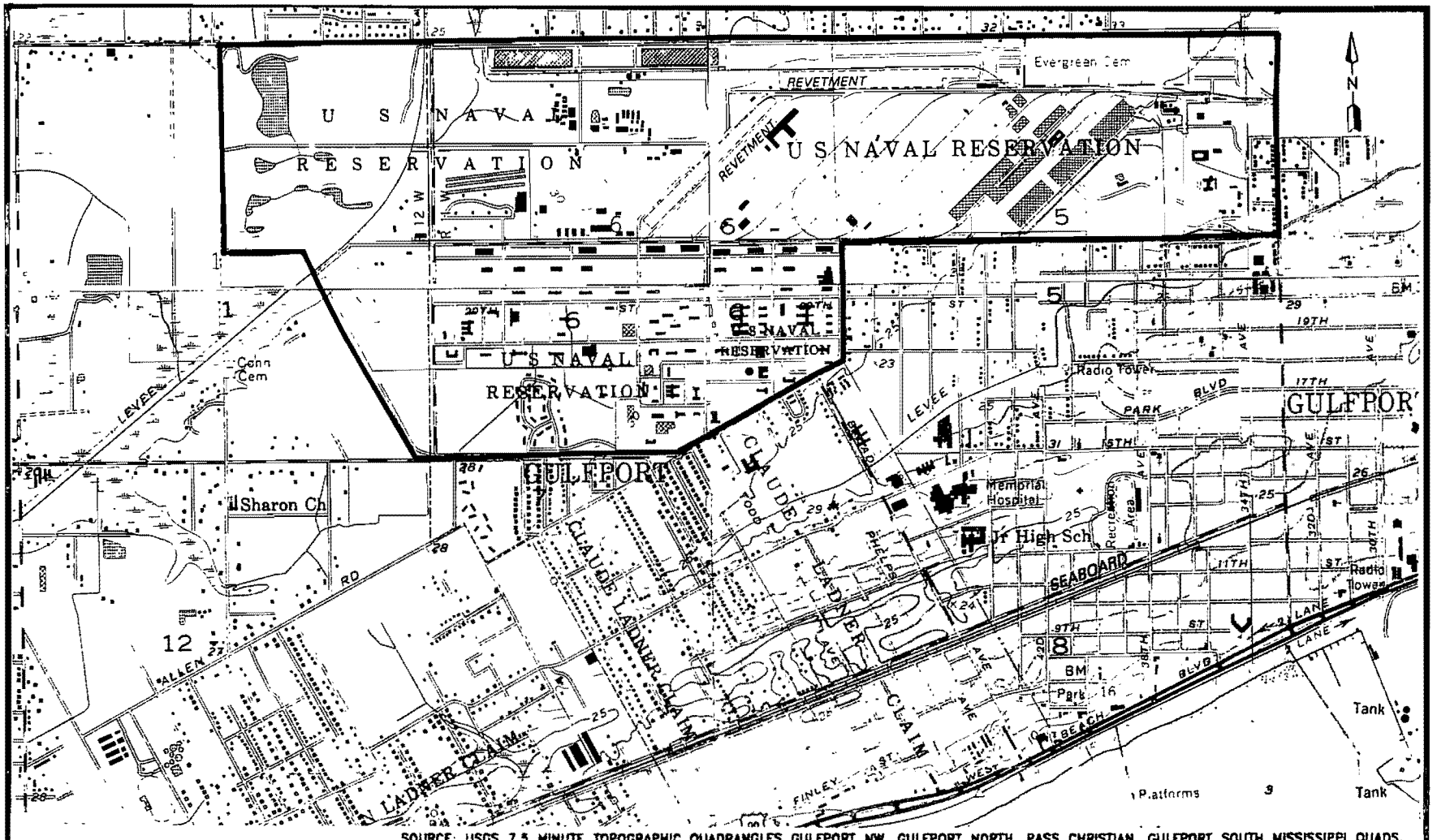

SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES GULFPORT NW, GULFPORT NORTH, PASS CHRISTIAN, GULFPORT SOUTH MISSISSIPPI QUADS.

0 1000 2000

SCALE: 1" = 2000'

FIGURE 1-2

TOPOGRAPHIC MAP OF SITE VICINITY

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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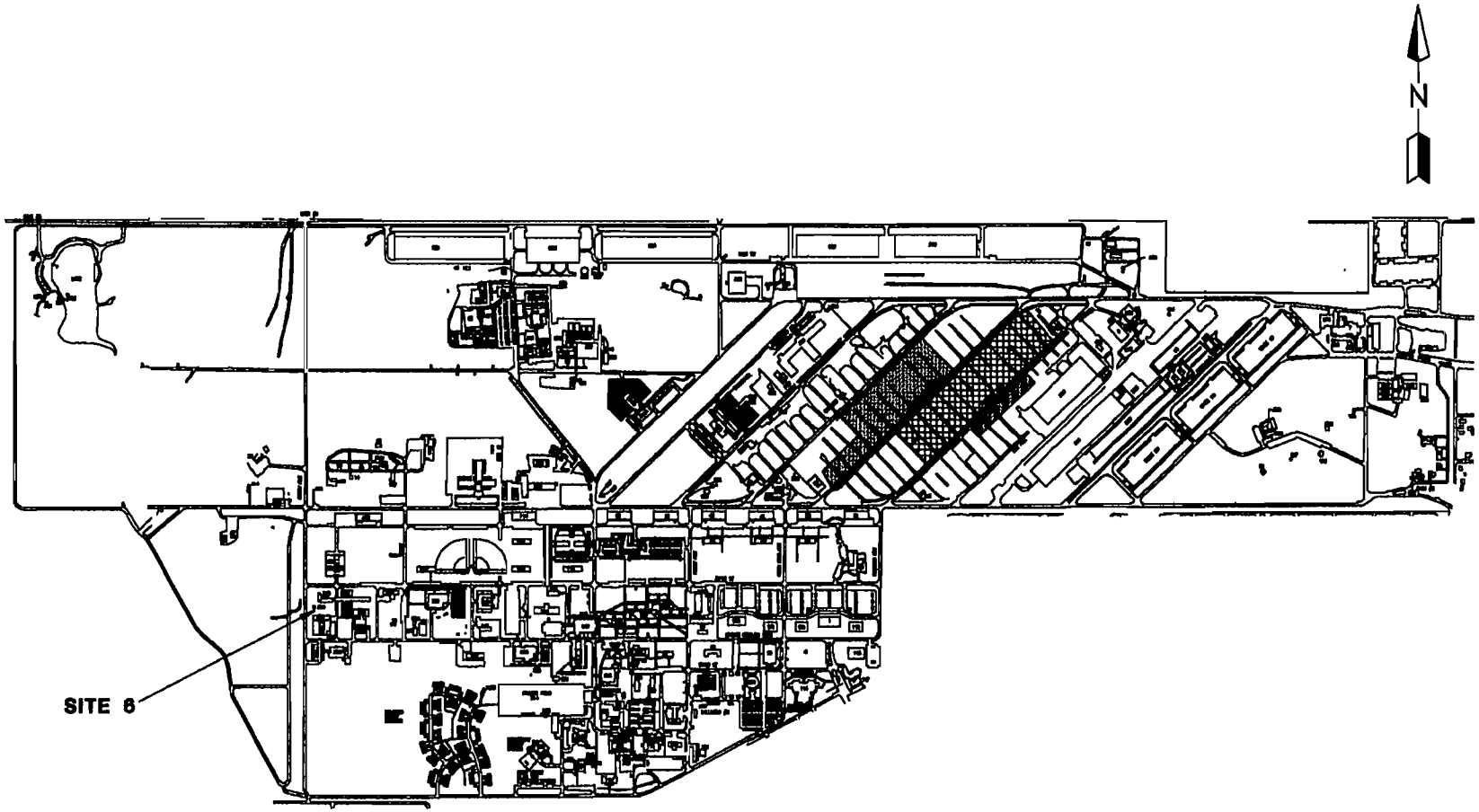

0 800 1600
SCALE: 1" = 1600'

FIGURE 1-3

FACILITY MAP

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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of four battalions of the Naval Construction Force (NCF) and the storage and maintenance of pre-positioned War Reserve Material Stock. NCF support consists of both homeport services and deployed support. Additional missions entail tenant support and services to other activities in the region (Envirodyne, 1985). Approximately 4,000 military and 1,600 civilian personnel are assigned to or employed by NCBC Gulfport.

1.2.2 Background NCBC Gulfport, originally named Camp Hollyday, was established on June 2, 1942, as an Advanced Base Depot. Between 1942 and 1944, an Armed Guard School and a Cooks and Bakers School were added, and millions of tons of supplies and equipment for military operations were stored at the camp. In 1944, NCBC became a U.S. Naval Training Center, which eventually resulted in a single command of the Naval Training Center and the Advanced Base Depot (Envirodyne, 1985).

Between 1945 and 1952, the Base was operated as the U.S. Naval Storehouse. The training center was decommissioned in 1946. On February 26, 1952, the Naval Storehouse was replaced by the Advanced Base Supply Depot and Naval Construction Equipment Depot (NCED). In July 1953, NCBC Gulfport was established by incorporating the two depots (Envirodyne, 1985).

In 1966, the activity expanded to include home-base battalion support functions and, after 20 inactive years, NCBC Gulfport was forming, staging, training, and homeporting two Naval Mobile Construction Battalions (NMCB). Presently, four construction battalions (NMCBs 1, 7, 74, and 133), under command of the 20th Naval Construction Regiment (NCR), are based at Gulfport. These four "Seabee" battalions average approximately 650 personnel each and are deployed on a rotational schedule (Envirodyne, 1985).

1.2.2.1 Site History The Fire-fighting Training Area (Site 6) consisted of two unlined pits located southeast of the Fifth Street and Colby Avenue intersection (Figure 1-4). The north pit was 50 feet long, 35 feet wide, and 4 feet deep. The south pit was 40 feet long, 25 feet wide, and 6 feet deep. The pits have been filled in and their outlines and locations at the surface are not recognizable, although the approximate locations of the pits are provided on Figure 1-4. Currently, Building 383 partially covers the north pit. Site 6 was recently used to train electricians.

Fire-fighting training activities began at Site 6 in 1966 and ceased in 1975. Waste liquids from the Base, as well as liquids from Keesler Air Force Base, the Air National Guard, and Pascagoula Shipyard were drained into the pits and ignited. Estimates suggest that as much as 500,000 gallons of liquids such as waste fuels, oils, solvents, paint thinners, and cleaning compounds were burned at the site over a 9-year period.

Three monitoring wells, GPT-6-1, GPT-6-2, and GPT-6-3, were installed and sampled as part of the Verification Study performed by Harding Lawson Associates (HLA) in 1987 (HLA, 1987). No free-phase product contaminants were found. During a site visit to NCBC Gulfport on October 31, 1991, ABB-ES personnel discovered free-phase floating product during sampling of monitoring well GPT-6-1 (Figure 1-4). The product is a brown, oily, viscous liquid. The surface of the water table was determined to be depressed 2 to 3 feet due to the presence of the free product.

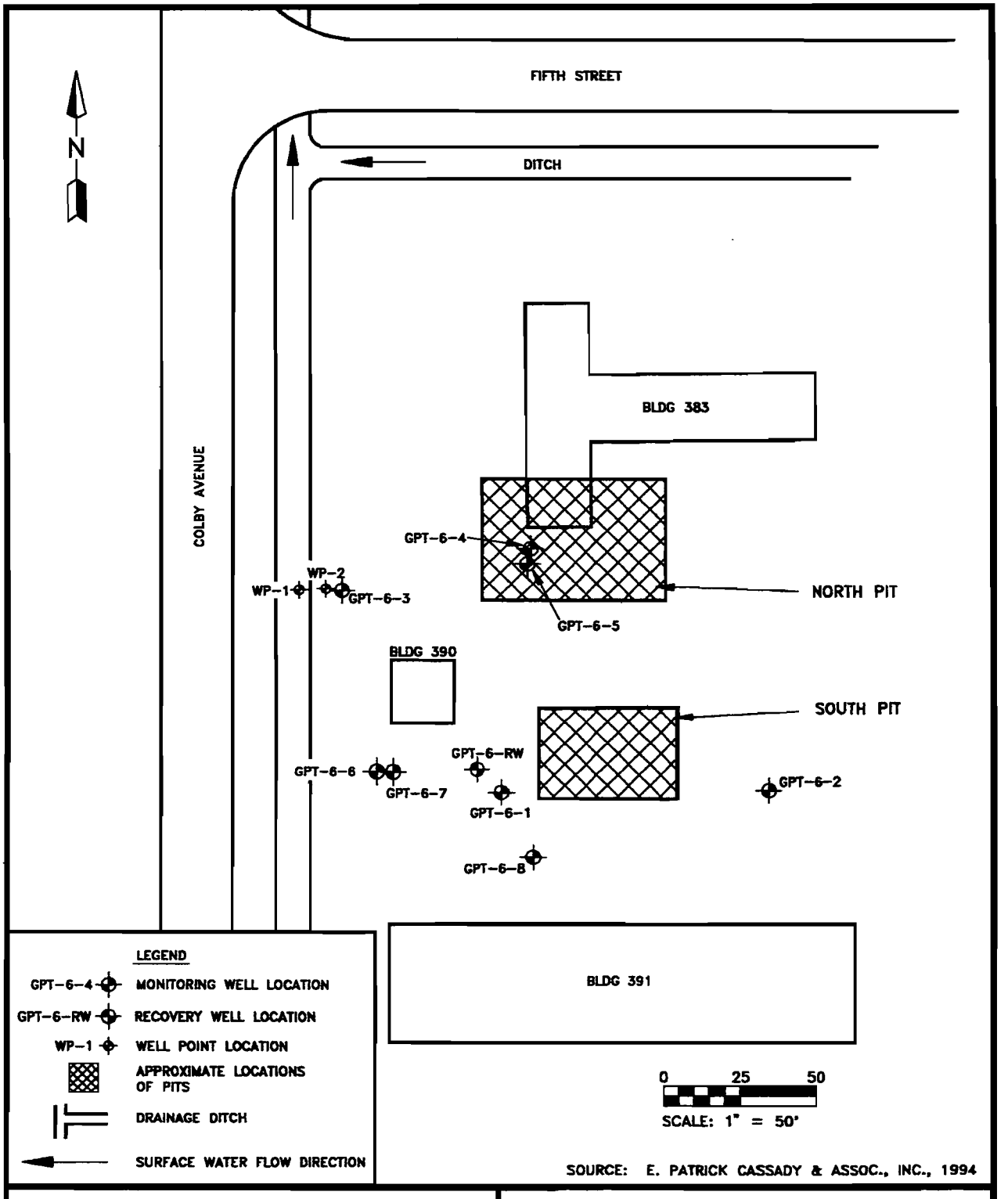

FIGURE 1-4

SITE MAP

F-PPA REPORT

NCBC GULFPORT
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During the field investigation conducted in late 1993 and early 1994, the extent of free-phase product was delineated using Hydropunch™ II technology. Five monitoring wells and one recovery well were installed and sampled during F-PPA field activities in December 1993. A pumping test was conducted on the recovery well in January 1994 to assist engineering and design of a remedial system for the site.

1.2.2.2 **Current Operations** Site 6 has recently been used to train electricians to construct and dismantle powerlines and transformers on electric utility poles. These training activities have been suspended for the duration of investigative activities.

1.3 SITE DESCRIPTION. Site 6 consists of the former Fire-fighting Training Area located at the corner of Fifth Street and Colby Avenue. The two unlined pits that existed during fire-fighting training operations have been backfilled, and the site has been converted for use as an electrician training area. Building 383 partially covers the north pit (see Figure 1-4). The other buildings on the site include Building 390 on the west side of the site and Building 391 on the southern side.

Surface water flows offsite to drainage ditches that bound the site on the west and north. The water in the drainage ditches flows north, eventually emptying into Canal No. 1.

Three monitoring wells were installed at the site by HLA in 1987 (HLA, 1987). Five additional monitoring wells and one recovery well were installed by ABB-ES in December 1993.

The conceptual model of the hydrogeologic setting for Site 6 describes the suspected sources of contaminant and the generalized physical conditions that affect contaminant migration. A cross-section location map is provided as Figure 1-5 and Figures 1-6 and 1-7 illustrate the conceptual model for Site 6.

At NCBC, topographic elevations range from 20 to 35 feet above the mean sea level (msl), with an average elevation of approximately 23 feet msl. There is little topographic relief at the Base except near the bauxite storage piles, which are approximately 70 feet above msl or about 50 feet high. At Site 6, the average elevation is approximately 29 feet msl (SOUTHNAVFACENGCOM, 1984; Envirodyne, 1985).

In the Gulfport area, geologic units containing fresh water are of Miocene to recent age. Aquifers are composed predominately of sand beds that are irregular in thickness and extent. There are no thick, consistently traceable confining units between aquifers.

The uppermost aquifer is the surficial aquifer. The surficial aquifer sediments are composed of alluvium and the Pamlico sand terrace deposits (recent to Pleistocene age). Generally, this aquifer is not used for potable water. This is the aquifer that was investigated at Site 6.

Beneath the surficial aquifer are what are collectively called the Miocene aquifers. The Miocene aquifers include the Citronelle Formation (Pliocene), the Graham Ferry Formation (Pliocene), and the Pascagoula, Hattiesburg, and Catahoula

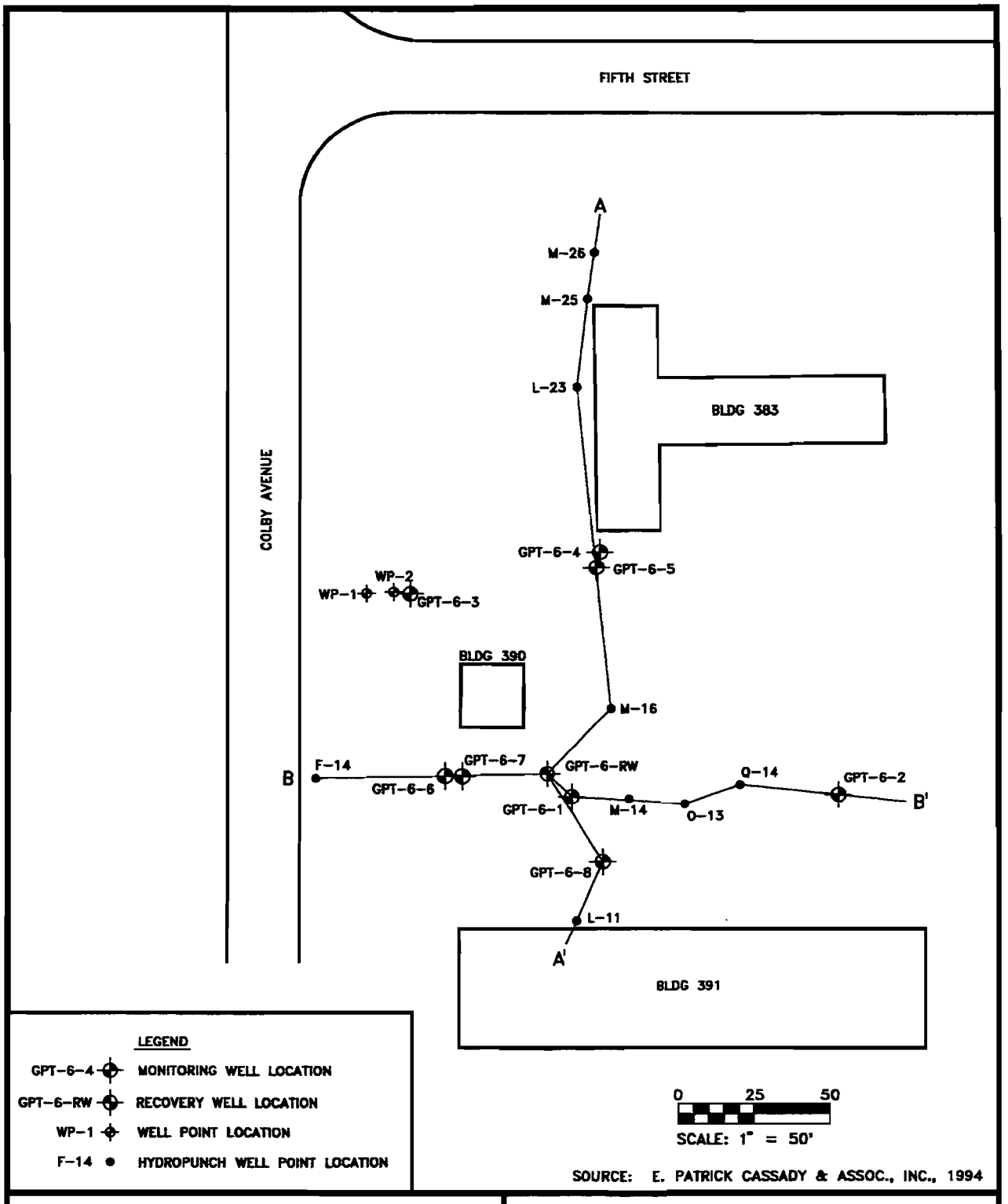

FIGURE 1-5

CROSS SECTION LOCATION MAP

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NCBC GULFPORT
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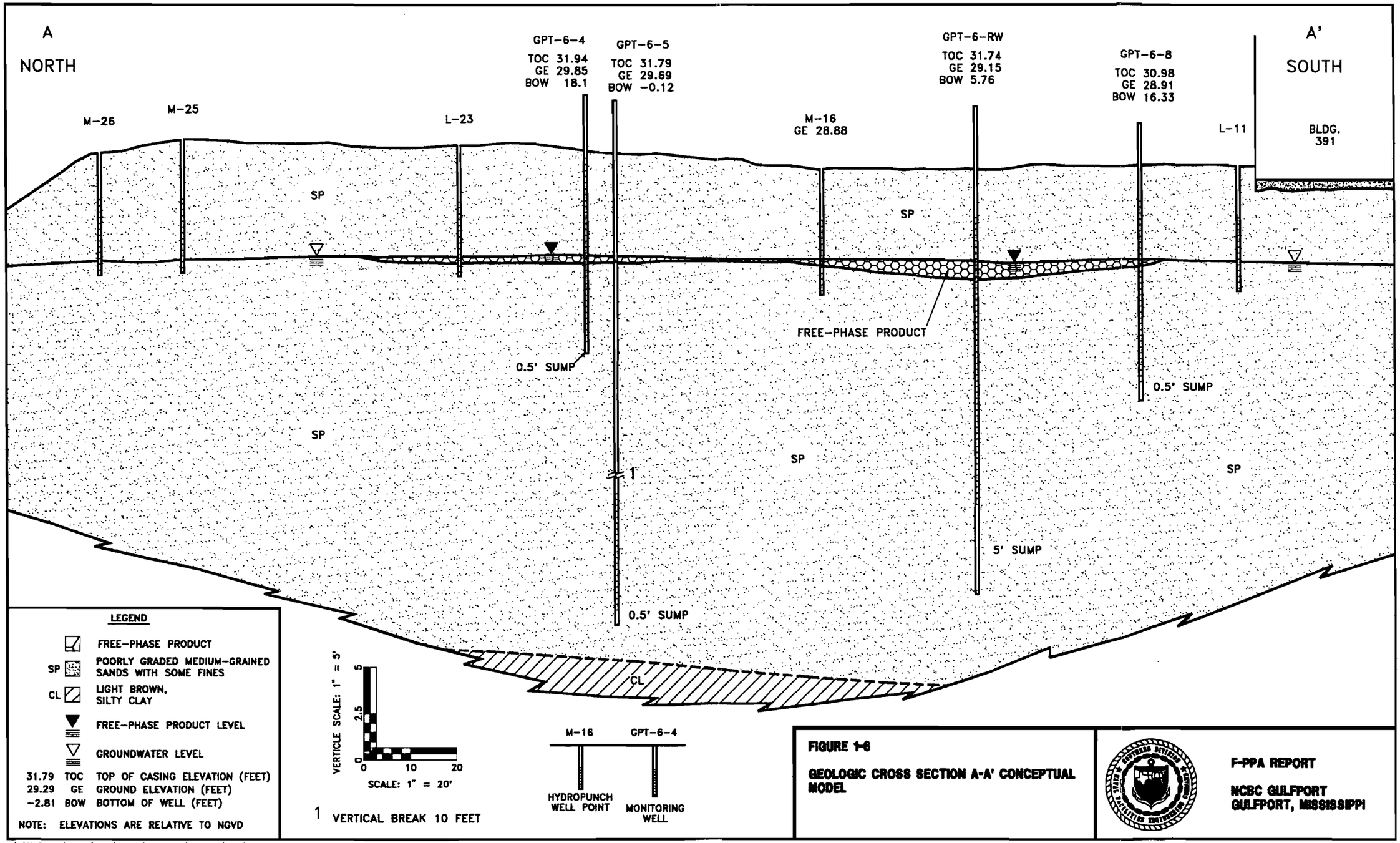

FIGURE 1-6

GEOLOGIC CROSS SECTION A-A' CONCEPTUAL MODEL

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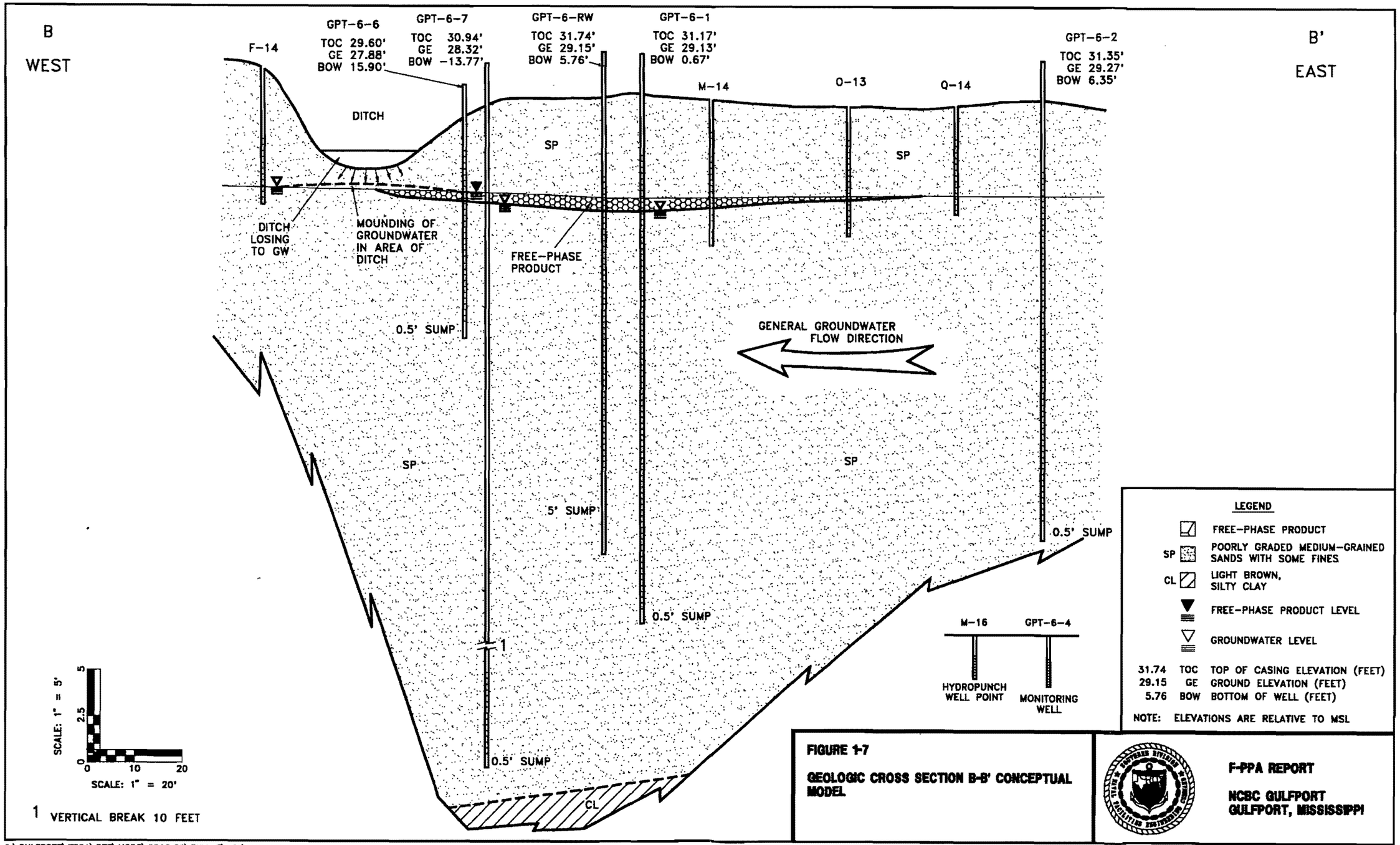

FIGURE 1-7

GEOLOGIC CROSS SECTION B-B' CONCEPTUAL MODEL

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Formations (Miocene). These aquifers are composed of sands and discontinuous clays. The Miocene aquifers are a major source of potable water in the Gulfport area (Brown and others, 1944; Newcome, 1975; Colson and Boswell, 1985).

Boundaries between aquifers are vaguely defined, if at all. At the site, the first artesian aquifer underlying the younger deposits of the surficial aquifer is considered to be part of the Miocene aquifers.

Regional groundwater flow in the Miocene aquifer system at NCBC has been interpreted to be to the south; however, the hydraulic gradient at Site 6 is generally to the west. The surficial aquifer consists of the Pamlico (Pleistocene to recent age) sand and recent deposits with thicknesses of up to 100 feet in the region. At NCBC, the surficial aquifer is composed of sands and fine-grained gravel ranging from 13 to 45 feet thick underlain by a clay layer ranging from 28 to 197 feet thick. Unconfined conditions exist in the surficial aquifer at Site 6 with groundwater elevations ranging from 23.29 to 24.30 feet above msl, as measured on January 13, 1994. In March 1987, groundwater elevations ranged in elevation from 26.37 to 24.24 feet above msl. Groundwater flow across the site during January 1994 was dissected by a drainage divide (Figure 1-8) in the area near GPT-6-2, GPT-6-3, and WP-1, but was generally flowing west.

Unconsolidated sediments encountered at Site 6 during drilling and soil sampling consisted of tan, gray, and brown, fine- to medium-grained sand with little silt underlain by a saturated, silty clay. This sand unit was generally encountered within 2 feet of the surface, depending on the amount of topsoil and/or any backfill material. The sand layer extended to depths ranging from 35 to 47 feet below land surface (bls) (see Figures 1-6 and Figure 1-7). A saturated silty clay unit underlies the sand unit to an undetermined depth.

Surface water generally flows west to a ditch located adjacent to the site that parallels Colby Avenue. The ditch flows offsite to the north. During periods of heavy rainfall, surface water ponds in the area of M-16 (Figure 1-8).

<u>1.4 OVERVIEW OF FREE-PHASE PRODUCT ASSESSMENT (F-PPA) REPORT</u>. This F-PPA report is separated into six chapters. Chapter 1.0, Introduction, outlines the purpose and scope of the F-PPA report and includes a facility history, a site description, and a conceptual model. Chapter 2.0, Free-Phase Product Assessment Activities, summarizes the free-phase product plume delineation, the drilling and well installation program, and presents the results of the pilot-scale pumping test. Chapter 3.0, Hydrogeologic Conditions, presents groundwater flow direction, aquifer slug test results, and capture zone analysis. Chapter 4.0, Nature of Contamination, outlines the laboratory analyses (including quality assurance and quality control [QA/QC]) and data assessment, as well as data evaluation and interpretation. Chapter 5.0, F-PPA Engineering Evaluation, presents applicable remedial technologies and technology screening. Chapter 6.0, Conclusions and Recommendations, summarizes extent of contaminants, aquifer characteristics, and remedial alternatives.

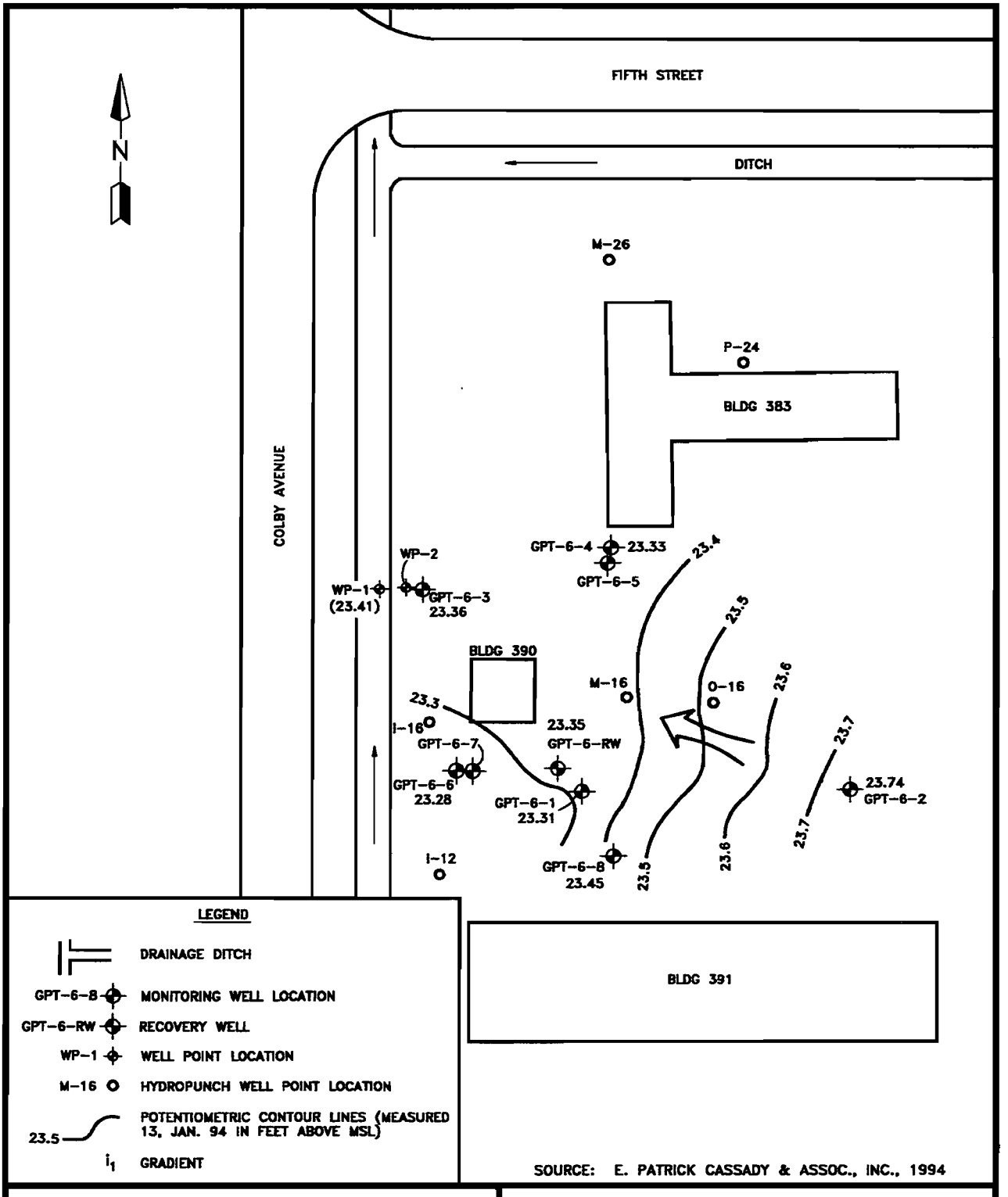

FIGURE 1-8

POTENTIOMETRIC SURFACE MAP
JANUARY 13, 1994
(REVISED MAY 27, 1994)

F-PPA REPORT

NCBC GULFPORT
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2.0 FREE-PHASE PRODUCT ASSESSMENT ACTIVITIES

2.1 FIELD INVESTIGATION OVERVIEW. The free-phase product assessment at Site 6 was performed during three field efforts. The first field activities, conducted from November 14 to November 20, 1993, consisted of horizontal and vertical delineation of the plume using the Hydropunch™ II. Drilling and well installation were completed during the second field effort (December 6 to December 16, 1993). The monitoring wells were located in areas that provided information regarding the thickness, extent, and migration potential of the free-phase product plume. The recovery well was located adjacent to and downgradient of the suspected source: the former fire-fighting training pit. These well locations were based on the results of the first field effort. A pilot-scale pumping test was performed on the recovery well during the third field effort (January 10 through January 14, 1994).

2.2 HYDROPUNCH™ INVESTIGATION. The primary objective of this field effort was to assess the horizontal and vertical extent of the free-phase product plume at Site 6, the former Fire-fighting Training Area. Observations of the free product were made by installing sacrificial Hydropunch™ II well points intersecting the groundwater surface. From these Hydropunch™ II well points, visual observations of the product were made by withdrawing the fluids with clear bailers. The results of these observations were recorded in the field book and on a gridded site map (Figure 2-1).

2.2.1 Free-Phase Product Plume Delineation Prior to installation of the Hydropunch™ II well points, a grid was overlaid on the site. The grid encompassed the former fire-fighting pits and the estimated extent of the plume. The north to south grid lines were designated D through T, with a 15-foot spacing between the lines. The east to west grid lines were designated 6 through 26 with a 15-foot spacing also. Each location was cleared to 3.0 feet bls with a posthole digger because of the possible presence of buried utilities on the site. The Hydropunch™ II tool (Figure 2-2) was then attached to the Mobile B-50 drill rig with standard AW drill rods and pushed or hammered 2 to 3 feet below the groundwater table. When the tool was withdrawn, the Hydropunch™ II well point remained in the soil with the well screen attached. This configuration (hydrocarbon mode) of the Hydropunch™ II allowed direct sampling and measurement of the floating product with a small diameter clear bailer. When the Hydropunch™ II well points were no longer needed, they were grouted in place.

Forty-one Hydropunch™ II well points were used to assess the horizontal and vertical extent of the free-phase product. The original plume, first discovered in well GPT-6-1, appears to originate from the south fire-fighting training pit. While delineating the northern extent of the plume, what appears to be a second plume was discovered. This second plume is suspected to be the result of the former north fire-fighting training pit. It appears that the two plumes have coalesced to form one plume and will, henceforth, be referred to as the plume. The southern part of the plume had a maximum observed thickness of 2.5 feet in GPT-6-1, and the northern part of the plume had a maximum observed thickness of 1.0 foot in Hydropunch™ II well point M-19.

The delineation of the free-phase product at the site started with installation of Hydropunch™ II well points near monitoring well GPT-6-1; the well was

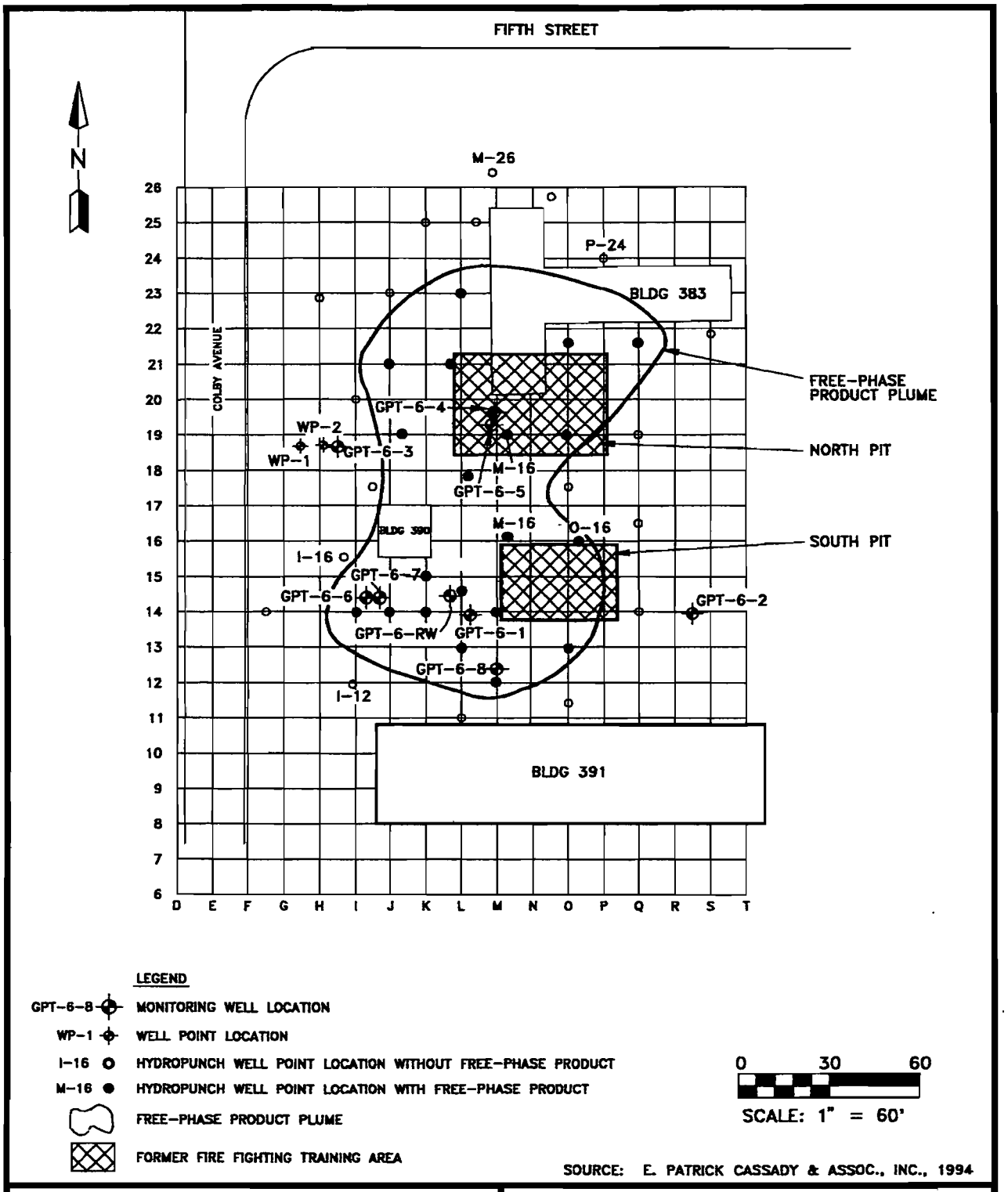

FIGURE 2-1

GROUNDWATER SCREENING GRID WITH FREE-PHASE PRODUCT PLUME

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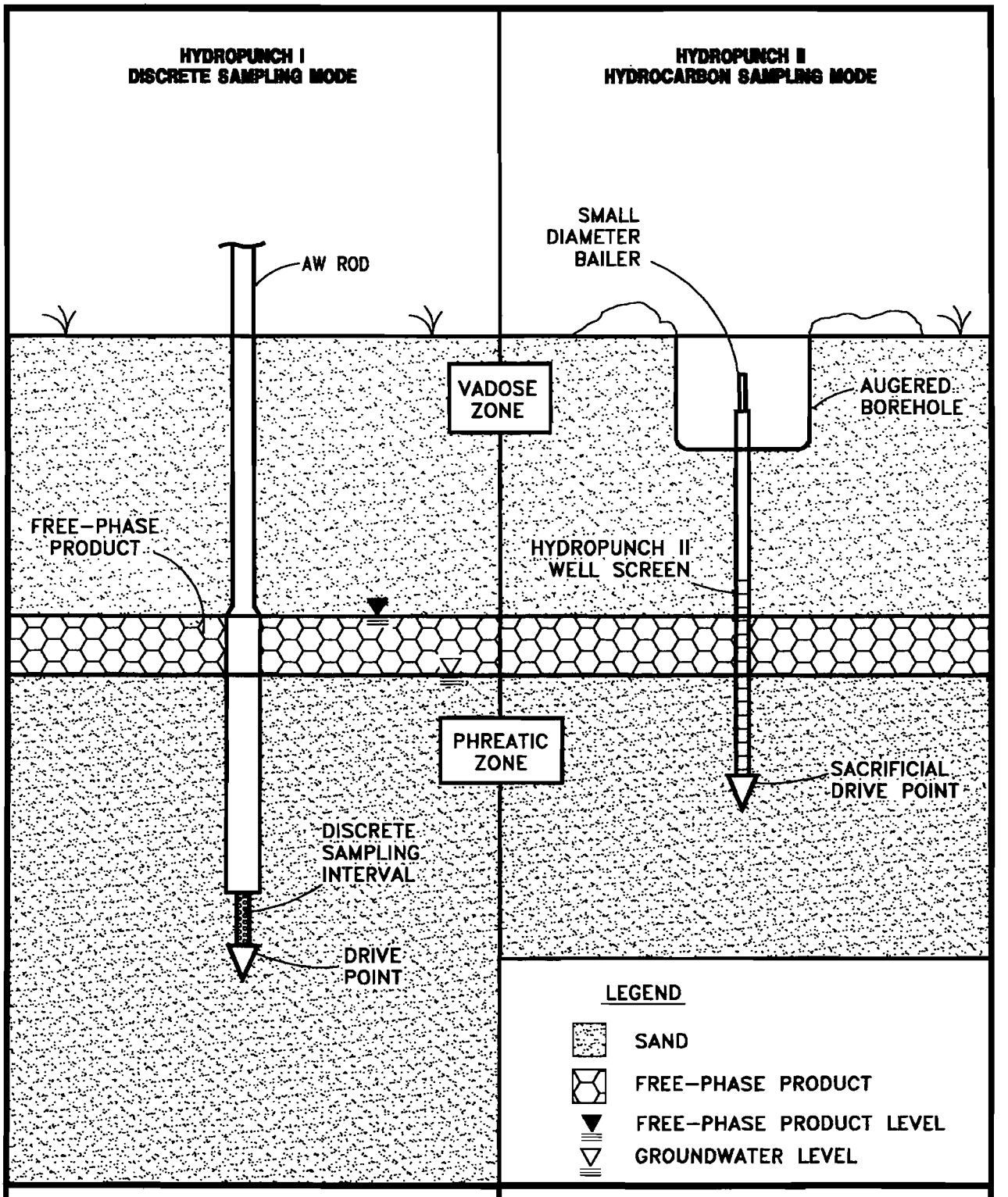

FIGURE 2-2

HYDROPUNCH I AND II DETAILS

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contaminated with nearly 2 feet of floating free-phase product. The investigation proceeded to the west, south, and east until groundwater that was free of floating product was observed. The map of the site (see Figure 2-1) shows observations from the Hydropunch™ II well points and the locations of buildings and the former pits. As shown, Hydropunch™ II well points Q-16 and Q-14 delineate the free-phase product plume to the east. Hydropunch™ II well points O-11, L-11, and I-12 delineate to the south, and F-14, I-16, and J-17 delineate free product to the west. The vertical extent of the floating free-phase product is defined by the Hydropunch™ II well points with floating free-phase product in them. The apparent thickness of the floating free-phase product ranges from 2.5 feet in L-14 to less than 0.01 foot in I-14, M-12, M-16, and O-16. The product in L-14 was described as a dark brown, oily, viscous fluid with a strong fuel odor. The product in I-14, M-12, M-16, and O-16 was described as a light brown, oily, viscous fluid with a fuel odor.

The northern extent of the plume was first discovered when Hydropunch™ II well point M-19 was installed. This Hydropunch™ II well point had 1 foot of free-phase product floating in it. The product was described as a dark brown, oily, viscous fluid with a strong odor of diesel fuel. M-19 is located in the north pit area, 30 feet south of Building 383. From M-19, delineation and characterization points were installed to the northwest and northeast. The horizontal extent of the floating free-phase product on the northern half of the plume is delineated by Hydropunch™ II well points I-20, J-23, M-25, O-25, P-24, S-21, Q-19, and O-17. The apparent vertical extent (thickness) of the floating free product ranges from 1.0 foot in Hydropunch™ II well point M-19 to less than 0.02 foot in Hydropunch™ II well points J-21, L-23, Q-21, and O-19.

Monitoring well GPT-6-3 did not have any free product, but flame ionization detector (FID) readings of the headspace in the well were as high as 500 parts per million (ppm) above background, and a strong diesel odor was present when the well was opened. Monitoring well GPT-6-2 did not have free product, and well head readings with the FID indicated no detectable organic vapors above background.

An oily sheen was discovered on the surface water of the ditch that bounds the site. The free-phase product from the site may be the source of the sheen. The product may have migrated to the ditch along a waterline that crosses Site 6 below grade. The ditch receives surface runoff from the site and eventually carries site-related waters off-base. Booms have been installed in the ditch, one on each side of Fifth Street, in an attempt to control migration of the product sheen.

The areal extent of the free-phase product is shown in Figure 2-1. The free-phase product extends approximately 170 feet north to south and 110 feet east to west. The product is present near the surface at 7 feet bls. The plume spans approximately 17,000 square feet elongated mostly north to south with an hourglass configuration (see Figure 2-1). The apparent product thicknesses across the site were measured and recorded, ranging from 0.01 to 1.85 feet. The mean of the thicknesses was calculated and used to estimate an average product thickness across the site of 0.65 foot, taking into account an estimated porosity of 40 percent for the sandy subsurface (Driscoll, 1986). The approximate product volume is 4,420 cubic feet or 33,064 gallons by the following equation:

$$PV = (PA \times PT) \times Porosity \quad (1)$$

where

PA = product areal extent,
PV = product volume,
PT = average apparent product thickness, and
porosity = a unitless value.

The two deep borings (K-15 and M-18) indicate that groundwater contamination may extend down to 20 feet.

2.2.2 Sampling Program Free-phase product samples were collected for capillary column U.S. Environmental Protection Agency (USEPA) 8260 analyses and dioxin and furan USEPA Method 8290 analyses. Results are described in Chapter 4.0 of this report. The samples were collected during the Hydropunch™ investigation using the Hydropunch™ I tool (see Figure 2-2).

Two deep Hydropunch™ borings at M-18 and K-15 were completed 22 to 27 feet deep in the surficial aquifer. The Hydropunch™ I tool was set in the groundwater sampling mode (see Figure 2-2), which allows discrete sampling at a selected interval. An underlying clay layer was described by HLA at depths ranging from 22 to 27 feet bls. Two groundwater samples were collected from K-15 and M-18 at this interval to analyze for dense nonaqueous phase liquids (DNAPLs). The groundwater samples from M-18 and K-15 were analyzed at an offsite laboratory for volatile organic compounds using USEPA Method 8260. Total petroleum hydrocarbon (TPH) was detected at these depths (see Chapter 4.0). However, the top of the clay layer ranged from 32 to 45 feet.

Two soil samples were collected from the deep boring M-18 at 8 and 15 feet bls. These samples were sent to an offsite laboratory for grain-size analysis (sieve and hydrometer), total organic carbon (TOC), and cation exchange capacity (CEC) analyses.

Results of the sieve and hydrometer tests on the two soil samples were similar. The results are as follows:

- about 1 percent fine-grained gravel,
- about 1 percent coarse-grained sand,
- 21 to 24 percent medium-grained sand,
- 62 percent fine-grained sand, and
- 13 to 15 percent fine-grained silt and clay.

2.3 DRILLING AND WELL INSTALLATION. The following discussion presents the field activities conducted during drilling and well installation at Site 6 from December 6 to 16, 1993.

During this field effort, the following activities were performed: (1) installation of two well points adjacent to Well GPT-6-3, (2) installation of three shallow monitoring wells (GPT-6-4, GPT-6-6, and GPT-6-8), (3) completion of two deeper monitoring wells at the clay layer (GPT-6-5 and GPT-6-7), and (4) installation of a recovery well (GPT-6-RW). Monitoring wells GPT-6-4 and GPT-6-5, and GPT-6-6 and GPT-6-7 were paired so that the vertical potential within the aquifer could be assessed.

2.3.1 Drilling Program The locations of the wells were based on the results of the Hydropunch™ II field investigation (see Figure 2-1). The wells were located within the free-phase product plume in areas that would allow assessment of the migration potential of the free-phase product plume. The shallow monitoring wells were installed so that the screened interval intersected the water table and/or free-phase product. The deep monitoring wells were installed several feet above the underlying silty clay layer. The depths of the clay layer were 35 feet bls in well GPT-6-5 and 47 feet bls in GPT-6-7. These depths are deeper than previously reported by HLA in 1987 (22 to 27 feet bls). The recovery well (GPT-6-RW) was located adjacent to and downgradient of the southern former fire-fighting training pit (see Figure 1-4).

2.3.1.1 **Well Point Installation** Two well points were installed with a post hole driver in the ditch area to provide water level data. Well point 1 (WP-1) was installed in the ditch adjacent to GPT-6-3. The other well point (WP-2) was installed between GPT-6-3 and WP-1. Data from these well points indicate that the head in the ditch is higher than that in the adjacent aquifer. This indicates that the ditch is losing water to the surficial aquifer.

2.3.1.2 **Soil Sampling Program** During drilling operations, 2-foot split-spoon soil samples were collected from GPT-6-5 and GPT-6-7 from the following intervals: (1) in the vadose zone (unsaturated zone), (2) just below the water table in the saturated zone, and (3) near the contact of the fine- to medium-grained sand formation and the underlying silty clay. Table 2-1 outlines the soil sampling program at Site 6 during monitoring well installation.

2.3.1.3 **Monitoring Well Installation** The slot size and filter pack of the monitoring wells were designed based on the boring logs from Site 6 from HLA (1987). Slot size and filter pack were designed using a method described by Driscoll (1986). The locations of the monitoring wells were based on product thicknesses observed during the Hydropunch™ field effort (see Figure 2-1). Soil boring logs for the monitoring wells are presented in Appendix A. Monitoring well construction details are contained in Appendix B.

The monitoring wells were installed with a Mobile B-57 drill rig using 8.25-inch outside diameter (OD) augers. No fluids or potable water were introduced into the ground during drilling. The shallow monitoring wells GPT-6-4, GPT-6-6, and GPT-6-8 were designed to have screens intersecting the water table and/or floating free-phase product. The deep monitoring wells were designed to determine the depth to, and the groundwater quality at, the contact of the fine- to medium-grained sand formation and the underlying silty clay layer. Monitoring well specifications are summarized in Table 2-2.

Monitoring well GPT-6-4 was installed in the backfill used to fill in the north fire-fighting training pit. The backfill material used to fill the north fire-fighting training pit is undistinguishable from the native vadose and aquifer materials and is reported in the boring logs as sand mixed with various amounts of gravel and silt (refer to Appendix A).

In general, subsurface soil sampling revealed what appears to be a vertically continuous unit of light to dark brown, fine- to medium-grained sand with little silt extending to a dark gray clay with some silt and little sand.

Table 2-1
Soil Sampling Plan

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Sample Analysis Depth Interval (feet bls)	Boring Number B-6-5 3 to 5	B-6-5 8 to 10	B-6-5 20 to 22	B-6-7 8 to 10	B-6-7 20 to 22	B-6-7 45 to 47
TCL-CLP VOAs	X	X	X	X	X	X
TCL-CLP SVOAs	X	X	X	X	X	X
TCL-CLP PEST/PCBs	X	X	NS	NS	NS	NS
TAL-CLP inorganics with cyanide	X	X	NS	NS	NS	NS
TPH (Method 418.1)	X	X	NS	X	NS	NS
TOC (Method 415.1)	NS	NS	NS	NS	X	NS
Herbicides (Method 8150)	X	X	NS	NS	NS	NS
Dioxins and furans (Method 8290)	X	X	NS	NS	NS	NS
Trip blank	XP	NS	NS	XP	NS	XP
Equipment rinsate field blank	XF	NS	NS	XL	NS	NS
Duplicate	XF	NS	NS	NS	XT	NS
Matrix spike	XF	NS	NS	NS	XT	NS
Matrix spike duplicate	XF	NS	NS	NS	XT	NS

Notes:
- bls = below land surface.
- TCL-CLP = target compound list, USEPA Contract Laboratory Program.
- VOA = volatile organic analysis.
- X = sample collected.
- SVOA = semivolatile organic analysis.
- PEST/PCB = pesticides and polychlorinated biphenyls.
- NS = not sampled.
- TAL-CLP = target analyte list, USEPA Contract Laboratory Program.
- TPH = total petroleum hydrocarbons.
- TOC = total organic carbon.
- XP = only VOAs.
- XF = full suite of analysis (TOC not sampled in B-6-5).
- XL = only VOAs, SVOAs, TPH, and TOC.
- XT = only TOC.
- USEPA = U.S. Environmental Protection Agency.

Table 2-2
Monitoring and Recovery Well Specifications

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No.	Casing Diameter (inch)	Total Depth (feet bls)	Screen Interval (feet bls)	Screen Slot Size (inch)	Filter Pack Sand Type[1]
GPT-6-4	2	13.7	3.2 to 13.2	0.020	16/30
GPT-6-5	2	32.1	26.6 to 31.6	0.020	16/30
GPT-6-6	2	13.7	3.2 to 13.2	0.020	16/30
GPT-6-7	2	44.9	39.4 to 44.4	0.020	16/30
GPT-6-8	2	14.7	4.2 to 14.2	0.020	16/30
GPT-6-RW	5.4	26.0	5 to 20	0.020	16/30

[1] The first number represents sieve size D_{90} and the second number represents sieve size D_{10}.

Note: bls = below land surface.

Monitoring wells were developed using a Brainard-Killman handpump and a gasoline-powered centrifugal pump. Well development forms are included in Appendix B. Typically, 100 to 150 gallons were removed from each well before turbidity decreased and the parameters had stabilized to within 10 percent of the previous measurement. Development water was transferred to a 6,500-gallon tank located onsite. Approximately 800 gallons were transferred from the monitoring wells to the onsite tank during development.

2.3.1.4 **Recovery Well Installation** The recovery well is located within the free-phase product plume and downgradient of the suspected source, the southern former Fire-fighting Training Area pits (see Figure 1-4). The recovery well, designated GPT-6-RW, was installed December 12, 1993, to a total depth of approximately 25 feet bls. Slot size and the filter pack range were determined from HLA (1987) soil boring logs for Site 6. The recovery well construction is shown in Appendix B. Construction was in accordance with the workplan and local well installation criteria.

The recovery well was developed by alternately mechanically surging the well and pumping fluids from the well to develop out the fine-grained particles in the filter pack. Pumping rate and drawdown were recorded to monitor the specific capacity of the recovery well as development progressed. As expected, the specific capacity of the recovery well increased during development. This indicated that the efficiency of the well had increased as fine-grained particles were removed. The specific capacity (gallons per minute per foot of drawdown) increased from 2.31 at the start of development to 2.71 near the end. A total of 1,700 gallons of groundwater was removed from the recovery well and transferred to the onsite tank.

A trace of free-phase product was observed in the recovery well prior to development. The free-phase product decreased significantly after development began, which resulted in little product removal during development. Following development, 1.14 feet of product was measured in the recovery well.

2.3.2 Groundwater Sampling Program Groundwater from the newly installed monitoring wells (except GPT-6-8) and existing monitoring wells GPT-6-2 and GPT-6-3 was sampled on December 13, 1993. Table 2-3 summarizes the sampling and analyses performed on the groundwater from Site 6. Results of these analyses are discussed in Chapter 4.0 of this report.

2.3.3 Aquifer Slug Tests Aquifer slug tests were performed on all newly installed wells. Two rising head slug tests were performed on each of the new shallow monitoring wells; falling head slug tests were performed on the deeper wells GPT-6-5 and GPT-6-7 (Bouwer and Rice, 1976). An electronic data logger recorded the water level changes. Section 3.2 presents the aquifer slug test results and the graphical results are presented in Appendix C.

2.4 PILOT-SCALE PUMPING TEST. A stepped pumping test was conducted on GPT-6-RW (the recovery well) for 16 hours on January 12 and 13, 1994. The test was preceded by 14.5 hours of background water level monitoring and followed by 9.25 hours of monitoring the recovering water levels.

The primary objective of the pumping test was to observe product recovery using three different scenarios: (1) free-phase product recovery only, (2) free-phase

Table 2-3
Groundwater Sampling Program

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Sample Analysis	GPT-6-1	GPT-6-2	GPT-6-3	GPT-6-4	GPT-6-5	GPT-6-6	GPT-6-7	GPT-6-8	GPT-6-RW
TCL-CLP VOAs	NS	X	X	X	X	X	X	NS	TBS
TCL-CLP SVOAs	NS	X	X	X	X	X	X	NS	NS
TCL-CLP PEST/PCBs	NS	NS	NS	X	NS	X	NS	NS	NS
TAL-CLP Inorganics with Cyanide	NS	NS	NS	X	NS	X	NS	NS	NS
TPH (Method 418.1)	NS	X	X	X	NS	X	NS	NS	NS
TOC (Method 415.1)	NS	NS	NS	X	NS	X	NS	NS	NS
Herbicides (Method 8150)	NS	NS	NS	X	NS	X	NS	NS	NS
Dioxins and Furans (Method 8290)	NS	NS	NS	X	NS	X	NS	NS	NS
Trip Blank	NS	XP	NS	XP	NS	XP	NS	NS	NS
Potable Water	NS	NS	NS	XF	NS	NS	NS	NS	NS
Distilled Water	NS	NS	NS	XF	NS	NS	NS	NS	NS
Equipment Rinsate	NS	XO	NS	XF	NS	NS	NS	NS	NS
Duplicate	NS	NS	NS	XF	NS	NS	NS	NS	NS
Matrix Spike	NS	NS	NS	XF	NS	NS	NS	NS	NS
Matrix Spike Duplicate	NS	NS	NS	XF	NS	NS	NS	NS	NS

Notes:
- TCL-CLP = target compound list, U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program.
- VOA = volatile organic analysis.
- NS = not sampled.
- X = sample collected.
- TBS = to be sampled during multi-staged product pumping test.
- SVOA = semivolatile organic analysis.
- NS = not sampled.
- PEST/PCB = pesticides and polychlorinated biphenyls.
- TAL-CLP = target analyte list, USEPA Contract Laboratory Program.
- TPH = total petroleum hydrocarbons.
- TOC = total organic compound.
- XP = only VOAs.
- XF = full suite of analysis (VOAs, SVOAs, PEST/PCBs, Inorganics, TPH, TOC, Herbicide, and Dioxins).
- XO = only VOAs, SVOAs, and TPH.

product recovery while depressing the groundwater with 3.0 gallons per minute (gpm) withdrawal, and (3) product recovery while depressing the groundwater with 7.1 gpm withdrawal. In addition, water levels in the recovery well and adjacent monitoring wells were recorded so that estimations of aquifer properties and the capture zone of the recovery well could be made. The volume limitation of the tank shortened the pumping test, which limits the interpretation of the pumping test data.

2.4.1 Preparing for the Pumping Test An oil and water interface probe was employed to determine depth to and thickness of free-phase product. Depths to water were measured with a water level indicator. The pH, conductivity, and temperature of the groundwater were determined by using a salinity-conductivity-temperature meter and a conductivity-temperature-pH tester.

Two different pumps were used to withdraw free-phase product and groundwater during the pumping test. A peristaltic pump withdrew the free-phase product through a Teflon™ tube. The free-phase product was discharged to 55-gallon drums. Groundwater withdrawal was accomplished with a centrifugal submersible pump. Groundwater was discharged through polyethylene tubing that was connected to a ball valve and totalizing flow meter assembly. The rate of groundwater discharge was regulated by adjusting the amount of back pressure asserted by the ball valve. Groundwater discharge from the recovery well (GPT-6-RW) was conveyed to the onsite tank.

Transducers were installed in wells GPT-6-RW, GPT-6-1, GPT-6-3, GPT-6-4, GPT-6-5, GPT-6-6, and GPT-6-7 on January 11, 1994, and allowed to equilibrate to the ambient groundwater temperature and monitor background water levels until 0900 on January 12.

Barometric observations were monitored throughout the test using a barometric transducer linked to a datalogger. Water levels in wells GPT-6-RW, GPT-6-1, GPT-6-3, GPT-6-4, GPT-6-5, GPT-6-6, and GPT-6-7 were monitored using pressure transducers linked to a datalogger. Water levels in wells GPT-6-8 and GPT-6-2 were manually observed using a water level indicator and an oil and water interface probe. Nine rounds of manual water levels and product thicknesses were recorded for all wells during the pumping test. Time and drawdown data from the pumping test, including background and recovery monitoring, are included in Appendix D.

2.4.2 Background Readings Background water level readings were monitored for 14.5 hours on January 11 to 12, 1994, except in the pumped well, which was not linked to the datalogger until 0800 on January 12. This information is also included in Appendix D.

2.4.3 Stepped Pumping Test The stepped pumping test consisted of withdrawing free-phase product for 2.5 hours, withdrawing groundwater and free-phase product at 3.0 gallons per minute (gpm) for 8 hours, and increasing the flow to 7.1 gpm for 5 hours, 50 minutes. Finally, pumping ceased and the recovery was observed.

2.4.3.1 Phase I, Free-Phase Product Phase I of the pumping test involved removal of free-phase product at a pumping rate of 0.16 gpm using only the peristaltic pump. Teflon™ tubing was lowered into the free-phase product layer prior to the start of the pumping test at 0900 hours on January 12, 1994. Product thicknesses were manually measured during Phase I, which lasted 2.33

hours. Table 2-4 presents the results of these measurements as well as product apparent thickness observations made during subsequent phases of the pumping test.

Table 2-4
Product Thickness Measurements in Pumped Well GPT-6-RW During Pumping Test

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Local Time (hours)	Phase	Depth to Product (feet)	Depth to Water (feet)	Product Thickness (feet)
0736	Background	8.31	8.58	0.27
0926	Phase I	8.39	8.52	0.13
1107	Phase I	8.44	8.47	0.03
1149	Phase II	9.81	9.86	0.05
1210	Phase II	9.81	9.87	0.06
1540	Phase II	9.82	9.92	0.10
2146	Phase III	11.91	12.85	0.94
0950	Recovery	8.34	8.57	0.23

At the beginning of Phase I (0926 hours), product apparent thickness was 0.27 foot, and the effluent from the peristaltic pump was 40 percent free-phase product and 60 percent water. Product thicknesses decreased by half in the first hour of Phase I. By 1107 hours, only 0.03 foot of free-phase product remained, and the pumping rate of the peristaltic pump was reduced from 0.16 to 0.11 gpm. At 1117 hours, the peristaltic pump was adjusted to 0.29 gpm. At 1120 hours, Phase I was terminated because of the reduced product thickness and the low percent recovery of free-phase product.

Approximately 5 gallons of free-phase product and 25 gallons of groundwater were removed during Phase I.

2.4.3.2 Phase II, Free-Phase Product Removal and Groundwater Depression at 3.0 Gallons Per Minute (gpm) Phase II of the pumping test began at 1130 hours when the peristaltic pump was turned on. The initial flow rate of 9.6 gpm was quickly adjusted to 3.7 gpm. Further adjustments resulted in a consistent flow rate of 3.0 gpm until the end of Phase II at 1930 hours. This flow rate adjustment is discernible on the hydrographs for the pumped well and the nearest monitoring wells (GPT-6-1 and GPT-6-3) at 1144. The peristaltic pump was shut off from 1123 to 1245 hours to allow product levels to thicken in the pumped well.

Product levels thickened throughout the second phase from 0.03 foot to 0.10 foot, possibly in response to the gradient created by the submersible (groundwater depression) pump. After product levels recovered (1245 hours), the peristaltic pump was turned on until the end of the pumping test.

Phase II (3.0 gpm) ended at 1930 hours after inducing 1.5 feet of total drawdown. Drawdown in the pumped well stabilized at 1.5 feet within 25 minutes after starting to pump at 3.0 gpm. Approximately 1,526 gallons of groundwater were removed during this phase.

2.4.3.3 Phase III, Free-Phase Product Removal and Groundwater Depression at 7.1 gpm At the end of Phase II (1930 hours), the peristaltic pump was readjusted to a flow rate of 7.1 gpm to start Phase III. This rate was maintained until the pumping test ended at 0120 hours on January 13, 1994. Product thickness also increased during this phase, although the product was emulsified. Removal of groundwater at a rate of 7.1 gpm from the pumped well induced an additional 2.0 feet of drawdown for a total of 3.5 feet drawdown.

Phase III of the pumping test ended when the storage tank was full. Both pumps were shut off and the recovery phase began. Approximately 2,486 gallons of groundwater were removed during the third phase. Approximately 4,010 gallons of groundwater were removed during all phases of the pumping test. Groundwater samples were collected at 2300 hours on January 12, 1994, to be analyzed for engineering and treatability parameters.

The pumping test indicated that groundwater depression enhanced product thickness and, therefore, product recovery (see Table 2-4).

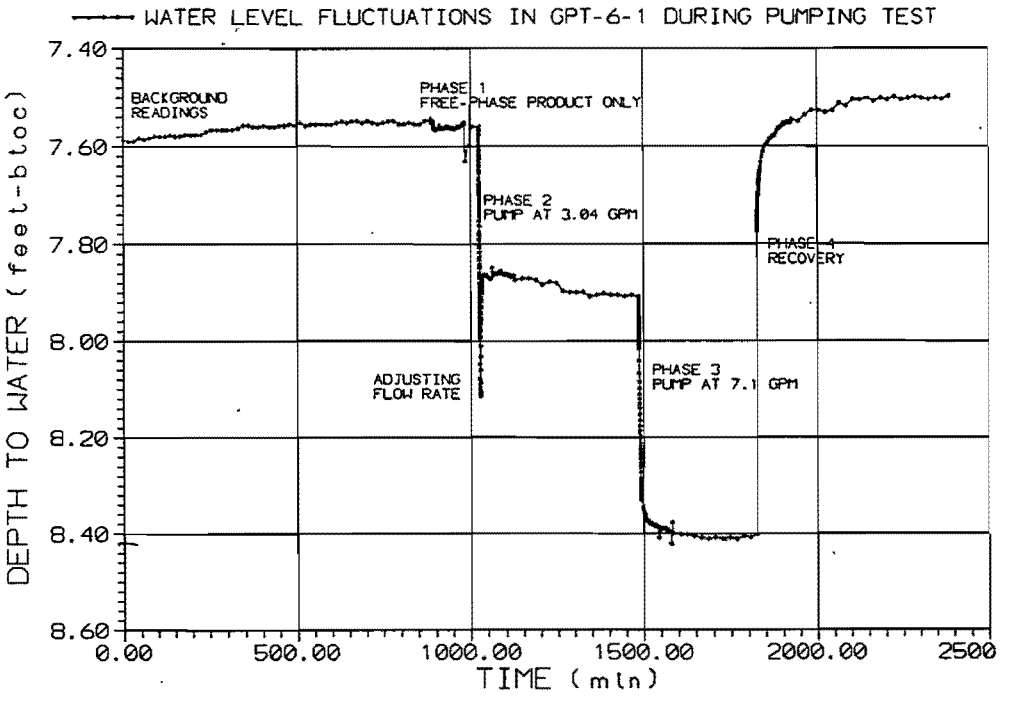
2.4.3.4 Phase IV, Recovery The recovery of groundwater levels was measured from the end of Phase III until 1100 hours on January 13, 1994. Groundwater levels recovered fully in all monitoring wells prior to ending the recovery phase. The product thickness in the pumped well at 0950 hours on January 13 was 0.23 foot. Levels of groundwater in all wells recovered above those observed during background readings. This pattern reflects an overall recharge of groundwater levels in the surficial aquifer, which may be attributable to several rainfall events prior to and during the pumping test.

2.4.4 Hydrographs of Water Level Fluctuations During the Pumping Test Hydrographs of water level fluctuations are provided for all instrumented wells in Figures 2-3 through 2-6. Barometric fluctuations during the pumping test are provided in Figure 2-6.

2.4.4.1 Background Readings Increasing water levels were observed in all instrumented wells during background readings except in the pumped well, which was not monitored until Phase I. In general, water levels in the shallow wells (GPT-6-1, GPT-6-3, GPT-6-4, GPT-6-6, and GPT-6-RW) increased approximately 0.04 foot, and water levels in the deep wells (GPT-6-5 and GPT-6-7) increased approximately 0.02 foot. Background readings are included on the hydrographs.

2.4.4.2 Phase I, Free-Phase Product Only During Phase I of the pumping test, only free-phase product was removed from the pumped well (GPT-6-RW). The drawdown in the pumped well was 0.04 foot.

2.4.4.3 Phase II, Free-Phase Product Removal and Groundwater Depression at 3.0 gpm The second phase of the pumping test began when the submersible pump was used. Initial pumping rates during this phase were 9.6 gpm. The flow rate was reduced to 3.0 gpm. The period of adjusting the flow rate is reflected in the hydrographs as a downward spike. As expected, the spike is most pronounced in



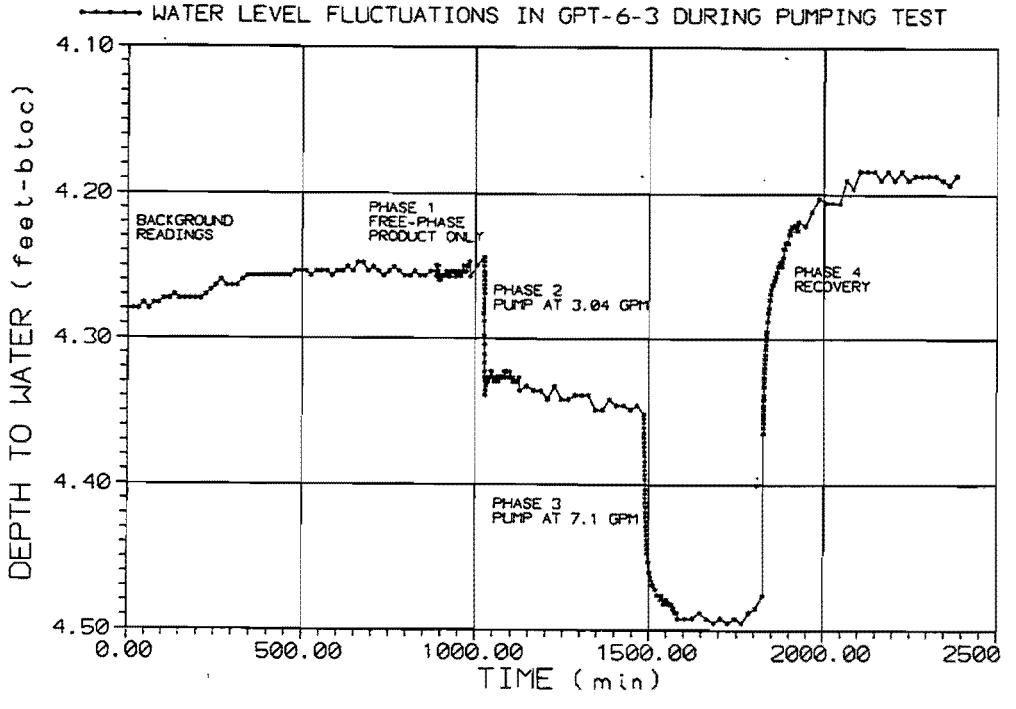


FIGURE 2-3

HYDROGRAPHS 6-1 AND 6-3

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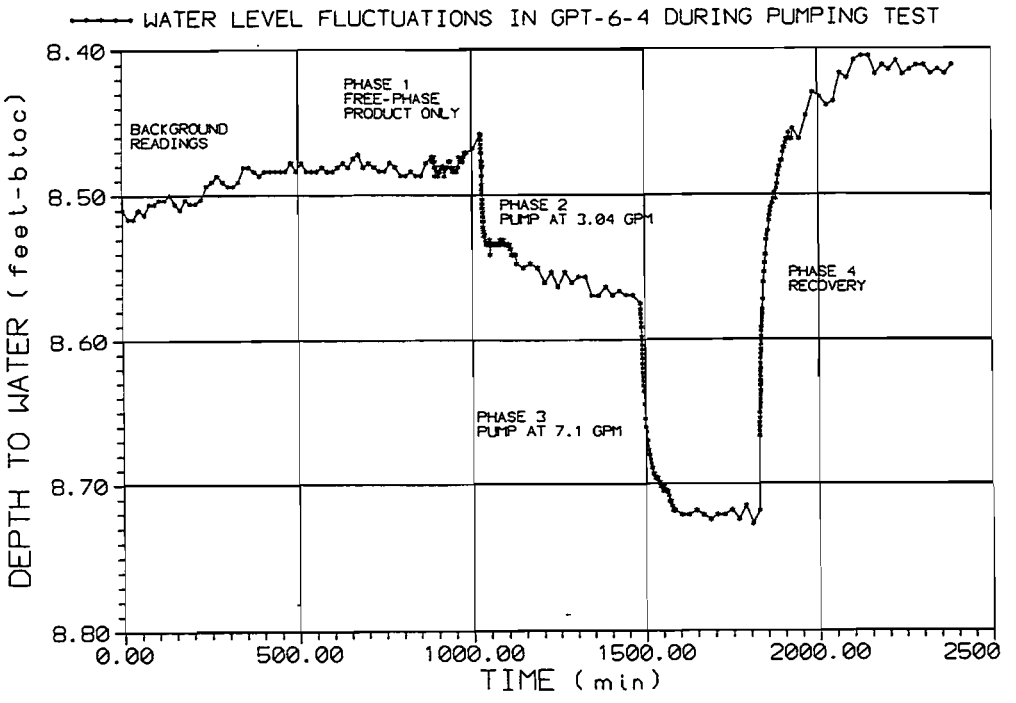

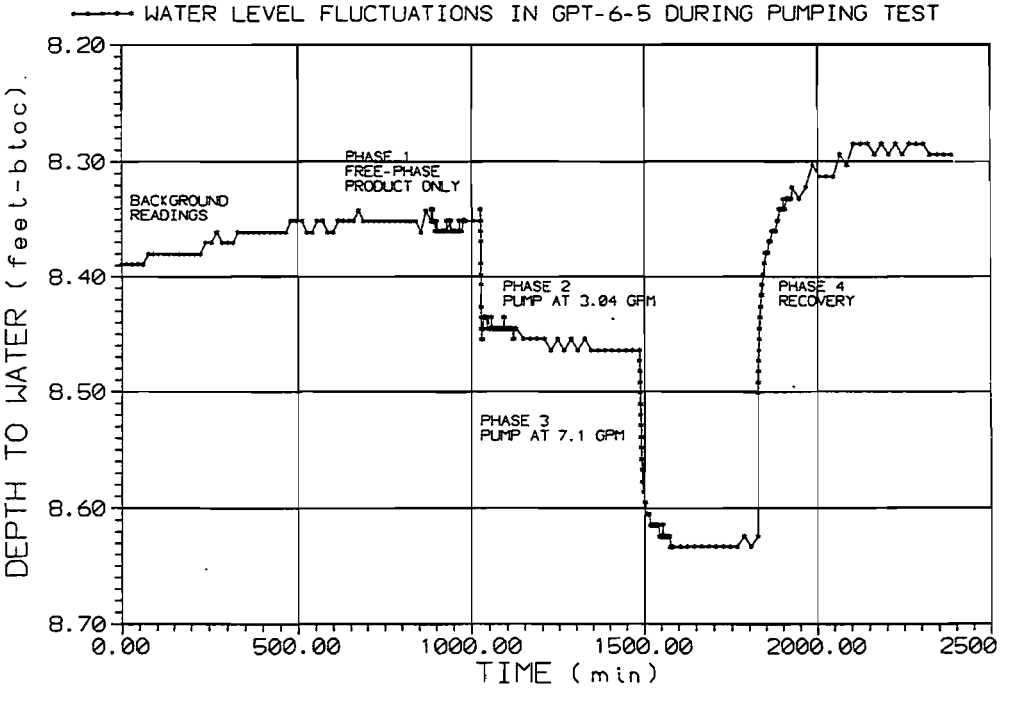

FIGURE 2-4

HYDROGRAPHS 6-4 AND 6-5

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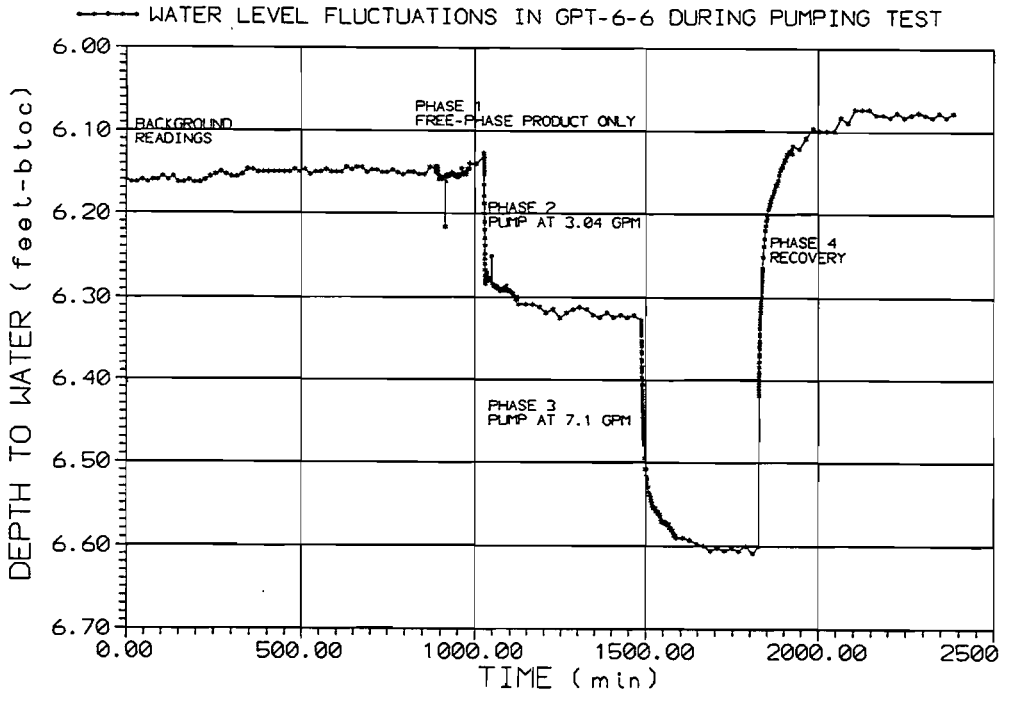

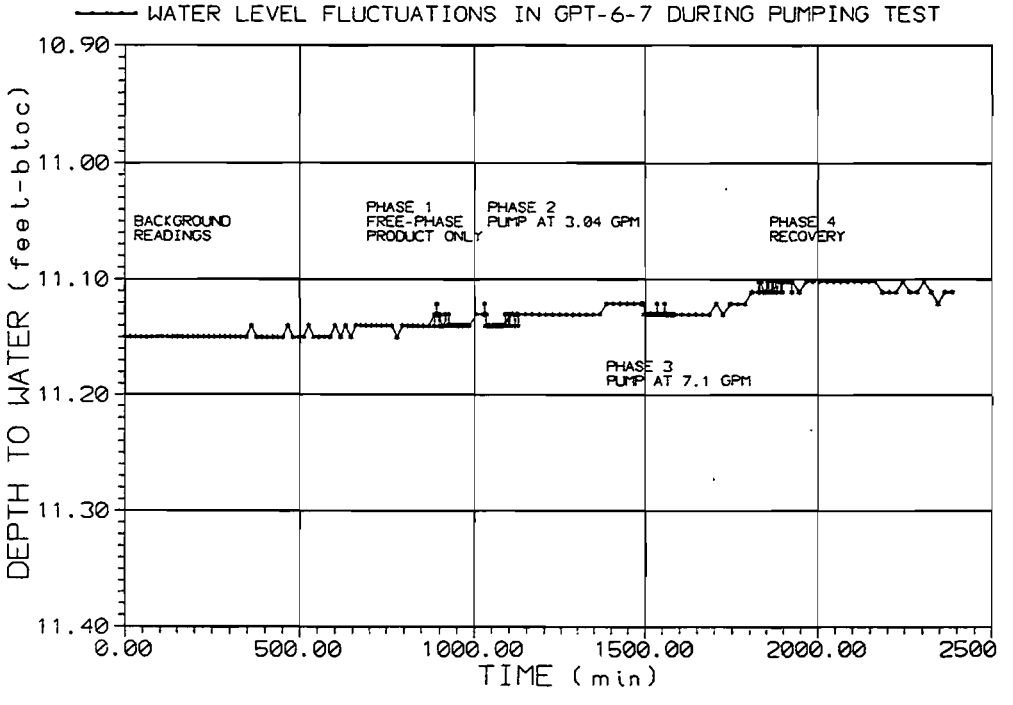

FIGURE 2-5

HYDROGRAPHS 6-6 AND 6-7

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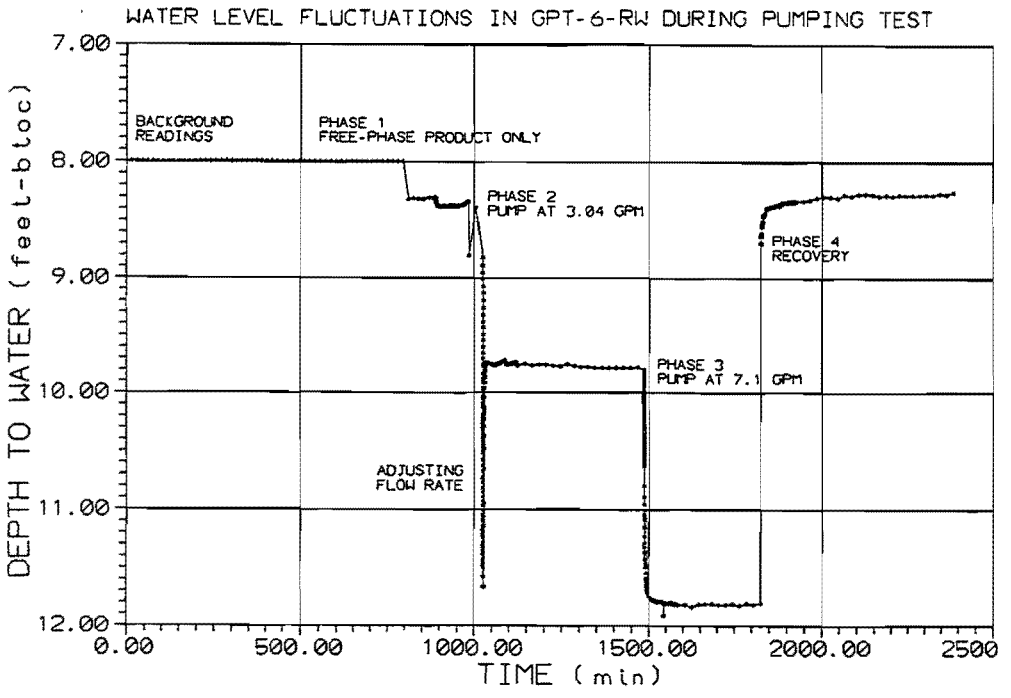

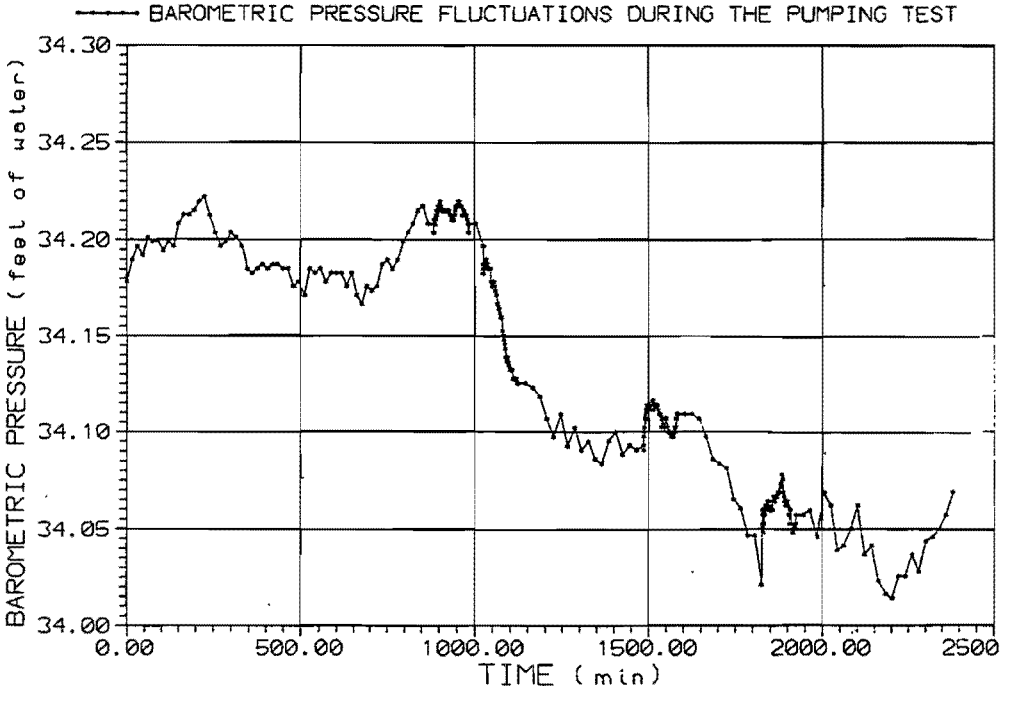

FIGURE 2-6

HYDROGRAPHS 6-RW AND BAROMETRIC FLUCTUATIONS

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the pumped well (1.8 feet) (see Table 2-4); the closest monitoring well (GPT-6-1) exhibits a pronounced spike of 0.26 foot.

Every well except GPT-6-7 responded to withdrawals of 3.0 gpm from the pumped well. The response observed in the monitoring wells was influenced by two variables: the distance from the pumped well and the depth of the screened interval. The wells closer to the pumped well exhibited the most drawdown, but depth was also a factor. GPT-6-4 and GPT-6-5 are a well pair with GPT-6-4 screened across the water table and GPT-6-5 screened from 26.6 to 31.6 feet bls. Water levels in GPT-6-4 decreased more rapidly than in GPT-6-5 (even though it is 7 feet farther away), but GPT-6-5 had more total displacement by the end of the test. GPT-6-6 and GPT-6-7 are a well pair 35 and 30 feet, respectively, west of the pumped well. GPT-6-6 has a screen that intercepts the water table and GPT-6-7 has a screen from 39.4 to 44.4 feet bls. Water levels in GPT-6-6 responded almost immediately after the groundwater depression pump was turned on, whereas the deeper GPT-6-7 did not respond at all during the test (Table 2-5).

Table 2-5
Water Level Drawdowns

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well Number	Drawdown Phase I (feet)	Drawdown Phase II (feet)	Drawdown Phase III (feet)	Total Drawdown (feet)
GPT-6-RW	0.04	1.35	2.05	3.44
GPT-6-1	0.01	0.34	0.52	0.87
GPT-6-2	NR	0.09	0.23	0.32
GPT-6-3	NR	0.10	0.14	0.24
GPT-6-4	NR	0.12	0.16	0.28
GPT-6-5	NR	0.11	0.18	0.29
GPT-6-6	0.01	0.19	0.28	0.48
GPT-6-7	NR	NR	NR	NR

Note: NR = no response.

This lack of measurable response in well GPT-6-7 may indicate that an anomalous condition exists at this depth or zone. This zone is well below the free-phase product and should not affect product recovery operations. The lack of response may also be due to the limited period of pumping from GPT-6-RW; water may not have been released from storage from this zone during the pumping period.

Product thickness in the pumped well increased during this phase in response to the gradient created by the groundwater depression pump.

2.4.4.4 Phase III, Free-Phase Product Removal and Groundwater Depression at 7.1 gpm The flow rate of the peristaltic submersible pump was increased to 7.1 gpm at the beginning of Phase III. Water levels in all instrumented monitoring wells except GPT-6-7 responded almost immediately.

Water levels again stabilized in all monitoring wells but increased distance and greater screened interval depth delayed stabilization.

2.4.4.5 **Phase IV, Recovery** The recovery phase of the pumping test began at 1,820 minutes into the pumping test when the peristaltic pump was turned off. Recovery of water levels to pre-pumping levels occurred rapidly in all wells. In fact, the groundwater levels recovered above pre-pumping test levels, which indicates a general trend of groundwater recharge. This is consistent with the increasing trend noted during background monitoring.

2.4.5 Barometric Readings During the Pumping Test Barometric pressure fluctuations during the pumping test are plotted and presented in Figure 2-6. A general trend towards lower pressure is observed throughout the test. Lower barometric pressure readings are indicative of the low pressure front that moved through the area during the pumping test.

2.4.6 Results of Pumping Test Several significant observations were made after initial review of the pumping test; they are as follows.

- The response of water levels in the monitoring wells indicated by the hydrographs demonstrated good hydraulic connection between the recovery well and the surficial aquifer.

- The increase in the free-phase product thickness levels during the second and third phases of the pumping test was in response to the gradient created by the submersible pump and product emulsification.

- The water level response in all the shallow wells suggests a minimum radius of influence of 120 feet from the recovery well, even at pumping rates as low as 3.0 gpm.

- Well GPT-6-7 did not respond to either 3.0 gpm or 7.1 gpm withdrawal from the recovery well. An anomalous condition or boundary condition may exist at this depth within the aquifer or it could be that the period of pumping was limited and did not stress the deeper part of the aquifer.

2.5 CONTAINMENT AND DISPOSAL OF INVESTIGATION-DERIVED WASTE. All investigation-derived wastes (IDW) generated during F-PPA activities were contained onsite in either U.S. Department of Transportation- (DOT) approved 55-gallon drums or in the 6,500-gallon storage tank.

At the end of the investigation, 33 drums of soil cuttings, decontamination water, and personal protective equipment (PPE) were stored on the western edge of Site 6. Also, the tank was filled to capacity (6,500 gallons) with groundwater from development and the pumping test.

Liquid wastes generated during investigations were transferred to the Navy for proper treatment and disposal by their oil recycling contractor.

All solid wastes (soil cuttings, PPE, and disposable equipment) will be disposed of by Waste Management at a later date.

3.0 HYDROGEOLOGICAL CONDITIONS

This chapter presents the results and analyzes the hydrogeologic information obtained during field activities at Site 6. Specifically, results and analyses of aquifer slug tests, the stepped pumping test, and groundwater flow direction and gradient are discussed.

3.1 GROUNDWATER FLOW DIRECTION. Groundwater flow direction and gradient across Site 6 were determined by generating potentiometric surface maps (Figures 3-1, 3-2, and 3-3). These maps show groundwater elevations from water level measurements taken on January 10, 11, and 13, 1994. Groundwater elevation was determined by subtracting the depth to water and product from the elevation of the top of casing. Depth to water in wells with free-phase product was corrected using a product density of 0.81 (groundwater elevation = water elevation - ((depth to product - product thickness) x 0.81)). The specific gravity was obtained during the analysis of free-phase product (Appendix E). Elevation data from the newly installed wells was provided by E. Patrick Cassady and Associates (1994), a licensed Mississippi surveyor. Initially, elevations of the existing wells were obtained from HLA (1987). A resurvey of elevations of previously existing wells that were tied into the newly installed wells revealed an error in elevations of previously existing wells. New survey data for GPT-6-1, GPT-6-2, GPT-6-3, and GPT-6-8 were incorporated in revised potentiometric surface maps presented in this section.

Groundwater flow across Site 6 is generally to the west as shown in Figures 3-1, 3-2, and 3-3. However, the gradient flattens out or even reverses as is exhibited in Figure 3-3 on the western edge, which is probably the result of groundwater mounding as the ditch discharges surface water into the surficial aquifer. The mounding of the groundwater near the ditch may also explain why the free-phase product plume has not migrated farther to the west.

The variances in the three potentiometric surface figures, particularly Figures 3-1 and 3-2, may reflect uneven recharge rates in the surficial aquifer due to several rainfall events occurring on and before January 11, 1994. For this reason, the potentiometric surface map of water level readings on January 13 was used to calculate gradients across Site 6. The gradient across i_1, on Figure 3-3, is 0.006 foot per foot (ft/ft), and across i_2 it is 0.005 ft/ft.

3.2 AQUIFER TEST RESULTS. This section presents the hydraulic conductivity values that were calculated from aquifer slug testing and transmissivity, specific yield, and hydraulic conductivity values that were calculated from aquifer pumping test results.

3.2.1 Slug Test Results Analyses of the aquifer slug tests indicated hydraulic conductivity values (K) ranging from 2.0×10^{-4} to 2.4×10^{-3} centimeters per second (cm/sec) in the shallow monitoring wells, 2.2×10^{-3} to 3.5×10^{-3} cm/sec in GPT-6-7, and 5.2×10^{-3} to 5.6×10^{-3} cm/sec in GPT-6-5 (results from Geraghty & Miller, 1991). These results yield a geometric average of 2.9×10^{-3} cm/sec (excluding the results from GPT-6-4). The results from GPT-6-4 were excluded because they are an order of magnitude lower than all other results. This is probably because GPT-6-4 was installed in compacted fill material used in the north pit.

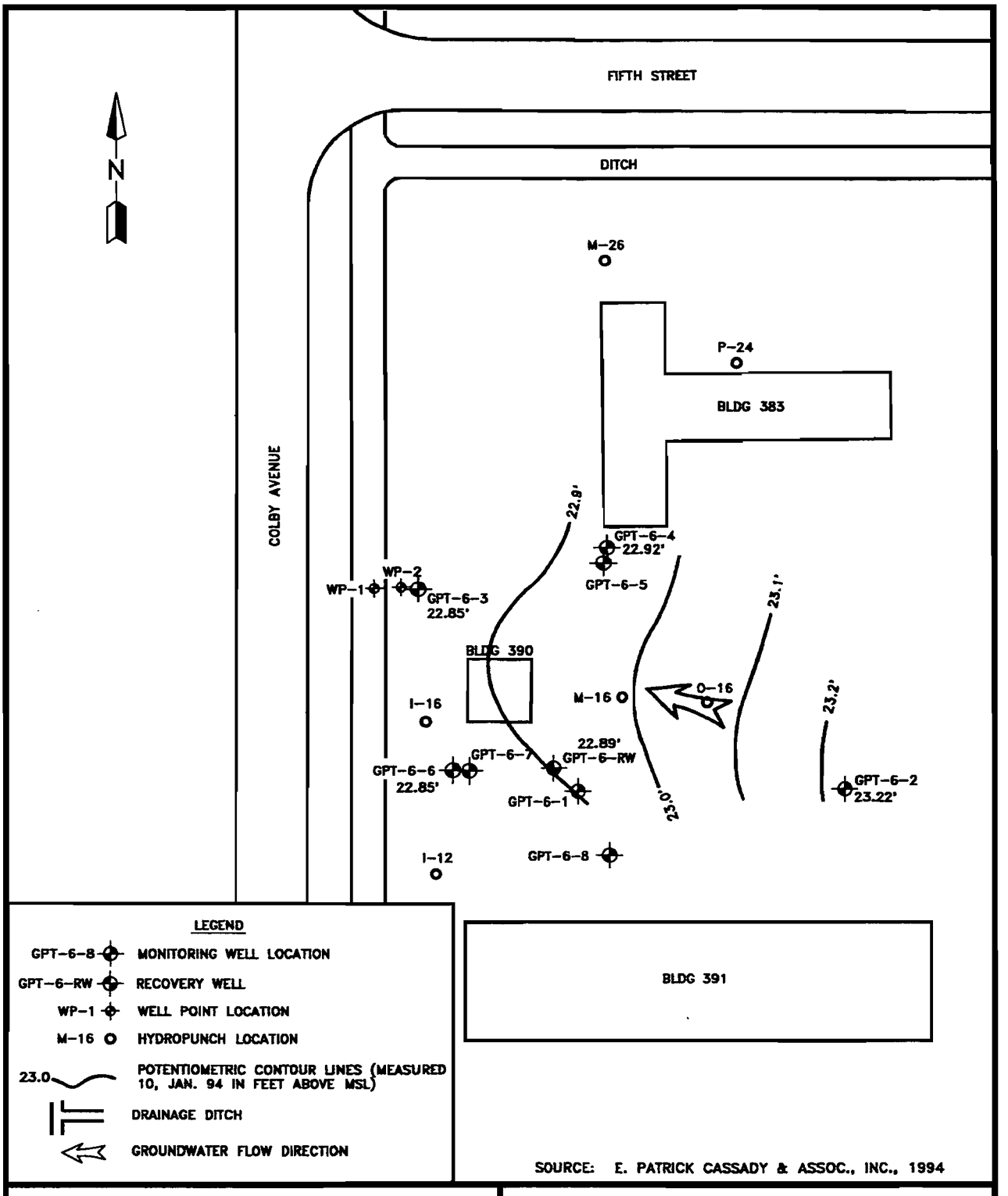

FIGURE 3-1

POTENTIOMETRIC SURFACE MAP
JANUARY 10, 1994
(REVISED MAY 27, 1994)

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NCBC GULFPORT
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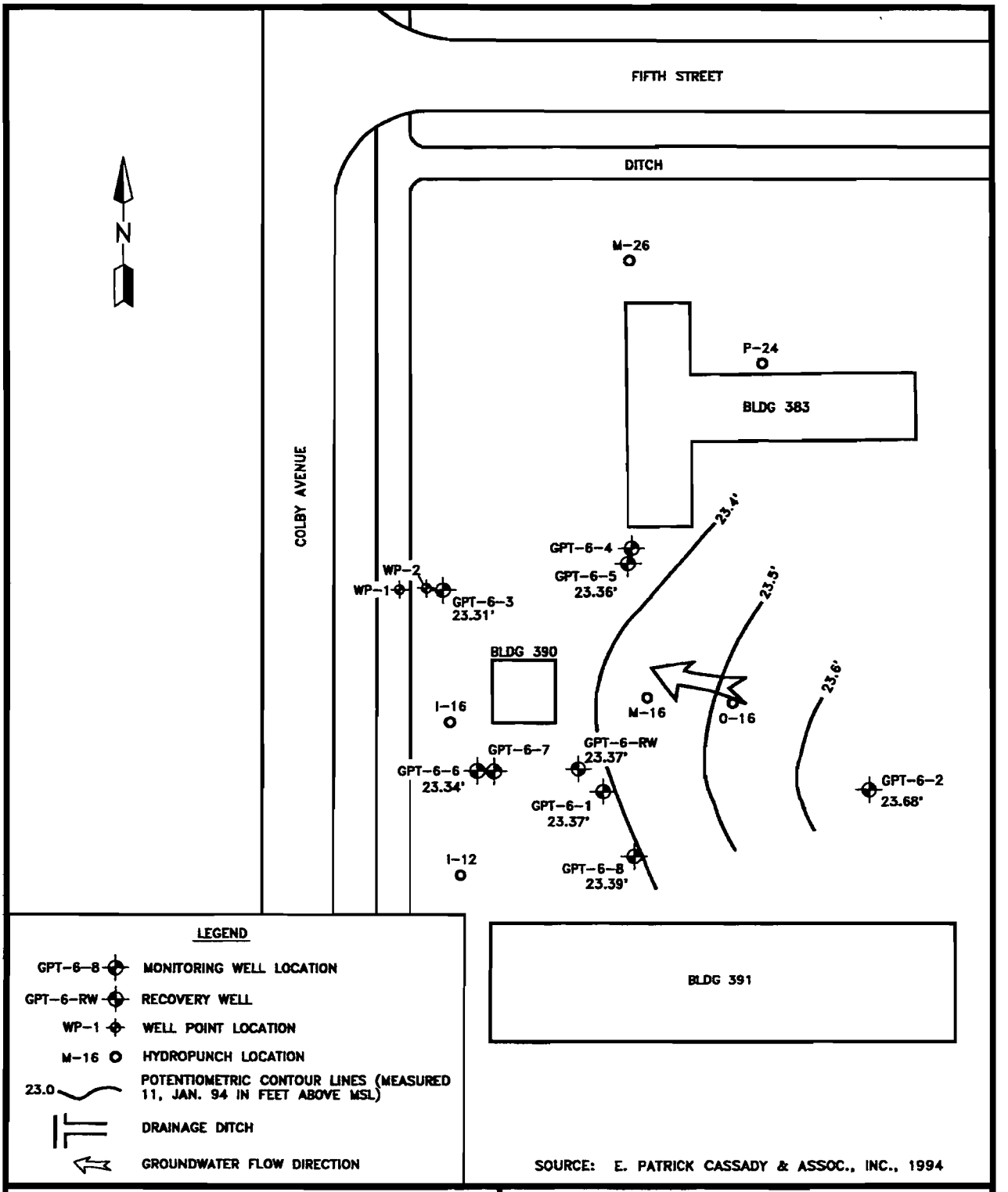

FIGURE 3-2

POTENTIOMETRIC SURFACE MAP
JANUARY 11, 1994
(REVISED MAY 27, 1994)

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GULFPORT, MISSISSIPPI

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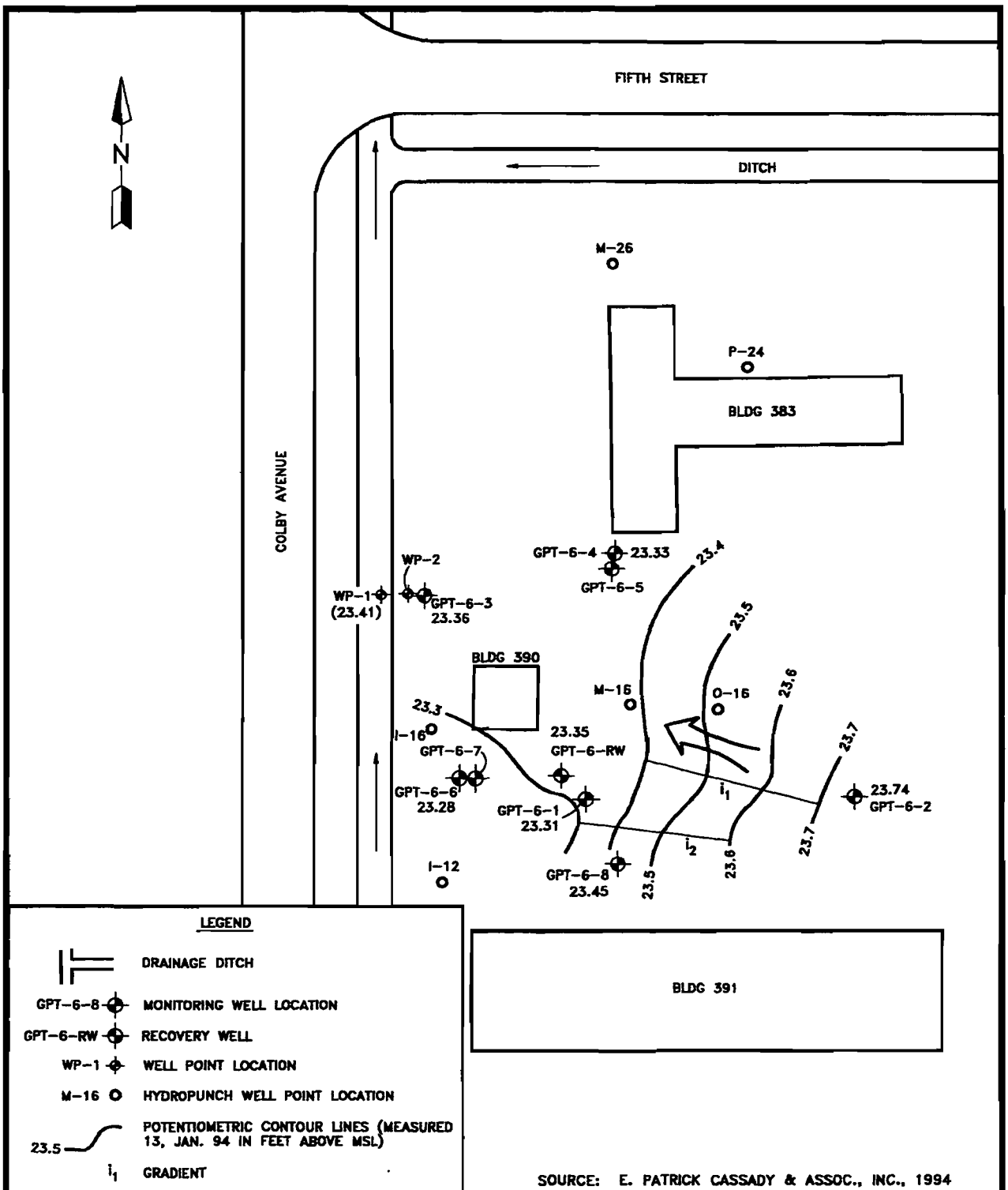

SOURCE: E. PATRICK CASSADY & ASSOC., INC., 1994

FIGURE 3-3

POTENTIOMETRIC SURFACE MAP
JANUARY 13, 1994
(REVISED MAY 27, 1994)

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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Table 3-1 presents tabulated slug test results, and Appendix C contains the graphical results of the slug tests.

Table 3-1
Slug Test Results

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well I.D.	Test No.	Hydraulic Conductivity ft/min	Hydraulic Conductivity cm/sec	Formation Characteristics
GPT-6-2	2	0.002002	0.001017	Fine- to medium-grained sand with little silt
GPT-6-3	4	0.00615	0.00312	Fine- to medium-grained sand with little silt
GPT-6-4[1]	0	0.0003983	0.0002025	Fine- to medium-grained sand with little silt
	1	0.0004488	0.0002281	Fine- to medium-grained sand with little silt
GPT-6-5	6[2]	0.01032	0.005246	Fine- to medium-grained sand with little silt
	7	0.01098	0.005581	Fine- to medium-grained sand with little silt
GPT-6-6[1]	2	0.004335	0.002204	Fine- to medium-grained sand with little silt
	3	0.004068	0.002068	Fine- to medium-grained sand with little silt
GPT-6-7	8[2]	0.004298	0.002185	Fine- to medium-grained sand with little silt
	9	0.006846	0.003480	Fine- to medium-grained sand with little silt
GPT-6-8[1]	4	0.004221	0.002146	Fine- to medium-grained sand with little silt
	5	0.004007	0.002037	Fine- to medium-grained sand with little silt

[1] Monitoring well with free-phase product.
[2] Falling head slug test.

Notes: I.D. = identification.
ft/min = feet per minute.
cm/sec = centimeters per second.

Rising head slug tests were performed on existing wells GPT-6-2 and GPT-6-3 in November 1993. (GPT-6-1 was not tested due to the presence of free product.) The results of these tests (see Table 3-1 and Appendix C) are hydraulic conductivities of 1.0×10^{-3} cm/sec for GPT-6-2 and 9.1×10^{-3} cm/sec for GPT-6-3. These hydraulic conductivity results are similar to those from the newly installed monitoring wells. Conductivities of this magnitude are typical for the fine- to medium-grained sands with little silts, which were observed during drilling operations and confirmed by grain size analyses.

<u>3.2.2 Aquifer Pumping Test Results</u> This subsection presents the aquifer pumping test results as analyzed by three different methods: Jacob straight-line, Neuman, and distance drawdown (Fetter, 1988). The distance drawdown solution is then used to model the capture zone at 7.1 gpm.

3.2.2.1 Jacob Straight-Line Method Using the Jacob straight-line method, drawdown data are plotted on semilogarithmic paper, and a straight line is drawn through the field data points and extended to the zero drawdown axis. The value of the drawdown per log cycle is obtained from the slope of the graph. The values of transmissivity and specific yield are then determined using the following equations:

$$T=\frac{2.3Q}{4\pi\Delta(h_o-h)} \quad (2)$$

and

$$S=\frac{2.25Tt_o}{r^2} \quad (3)$$

where

Q	= constant rate of pumpage (cubic feet per day [ft^3/day]),
$\Delta(h_o-h)$	= drawdown per log cycle of time (feet),
T	= transmissivity (square feet per day [ft^2/day]),
S	= storativity (dimensionless),
r	= the distance to the pumping well (feet), and
t_o	= time at zero drawdown from straight line extension (days).

Calculations were performed to determine the time when the casing storage effect would become negligible in the recovery well. These calculations are necessary to determine when time-drawdown data becomes useable for Jacob straight-line analyses. Using a method described by Schafer (from Driscoll, 1986):

$$tc = \frac{0.6(dc^2 - db^2)}{Q/s} \quad (4)$$

Where:

tc	= time in minutes,
dc	= inside diameter of well casing,
dp	= outside diameter of pump-column pipe, and
Q/s	= specific capacity in gallons per minute per foot of drawdown at time of tc.

The casing storage effect becomes negligible at approximately 8.5 minutes.

Jacob straight-line solutions for monitoring wells GPT-6-1, GPT-6-4, and GPT-6-6 during Phase II (3.0 gpm) of the pumping test are in Appendix C. Transmissivity and hydraulic conductivity values from the Jacob straight-line solutions are summarized in Table 3-2, aquifer testing results.

Storativity values ranged from 10^{-2} to 10^{-4}, much lower than would be expected from a fine- to medium-grained sands surficial aquifer. This could be an indication of delayed yield from the aquifer. Also, because the pumping test was concluded when the onsite tank was full, the resolution of this effect could not be fully determined.

3.2.2.2 **Neuman Method** The Neuman solution is a good method to check the values obtained from the Jacob straight-line solution. The Neuman solution for GPT-6-4 during Phase II was obtained using AQTESOLV™ software (Geraghty and Miller, 1991) and is in Appendix C. The transmissivity value was 0.7126 cubic feet per minute, which is equal to 1,026.1 ft^2/day. The Jacob straight-line solution for GPT-6-4 during Phase II was 2,142.2 ft^2/day.

3.2.2.3 **Distance-Drawdown Method** The distance-drawdown version of the Jacob straight-line method employed by ABB-ES is in Appendix C. Using simultaneous drawdown observations in the monitoring wells at Site 6, drawdown is plotted on an arithmetic scale as a function of the distance from the pumping well on the logarithmic scale (Fetter, 1988). As before, a line is extended until it intercepts the zero-drawdown line. This is designated as r_o, the distance at which the recovery well is not affecting the water level.

Table 3-2
Aquifer Testing Results

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

	Phase II (3.0 gpm)		Phase III (7.1 gpm)	
Well Number	Transmissivity (ft^2day)	Hydraulic Conductivity Value (cm/sec)	Transmissivity (ft^2day)	Hydraulic Conductivity Value (cm/sec)
		Jacob Straight-Line Solutions		
GPT-6-1	978.7	1.3×10^{-2}	ND	ND
GPT-6-4	2,142.2	7.6×10^{-1}	1,786.7	2.1×10^{-2}
GPT-6-6	[1]9,737.1	[1]3.4	ND	ND
		Distance Drawdown Method		
All Monitoring Wells	194	2.5×10^{-3}	166	2.2×10^{-3}

[1] Values too high for the aquifer.

Notes: gpm = gallons per minute.
ft^2/day = squared feet per day.
cm/sec = centimeters per second.
ND = not detected.

The values of transmissivity and storativity using the distance drawdown method were determined by using:

$$T = \frac{70Q}{\Delta(h_o - h)} \tag{5}$$

and

$$S = \frac{Tt}{640r^2} \tag{6}$$

where

- Q = constant rate of pumpage (ft^3/day),
- $\Delta(h_o-h)$ = drawdown per log cycle (feet),
- r_o = the distance at zero drawdown from straight-line extension (feet),
- t = time since pumping began (days),
- T = transmissivity (ft^2/day), and
- S = storativity (dimensionless).

Results from Phase II and Phase III are included in Appendix C and summarized in Table 3-2.

The transmissivity values obtained using the distance-drawdown method for Phase II and Phase III were similar (194 ft^2/day and 166 ft^2/day, respectively), whereas the time-drawdown method values ranged from 1,786.7 ft^2/day to 9,737.1 ft^2 day for GPT-6-4 and GPT-6-6.

The storativity values varied as well, but the distance-drawdown method results correlated better than the time-drawdown method. The low (10^{-2} and 10^{-4}) storativity values were unrealistic for an unconfined sand aquifer.

The calculated radius of influence of the recovery well at 3.0 gpm is approximately 120 feet. The radius of influence increased to approximately 140 feet at the pumping rate of 7.1 gpm. A cone of depression map (Figure 3-4) shows the amount of drawdown in the monitoring wells that resulted from pumping the recovery well at 7.1 gpm.

3.3 CAPTURE ZONE ANALYSIS. The calculated radius of influence developed by pumping at 7.1 gpm was estimated to be approximately 140 feet. This estimate was developed by projecting the distance versus drawdown plot to intersect the distance axis at a drawdown of zero. Actual drawdowns related to pumping at 7.1 gpm are shown on Figure 3-4. The observed radius of influence ranged from 75 to 180 feet.

The capture zone created by pumping at 7.1 gpm (Phase III) was derived empirically by superimposing of the cone of depression on the baseline potentiometric surface of prepumping water levels. The point of inflection was interpreted to be 75 feet downgradient of GPT-6-RW and the lateral limits of influence were interpreted to be 180 feet to the north and 80 feet to the south. The resulting capture zone is shown on Figure 3-5. This capture zone is overlaid on the known extent of free-phase product on Figure 3-5. This indicates that extraction of groundwater from GPT-6-RW would capture contaminants from the southern extent of the plume, but not the entire plume. The capture zone was left open-ended upgradient because closure was not well defined by the data.

The pumping test may not have been conducted over a sufficient time period to obtain reliable data for Phase III. Values obtained for Phase III may reflect a transitive state instead of a steady state condition. The following equation is designed to determine if a test has been conducted for a sufficient duration so that straight-line plots can be used for interpretation (Lohman, 1979).

$$t=\frac{r^2S}{4Tu} \qquad (7)$$

where

- t = minimum permissible pumping test (day),
- r = distance to farthest observation well (feet),
- S = storativity (dimensionless),
- T = transmissivity (ft^2/day), and
- u = well function value.

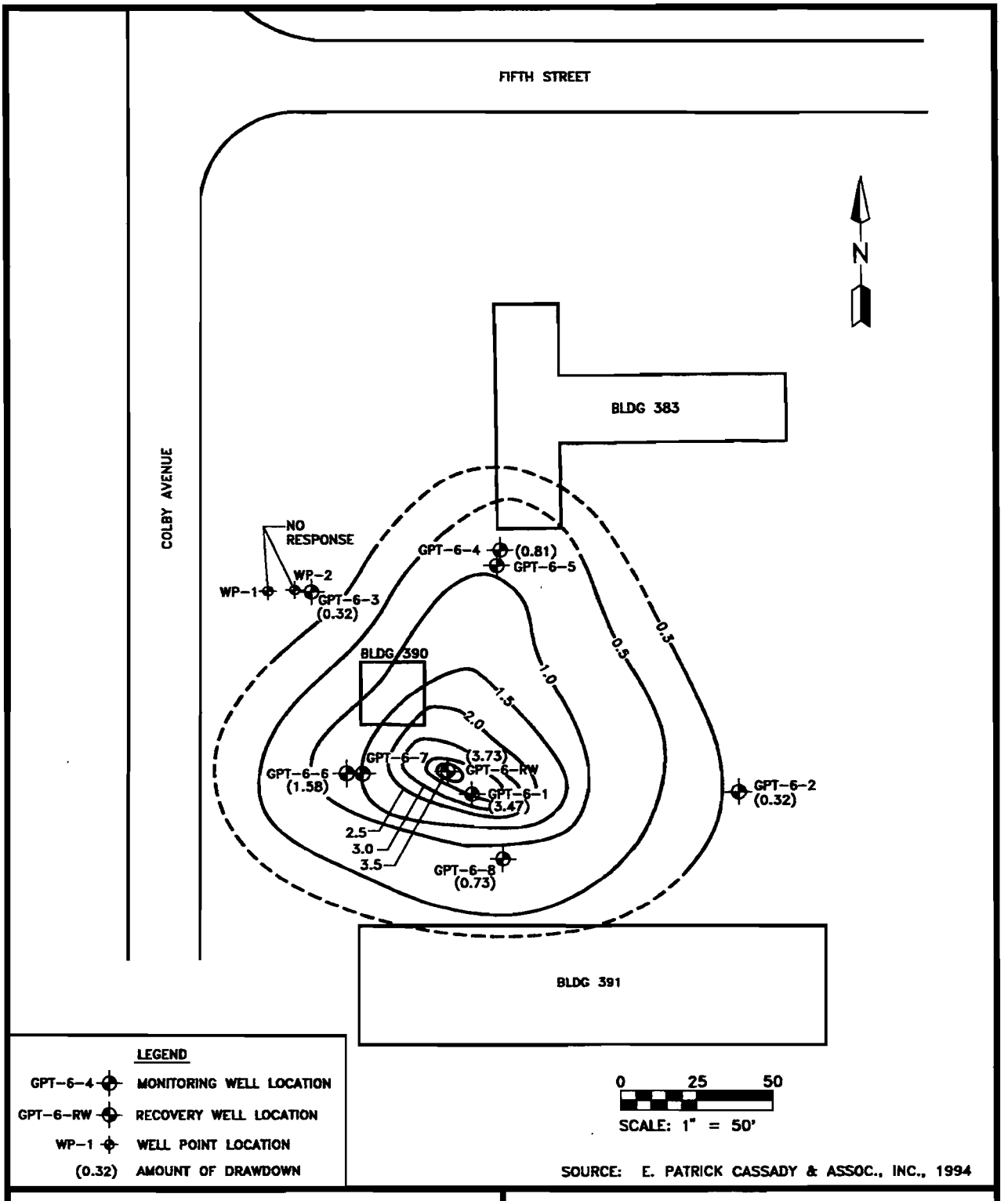

FIGURE 3-4

CONE OF DEPRESSION AT END OF PHASE III AT 7.1 GPM

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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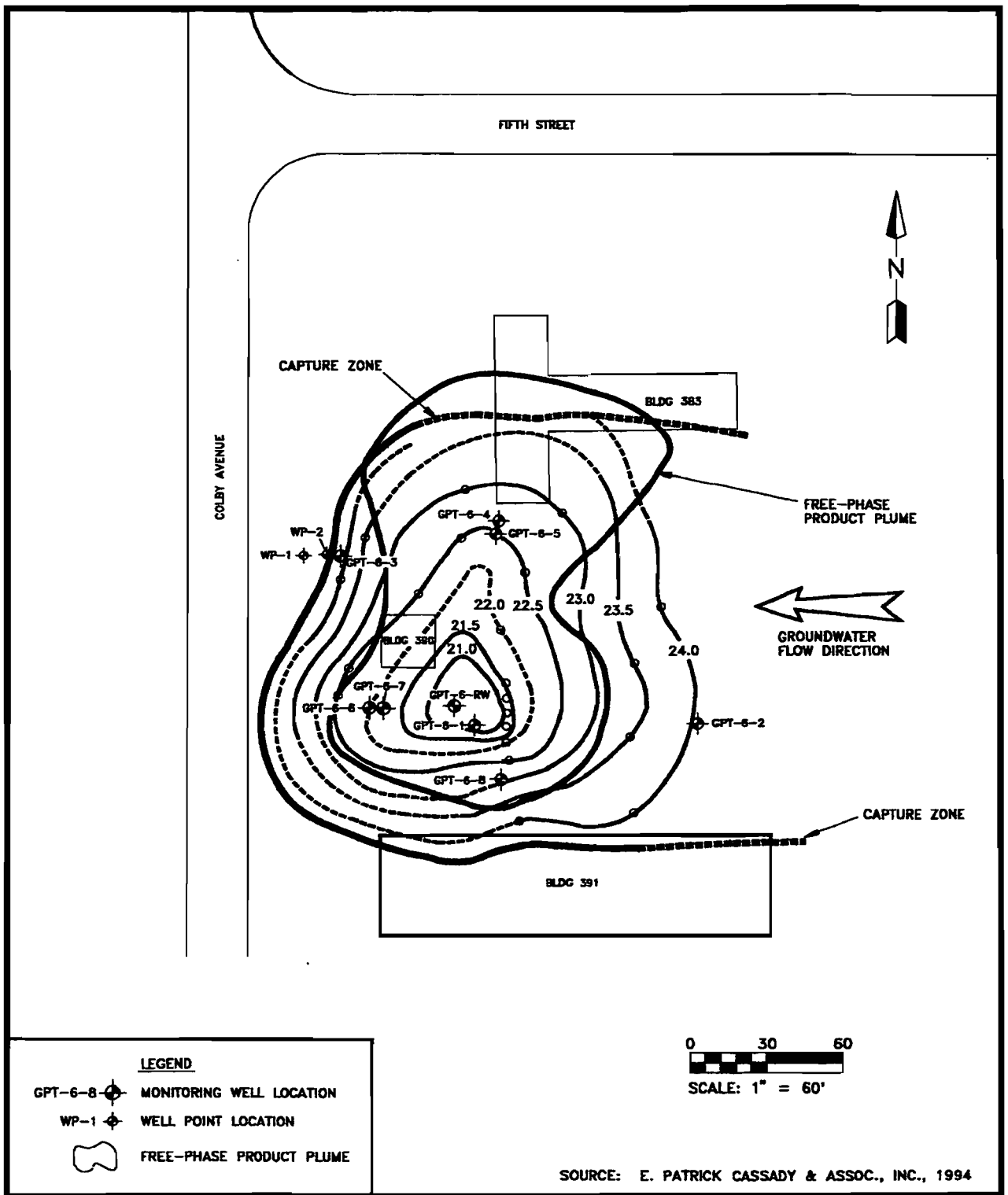

SOURCE: E. PATRICK CASSADY & ASSOC., INC., 1994

FIGURE 3-5

POTENTIOMETRIC SURFACE DURING PHASE III, 7.1 GPM

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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Using average values obtained from Phase II and assuming a storativity of 0.22, Phase III should have lasted approximately 20 hours for complete drainage at a radius of 35 feet from the pumping well. At a radius of 10 feet, the pumping test would need to last approximately 2 hours.

With the information and data collected from the pumping test, groundwater depression appeared to work well for free-phase product recovery. For complete remediation of the free-phase product, more sophisticated modeling will be done to screen several applicable technologies. A single recovery well at this site would require higher pumping rates, which may not produce optimum product recovery conditions and which may cause the free-phase product to remain in the vadose zone. This issue and other remedial options will be further addressed in Chapter 5.0 and during the actual design phase.

4.0 NATURE OF CONTAMINATION

4.1 DATA QUALITY OBJECTIVES (DQOs). Data Quality Objectives (DQOs) refer to standards for analytical precision, accuracy, representativeness, completeness, and comparability (PARCC). Five DQO levels have been defined by the USEPA: Level I, Field Screening; Level II, Field Analysis; Level III, Laboratory Analysis; Level IV, Contract Laboratory Program-Routine Analytical Services (CLP-RAS); and Level V, Non-Conventional Parameter Analysis (USEPA, 1991a).

The Naval Energy and Environmental Support Activity (NEESA) has adopted three of these levels as QA requirements, Levels C, D, and E, which correspond with USEPA Levels III, IV, and V, respectively (NEESA, 1988). For the purposes of this document, the USEPA nomenclature (Levels I through V) will be used.

4.1.1 General Description The DQO level needed for a specific task is generally based on the intended use of the data and on the limitations of the analytical instrumentation. Many field screening and field analytical techniques are intended to provide a rapid turn-around time and qualitative data for decision-making in the field. Field techniques necessarily involve rugged instrumentation with less sample preparation and rapid analysis. More precise and accurate analytical methods are used when both qualitative and quantitative data are needed, such as to support site characterization confirmation, enforcement, treatability, and/or remedial action. The DQO level also specifies laboratory QC requirements and the deliverable package associated with the analysis. The five broad categories of DQOs are outlined in the Free-Phase Product Assessment/Interim Action Design workplan (ABB-ES, 1993).

4.1.2 Task-Specific DQOs Tasks for the free-phase product investigation involved data collection with DQOs ranging from Level I through Level V. The following narrative discusses the primary tasks and the associated DQO level.

- Soil Sample Screening, Level I: Split-spoon samples from discrete depths in soil borings were screened in the field with an FID, providing Level I data concerning the presence or absence of volatile organic compounds (VOCs).

- Air-Quality Monitoring, Level I: For health and safety purposes, air quality was monitored in the breathing zone by FID, providing Level I data concerning the presence or absence of volatile compounds.

- Field Parameter Analysis, Levels I and II: Field measurements of surface water and groundwater temperature, pH, and specific conductance were performed to screen samples for laboratory analysis and to determine aquifer stabilization during well purging. These measurements were both quantitative and qualitative, and the data that was generated conformed with both Level I and II DQOs.

- Characterization and Confirmation Sampling, Level III: Groundwater and soil samples that were collected from wells and split-spoon soil sampling, respectively, were collected and analyzed in conformance with Level III DQOs and USEPA Contract Laboratory Program (CLP) methods.

- Engineering Treatability Parameters, Hydropunch™ Samples, and Grain Sieve Analysis, Level V: Samples that were collected to evaluate the effectiveness and feasibility of selected remedial alternatives and samples that were collected to characterize the free-phase product were analyzed in conformance with Level V DQOs.

These data were used, as applicable, for health and safety monitoring, site characterization, evaluating remedial alternatives, treatability studies, remedial action, and monitoring.

4.2 CHEMICAL ANALYSES. Sampling activities at NCBC Gulfport included the collection of free-phase product, soils, and groundwater. All samples were collected in accordance with the procedures outlined in the Gulfport Site 6 workplan (ABB-ES, 1993). Samples were submitted to an offsite laboratory for chemical and physical analyses. Table 4-1 summarizes the sampling and analysis program for samples collected according to Level III DQOs. Soil and groundwater

Table 4-1
Summary of Level III Sampling and Analysis Program

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Location and Type of Sampling	Laboratory Analysis							
	A	B	C	D	E	F	G	H
Gulfport Site 6 Number of Samples	Number of Samples							
Soil	7	7	3	3	2	3	4	3
Groundwater	7	7	3	3	3	3	5	3
Field Duplicates								
Soil	1	1	1	1	1	1	1	1
Groundwater	1	1	1	1	1	1	1	1
Quality Control Samples								
Trip blanks	3	0	0	0	0	0	0	0
Rinsate blanks (DI, PI, and ER)	5	5	4	4	4	4	4	4
Matrix spike and matrix spike duplicate	2	2	2	2	2	2	2	2

Notes:
A = target compound list (TCL) volatile organic compounds.
B = TCL semivolatile organic compounds.
C = TCL organochlorine pesticides and polychlorinated biphenyls.
D = chlorinated herbicides.
E = total organic carbon.
F = polychlorinated dibenzo furans and furans.
G = total petroleum hydrocarbons.
H = TAL inorganics and cyanide.
DI = distilled water.
PI = potable water.
ER = equipment rinsate.

samples were analyzed in accordance with the CLP Statement of Work (SOW) for organic and inorganic analyses (USEPA, 1991b; 1991c) including target compound list (TCL) VOCs, semivolatile organic compounds (SVOCs), organochlorine pesticides and polychlorinated biphenyls (PCBs), TPH, and target analyte list (TAL) inorganics (including cyanide). Soil and groundwater samples were also analyzed for chlorinated herbicides, total organic carbon (TOC), and polychlorinated dibenzo-furans and dioxins according to USEPA Method 1613 (8290) (USEPA, 1983). A fingerprint analysis was run on the free-phase product samples, and the samples were analyzed for polychlorinated dibenzo-furans and dioxins

according to USEPA Method 1613 (8290) (USEPA, 1983). Engineering treatability parameters (ETPs) were collected in accordance with Level V (NEESA Level E) protocol and included alkalinity, biological oxygen demand (5-day) (BOD_5), color, total dissolved solids (TDS), total suspended solids (TSS), sulfate, chloride, chemical oxygen demand (COD), hardness, and filtered metals.

Table 4-2 lists the TCL organic analytes and TAL inorganic analytes included in the analytical program and the corresponding contract required quantitation limits (CRQLs). Table 4-3 lists the practical quantitation limits (PQL) for the chlorinated herbicides using Method 8150. There are no published PQLs in the SW-846 method manual for dioxins and furans. Table 4-4 provides a list of CLP and SW-846 groups and corresponding USEPA analytical method numbers.

Sample identifiers indicate the media or field blank, site location, sample location, and sample depth. The first two characters determine the type of media or field blank; SB refers to a subsurface soil boring, GW a groundwater sample, DB a distilled water blank, PB a potable water blank, and ER an equipment rinsate. The third and fourth characters indicate the site location which, for this sampling event, is always G6 referring to Gulfport NCBC Site 6. The fifth character refers to the sampling location. For instance, a 4 indicates that the sample was taken from well GPT-6-4. The subsurface soil samples have two additional characters indicating the beginning depth of the sampling interval. A sample taken from 3 to 5 feet at soil boring GPT-6-5 would have sample identifier SBG6503. Duplicate samples have a D at the end of the sample identifier.

4.3 DATA QUALITY ASSESSMENT. All soil and groundwater samples collected during the field effort were properly preserved, placed in coolers, and packed with ice immediately after their collection. All samples remained in the custody of the field operations leader until delivery to the courier service providing overnight shipment to the laboratory. All samples were shipped, complete with chain-of-custody forms, to the offsite laboratory within 24 hours for analyses. Upon arrival at the laboratory, the chain-of-custody form, contents, and preservation of the samples in each cooler were checked by laboratory personnel. After verification, the chain-of-custody form was signed by laboratory personnel and the samples were accepted for analyses.

Review of the field notebook and chain-of-custody forms did not indicate any non-conformances relative to field instrument calibration or sample handling. All required field QC samples were collected in conformance with the requirements of the USEPA, NEESA, and ABB-ES Quality Assurance Plans and the *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program* (NEESA, 1988). These field QC samples included field duplicates, equipment rinsate blanks, field blanks, and VOC trip blanks for each VOC sample shipment.

4.3.1 Validation The analytical results for the groundwater and soil samples that were collected according to Level III DQOs were evaluated and validated to determine data quality and usability. The USEPA functional guidelines for evaluating organic and inorganic data (USEPA, 1991b; 1991c) were used, where applicable, to validate the laboratory data. Appendix E contains the validated data tables. The free-phase product, DNAPLs, and ETP analyses conform to Level V criteria and were not reviewed or validated by the data validators. End users

Table 4-2
Target Compound List and target analyte list and Corresponding Contract Required Quantitation Limits

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Compound	CRQL[1] Soil (µg/kg)	CRQL[1] Water (µg/ℓ)
Volatile Organic Compounds		
Method: Contract Laboratory Program Statement of Work for Organic Analysis, Multi-media, Multi-concentration, USEPA Document No. OLM01.0, August 1991, (USEPA, 1991b).		
Chloromethane	10	10
Bromomethane	10	10
Chloroethane	10	10
Methylene chloride	10	10
Acetone	10	10
Carbon disulfide	10	10
2-Hexanone	10	10
1,1-Dichloroethene	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethene (total)	10	10
Chloroform	10	10
1,2-Dichloroethane	10	10
2-Butanone	10	10
1,1,1-Trichloroethane	10	10
Carbon tetrachloride	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
Trichloroethene	10	10
Dibromochloromethane	10	10
1,1,2-Trichloroethane	10	10
Benzene	10	10
trans-1,3-Dichloropropene	10	10
Bromoform	10	10
Bromodichloromethane	10	10
4-Methyl-2-pentanone	10	10
Tetrachloroethene	10	10
1,1,2,2-Tetrachloroethane	10	10
Toluene	10	10
Chlorobenzene	10	10
Ethylbenzene	10	10
Styrene	10	10

See notes at end of table.

Table 4-2 (Continued)
Target Compound List and target analyte list and Corresponding Contract Required Quantitation Limits

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Compound	CRQL[1] Soil (µg/kg)	CRQL[1] Water (µg/ℓ)
Xylene (total)	10	10
Semivolatile Organic Compounds		
Method: Contract Laboratory Program Statement of Work for Organic Analysis, Multi-media, Multi-concentration, USEPA Document No. OLM01.0, August 1991, (USEPA, 1991b).		
Phenol	330	10
bis(2-Chloroethyl)ether	330	10
1,3-Dichlorobenzene	330	10
1,4-Dichlorobenzene	330	10
1,2-Dichlorobenzene	330	10
Dibenzofuran	330	10
2-Methylphenol	330	10
2,2'-oxybis(1-Chloropropane)	330	10
4-Methylphenol	330	10
N-Nitroso-di-n-propylamine	330	10
Hexachloroethane	330	10
Nitrobenzene	330	10
Isophorone	330	10
2-Nitrophenol	330	10
2,4-Dimethylphenol	330	10
bis(2-chloroethoxy)Methane	330	10
2,4-Dichlorophenol	330	10
1,2,4-Trichlorobenzene	330	10
Naphthalene	330	10
4-Chloroaniline	330	10
Hexachlorobutadiene	330	10
4-Chloro-3-methylphenol	330	10
2-Methylnaphthalene	330	10
Acenaphthene	330	10
2,4-Dinitrophenol	800	25
4-Nitrophenol	800	25
Dibenzofuran	330	10
2,4-Dinitrotoluene	330	10
Diethylphthalate	330	10
4-Chlorophenyl-phenylether	330	10

See notes at end of table.

Table 4-2 (Continued)
Target Compound List and target analyte list and Corresponding Contract Required Quantitation Limits

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Compound	CRQL[1]	
	Soil (µg/kg)	Water (µg/ℓ)
Fluorene	330	10
4-Nitroaniline	800	25
4,6-Dinitro-2-methylphenol	800	25
N-Nitrosodiphenylamine	330	10
4-Bromophenyl-phenylether	330	10
Hexachlorobenzene	330	10
Pentachlorophenol	800	25
Phenanthrene	330	10
Anthracene	330	10
Carbazole	330	10
Di-n-butylphthalate	330	10
Fluoranthene	330	10
Pyrene	330	10
Butylbenzylphthalate	330	10
3,3'-Dichlorobenzidine	330	10
Benzo(a)anthracene	330	10
Hexachlorocyclopentadiene	330	10
Chrysene	330	10
2,4,6-Trichlorophenol	330	10
bis(2-Ethylhexyl)phthalate	330	10
2,4,5-Trichlorophenol	800	25
Di-n-Octyl phthalate	330	10
2-Chloronaphthalene	330	10
2-Nitroaniline	800	25
Dimethylphthalate	330	10
Acenaphthalene	330	10
2,6-Dinitrotoluene	330	10
3-Nitroaniline	800	25
Benzo(b)fluoranthene	330	10
Benzo(k)fluoranthene	330	10
Benzo(a)pyrene	330	10

See notes at end of table.

Table 4-2 (Continued)
Target Compound List and target analyte list and Corresponding Contract Required Quantitation Limits

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Compound	CRQL[1] Soil (µg/kg)	CRQL[1] Water (µg/ℓ)
Ideno(1,2,3-cd)pyrene	330	10
Dibenz(a,h)anthracene	330	10
Parameter: Organochlorine Pesticides and Polychlorinated biphenyls		
Method: Contract Laboratory Program Statement of Work for Organic Analysis, Multi-media, Multi-concentration, USEPA Document No. OLM01.8, August 1991, (USEPA, 1991a).		
alpha-BHC	1.7	0.05
gamma-BHC	1.7	0.05
beta-BHC	1.7	0.05
delta-BHC	1.7	0.05
Endosulfan I	1.7	0.05
Dieldrin	3.3	0.10
4,4'-DDD	3.3	0.10
Methoxychlor	17	0.5
Aroclor-1016	33	1.0
Aroclor-1242	33	1.0
Heptachlor	1.7	0.05
Aldrin	1.7	0.05
Endrin	3.3	0.10
4,4'-DDE	3.3	0.10
4,4'-DDT	3.3	0.10
Toxaphene	170	5.0
Aroclor-1221	67	2.0
Aroclor-1248	33	1.0
Aroclor-1260	33	1.0
Heptachlor epoxide	1.7	0.05
Endosulfan II	3.3	0.10
Endosulfan sulfate	3.3	0.10
Endrin ketone	3.3	0.10
Endrin aldehyde	1.7	0.05
alpha-Chlordane	1.7	0.05
gamma-Chlordane	1.7	0.05
Aroclor-1232	33	1.0
Aroclor-1254	33	1.0

See notes at end of table.

Table 4-2 (Continued)
Target Compound List and target analyte list and Corresponding Contract Required Quantitation Limits

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Compound	CRQL[1] Soil (µg/kg)	CRQL[1] Water (µg/ℓ)
Parameter: Inorganic Analytes		
Method: Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-media, Multi-concentration, USEPA Document No. ILM02.1, August 1991 (USEPA, 1991c).		
Compound	CRDL Soil (mg/kg)	CRDL Water (µg/ℓ)
Aluminum	40	200
Antimony	12	60
Arsenic	2	10
Barium	40	200
Beryllium	1	5
Cadmium	1	5
Calcium	1,000	5,000
Chromium	2	10
Cobalt	10	50
Copper	5	25
Iron	20	100
Lead	1	3
Magnesium	1,000	5,000
Manganese	3	15
Mercury	0.1	0.2
Nickel	8	40
Potassium	1,000	5,000
Selenium	1	5
Silver	2	10
Sodium	1,000	5,000
Thallium	2	10
Vanadium	10	50
Zinc	4	20
Cyanide	1	10

[1] CRQLs have been established for Contract Laboratory Program methodology but values may vary based on instrument performance and moisture content.

Notes:
- CRQL = Contract Required Quantitation Limit.
- µg/kg = micrograms per kilogram.
- µg/ℓ = micrograms per liter.
- USEPA = U.S. Environmental Protection Agency.
- BHC = benzene hexachloride.
- 4,4'-DDD = 4,4'-dichlorodiphenyldichloroethane.
- 4,4'-DDE = 4,4'-dichlorodiphenyldichloroethylene.
- 4,4'-DDT = 4,4'-dichlorodiphenyltrichloroethane.
- CRDL = Contract Required Detection Limit.
- mg/kg = milligrams per kilogram.

Table 4-3
Target Compound List for SW-846 Methods 8150 and 8290 and Corresponding Practical Quantitation Limits[1]

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

	Soil (µg/kg)	Water (µg/ℓ)
Parameter: Chlorinated Herbicides		
Method: USEPA SW-846 Method 8150 (USEPA, 1986)		
4-chloro-2-Methylphenoxy-acetic acid	50,000	2,500
Dalapon	1,160	58
mecoprop 4-Chloro-2-Methylphenoxy-propanoic acid	40,000	2,000
Dicamba	54	2.7
2,4-Dichlorophenoxyacetic acid (2,4-D)	240	12
Dichlorprop (2,4-DP)	130	6.5
Silvex (2,4,5-TP)	40	1.7
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	34	2.0
4-(2,4-Dichlorophenoxy)butanoic acid	182	9.1
Dinoseb	14	0.7

[1] Practical Quantitation Limits are established using SW-846 methodology and values may vary based on instrument performance and moisture content.

Notes: µg/kg = micrograms per kilogram. USEPA = U.S. Environmental Protection Agency.
µg/ℓ = micrograms per liter (parts per billion).

Table 4-4
Contract Laboratory Program and SW-846 Methods

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Method Name	Source	Description
CLP TCL Volatile Compounds	USEPA CLP, CLP SOW OLM01.8	GC and MS Volatile Compounds
CLP TCL Semivolatile Compounds	USEPA CLP, CLP SOW OLM01.8	GC and MS Semivolatile Compounds
CLP TCL PEST/PCB	USEPA CLP, CLP SOW OLM01.8	GC PEST/PCBs
CLP TAL Metals	USEPA CLP, CLP SOW ILM02.1	Metals
CLP Cyanide	USEPA CLP, CLP SOW ILM02.1	Cyanide
TPH 418.1 (9071/3550 extraction for soils)	SW-846	Total Petroleum Hydrocarbons
TOC 9060	SW-846	Total Organic Carbon
Herbicides 8150	SW-846	GC Herbicides
Dioxins and Furans 8290	SW-846	High Resolution MS Dioxins and Furans

Notes:
CLP = Contract Laboratory Procedure.
TCL = target compound list.
USEPA = U.S. Environmental Protection Agency.
SOW = Statement of Work.
GC = gas chromatograph.
MS = mass spectroscopy.
PEST/PCB = pesticides and polychlorinated biphenyls.
PCB = polychlorinated biphenyls.
TAL = target analyte list.
TPH = total petroleum hydrocarbons.
TOC = total organic carbon.

of these data, however, should review the analytical results. Analytical results for the non-validated samples are also in Appendix E.

4.3.2 Precision, Accuracy, Representativeness, Completeness, and Comparability
Data quality indicators of PARCC were evaluated for all data generated during this effort. Appendix F of this report contains a detailed evaluation of each PARCC parameter and data tables summarizing analytical results for matrix spike and matrix spike duplicate (MS/MSD) samples, initial and continuing calibration standards, field duplicate samples, and compounds detected in method blanks, trip blanks, rinsate blanks, and source-water blanks.

4.3.2.1 **Precision** Precision was met for all soil and groundwater data with a few minor exceptions. The soil samples exhibited noncompliance in three volatile compounds, one dioxin compound, seven metal analytes, and TPH. The noncompliances can be attributed to laboratory and/or field inconsistencies. Octachlorodibenzodioxin (OCDD) was reported as a maximum possible concentration (MPC) and should not be considered as a true positive result. A potential bias is present in calcium and results were qualified as estimated. The soil matrix analytical data were acceptable based on duplicate precision criteria.

The groundwater field duplicate exhibited noncompliance in 17 volatiles, 1 semivolatile, 1 dioxin, and 13 metals. Two volatile compounds, chloroethane and toluene, were qualified as estimated because concentrations exceeded the linear range, and one metal analyte, selenium, was qualified as estimated. The water matrix data were acceptable based on the assessment of duplicate precision criteria.

4.3.2.2 **Accuracy** Accuracy criteria were met for all data with the following minor exceptions. Soil samples SBG6503, SBG6503D, and SBG6508 exhibited some non-compliant surrogate recoveries. Volatile results for sample SBG6508 were qualified as estimated because of non-compliant recoveries. Positive volatile results for sample SBG6503D were also qualified as estimated because recoveries were unacceptable. The pesticides and PCBs for all three samples were qualified as estimated because of non-compliant recoveries. Based on the accuracy evaluation criteria, the soil matrix data were acceptable.

The groundwater matrix exhibited acceptable results with a few exceptions. Positive volatile results for samples GWG64 and GWG64D were qualified as estimated because surrogate recoveries were non-compliant. Semivolatile results for sample GWG64 were qualified as estimated for positive results and rejected for non-detected results because the MS/MSD experienced non-compliant percent recoveries. Pesticides and PCBs exhibited no spike recoveries resulting in non-detected results being rejected and positive results being qualified as estimated. Herbicide results for sample GWG66 were rejected because surrogate recoveries were low. Arsenic, thallium, and selenium results were qualified as estimated because spike recoveries were non-compliant. The groundwater matrix analytical data were acceptable with the exceptions of the pesticide and PCBs and herbicide fractions.

4.3.2.3 **Representativeness** Representativeness of the analytical data was assessed and corrective action was taken when necessary. No target analytes were detected in the trip blank samples. Four volatiles, one dioxin and furan, five metals, and TOC were detected in the field blank. The assessment of field blanks for representativeness was acceptable even though some of the metal analytes

required qualification. Three volatiles and OCDD were detected in the equipment rinsate blank. The assessment of equipment rinsate blank for representativeness was acceptable. Two volatiles, two semivolatiles, and three metal analytes were detected in the method blanks. The assessment of method blanks for representativeness was acceptable even through some of the analytical results were qualified. All holding times were met with the exception of PBG601RE for semivolatiles, which was rejected in favor of the original analysis.

4.3.2.4 **Comparability** Comparability is the qualitative measure designed to express the confidence with which one data set may be compared to another. The analytical samples were collected and transported to the chemical analytical laboratory in accordance with standard procedures and were analyzed in conformance with acceptable USEPA procedures. The analytical data are reported in standard units (micrograms per liter [$\mu g/\ell$], micrograms per kilogram [$\mu g/kg$], picograms per gram [pg/g], etc.).

4.3.2.5 **Completeness** The analytical data met the completeness goal of 85 percent for every fraction with the exceptions of pesticides, PCBs, and herbicides.

4.4 PHYSICAL RESULTS. Physical properties of the soil and general water quality of groundwater were analyzed to assist with the design of an effective remedial system. Two soil samples were collected during the Hydropunch™ II investigation and sent to an offsite laboratory for grain size, CEC, and TOC analyses. Both samples were collected from grid location M-18 (see Figure 2-1). The sample collected from 8 to 10 feet had a CEC of 5.7 milliequivalents per 100 grams (meq/100g) and a TOC of 2.23 percent. The 15- to 17-foot sample had a CEC of 4.1 meq/100g and a TOC of 2.43 percent. Laboratory results are in Appendix E.

One sample and a duplicate were collected from the recovery well during the stepped pumping test and sent to an offsite laboratory for analysis. Analytes included alkalinity, color, hardness, TDS, TSS, chloride, sulfate, BOD_5, and COD. Table 4-5 summarizes the analytical results. During the design of the remedial system, these results will assist in predicting and avoiding scaling and fouling of pipes and filters.

4.5 ANALYTICAL RESULTS. Samples were collected from the soil, free-phase product, and groundwater. Soil samples and groundwater samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, dioxins, furans, TPH, and TOC following Level III protocol. Validated summary tables for all of these samples, rinsates, and blanks are in Appendix E. Free-phase samples were collected for fingerprint and dioxin and furan analyses following Level V protocol.

Table 4-5
General Water Quality Physical Results from Groundwater Sampling

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Sample I.D. Analytical Parameter	GPT-6-RW ETPRW (mg/ℓ)	GPT-6-RW ETPRWD (mg/ℓ)
Alkalinity as $CaCO_3$	16	17
Color	0.0	0.0
Hardness as $CaCO_3$	44	37
Total dissolved solids	78	72
Total suspended solids	<1.0	<1.0
Chloride	9.4	9.9
Sulfate	14	14
BOD_5	6.7	13
Chemical oxygen demand	32	36

Notes: I.D. = identification. $CaCO_3$ = calcium carbonate.
mg/ℓ = milligrams per liter. BOD_5 = biological oxygen demand.

4.5.1 Compounds Detected in Soil Soil samples were collected from split spoons during the well installation. Results of VOC, SVOC, pesticide, PCB, and herbicide analyses of soil samples are summarized in Table 4-6.

A wide range of VOCs were detected in the soil samples. As expected, fuel constituents were detected at high concentrations. The largest concentrations were detected from boring GPT-6-5, which is located in the center of the north pit. Three samples were collected from boring GPT-6-5 to characterize the vertical extent of contamination. Figure 4-1 shows the locations and depths of the soil samples. Sample SBG6508 was collected from the 8- to 10-foot interval and had especially high concentrations ranging from 980 μg/kg tetrachloroethene to 19,000 μg/kg xylene. Sample SBG6503, collected from 3- to 5-foot interval, also contained VOCs with the higher concentrations being from fuel constituents. The deepest sample from boring GPT-6-5, SBG6520, indicated a much lower level of contamination. Samples SBG6708, SBG6720, and SBG6745 are from boring GPT-6-7, which is west of the south pit. SBG6708, collected from 8 to 10 feet, showed slight detections with a maximum concentration of 26 μg/kg xylene. The deeper samples reported fewer chemical detections at lower concentrations.

SVOCs were detected at high concentrations in sample SBG6508. Again, fuel constituents were detected at the highest concentrations: 28,000 μg/kg of 2-methylnaphthalene and 7,600 μg/kg of anthracene. 2-Methylphthalene and anthracene were also detected at high concentrations in samples SBG6520 and SBG6708.

No pesticides, PCBs, or herbicides were detected in soil samples. Samples SBG6720 and SBG6720D were analyzed for TOC with values of 1,960 and 2,030

Table 4-6
Compounds Detected in Soil

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Depth Analyte	GPT-6-5 3 to 5 ft SBG6503[1]	GPT-6-5 3 to 5 ft SBG6503D[1,2]	GPT-6-5 8 to 10 ft SBG6508[1,2]	GPT-6-5 20 to 23 ft SBG6520
Volatile Organic Compounds (µg/kg)				
1,1-Dichloroethene	1 J	11 U	17 J	12 U
1,1-Dichloroethane	3 J	11 U	38 J	12 U
1,2-Dichloroethene (total)	7 J	11 U	23 J	12 U
1,2-Dichloroethane	4 J	11 U	70 J	12 U
2-Butanone[3]	10 J	11 U	11 UJ	12 U
1,1,1-Trichloroethane	11 U	11 U	27 J	12 U
Trichloroethene	3 J	3 J	39 J	12 U
Benzene	20	12 J	170 J	4 J
Tetrachloroethene	63	51 J	980 J	10 J
Toluene[4]	160	140 J	5,200 J	73
Ethylbenzene[4]	170	110 J	2,700 J	34
Xylene (total)	590	400	19,000 J	240
Semivolatile Organic Compounds (µg/kg)				
4-Methylphenol	250 J	350 J	3,700 U	400 U
Naphthalene	300 J	310 J	4,800	330 J
2-Methylnaphthalene	260 J	370 U	28,000	2,300
Acenaphthene	370 U	370 U	720 J	400 U
Fluorene	370 U	370 U	4,400	410
Phenanthrene	370 U	370 U	2,100 J	260 J
Anthracene	370 U	370 U	7,600	830
Pyrene	370 UJ[4]	370 U	1,400 J	400 U
Pesticides (µg/kg)	ND	ND	ND	NA
Herbicides (µg/kg)	ND	ND	ND	NA
Total Organic Carbon (mg/kg)	ND	ND	ND	NA
Total Petroleum Hydrocarbons (mg/kg)	88,000	16,000	15,300	NA
Dioxins and Furans (pg/g)				
Octachlorodibenzodioxin	130 MPC	110 U	152 J	NA
Volatile Organic Compounds (µg/kg)				
Carbon Disulfide	12 U	2 J	NA	12 U
1,2-Dichloroethene (total)	9 J	12 U	NA	12 U
1,2-Dichloroethane	8 J	12 U	NA	12 U
Benzene	2 J	12 U	NA	12 U
Tetrachloroethene[4]	3 J	12 U	NA	12 U

See notes at end of table.

Table 4-6 (Continued)
Compounds Detected in Soil

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Depth Analyte	GPT-6-7 8 to 10 ft SBG6708	GPT-6-7 20 to 22 ft SBG6720	GPT-6-7 20 to 22 ft SBG6720D	GPT-6-7 45 to 47 ft SBG6745
Toluene[4]	11 J	2 J	NA	1 J
Ethylbenzene[4]	4 J	12 U	NA	12 U
Xylene (total)	26	12 U	NA	12 U
Semivolatile Organic Compounds (µg/kg)				
Naphthalene	390	380 U	NA	380 U
2-Methylnaphthalene	880	380 U	NA	55 J
Acenaphthene	63 J	380 U	NA	380 U
Fluorene	200 J	380 U	NA	380 U
Phenanthrene	380 U	380 U	NA	52 J
Anthracene	450	380 U	NA	380 U
bis(2-Ethylhexyl)phthalate	59 J	380 U	NA	380 U[5]
Herbicides (µg/kg)	NA	NA	NA	NA
Pesticides and PCBs (µg/kg)	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	1,960	2,030	NA
Total Petroleum Hydrocarbons (mg/kg)	101	NA	NA	NA
Dioxins and Furans (pg/g)	NA	NA	NA	NA

[1] Sample values reported from diluted sample and quantitation limits reported from original analyses.
[2] Sample values and quantitation limits flagged "J" and "UJ" as estimated because one or more surrogate recoveries were outside quality assurance and quality control (QA/QC) limit.
[3] Values flagged "J" as estimated because the calibration contained greater than 25 percent but less than 50 percent differences between the 2 columns.
[4] Sample values and quantitation limits flagged "J" and "UJ" as estimated because the internal standards for chlorobenzene-d_5, chrysene-d_{12}, and phenanthrene-d_{10} exhibited areas less than QA/QC limits.
[5] Values flagged "U" due to method blank contamination.

Notes:
- ft = feet.
- µg/kg = micrograms per kilogram.
- J = estimated value.
- U = undetected, value is contract required quantitation limits.
- ND = not detected.
- NA = not analyzed.
- mg/kg = milligrams per kilogram.
- pg/g = picograms per gram.
- MPC = maximum possible concentration.
- PCB = polychlorinated biphenyl.

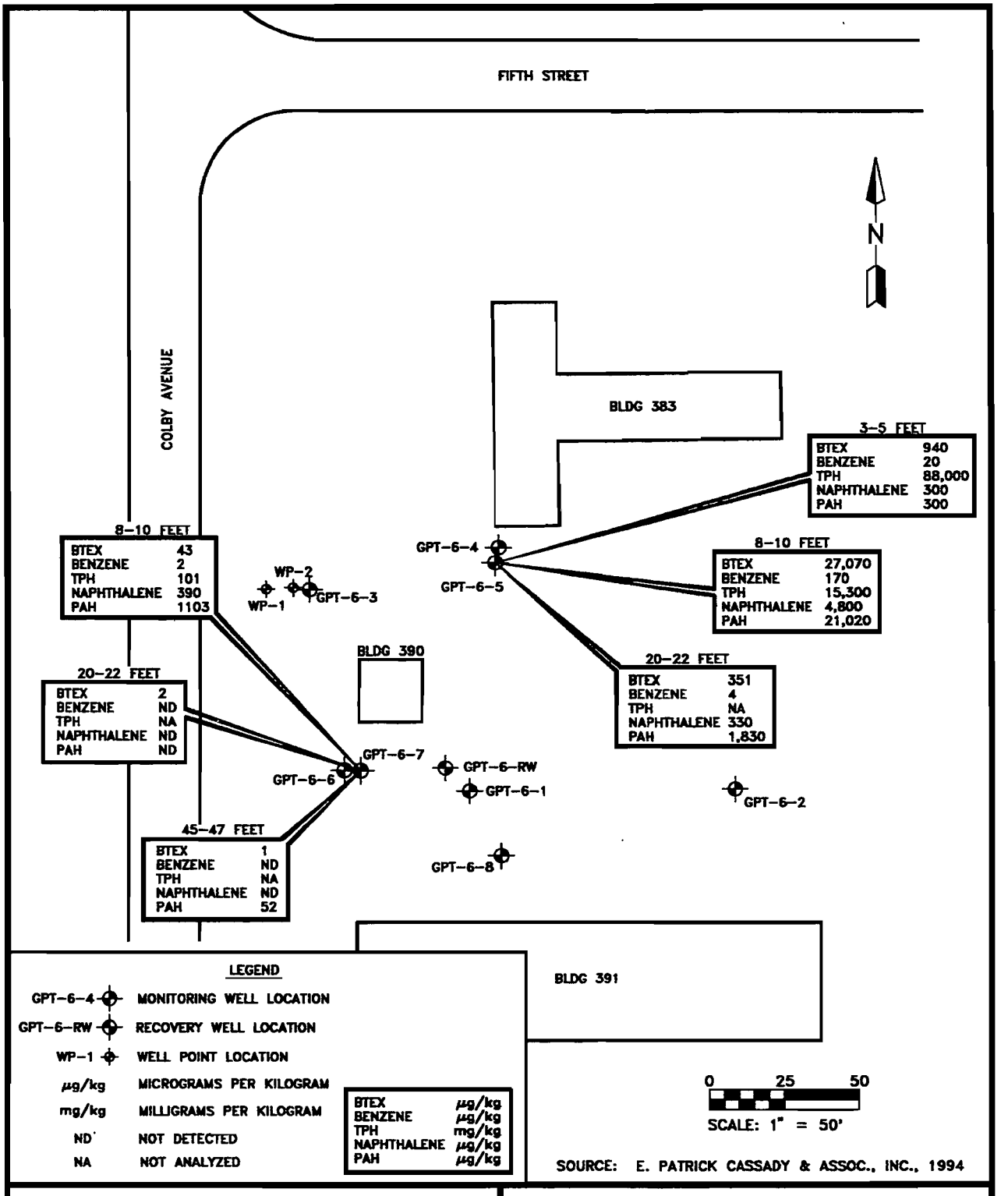

FIGURE 4-1

SOIL QUALITY MAP

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

C:\GULFPORT\FPPA\RPT\NCBC\8505.50\FIG4-1\JSL\940628

MS_S6FFTA.FPA
MVL.07.94

milligrams per kilogram (mg/kg), respectively. TPH values ranging from 101 to 88,000 mg/kg were detected in samples SBG6503, SBG6503D, SBG6508, and SBG6708.

4.5.2 Dioxins and Furans in Soil OCDD was detected in samples SBG6503 and SBG6508 at concentrations of 130 pg/g and 152 pg/g (estimated), respectively. The OCDD result of 130 pg/g for SBG6503 was reported as an MPC. The actual result may be less than 130 or non-detected. The OCDD result of 152 pg/g for SBBG508 is qualified as estimated because the associated internal standards exhibited high recoveries.

4.5.3 Inorganics Detected in Soil Metals were detected in all three soil samples, SBG6503, SBG6503D, and SBG6508. Results from the deeper sample were lower for all analytes except selenium. The inorganic results are presented in Table 4-7.

Table 4-7
Inorganics Detected in Soil

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Depth Analyte	GPT-6-5 3 to 5 ft SBG6503 (mg/kg)	GPT-6-5 3 to 5 ft SBG6503D (mg/kg)	GPT-6-5 8 to 10 ft SBG6508 (mg/kg)
Aluminum	5,840	8,610	1,460
Arsenic[1]	0.48 J	1.5 J	0.39 UJ
Barium[2]	32.0 J	29.4 J	2.2 U
Chromium	8.4	7.2	3.9
Cobalt	0.91 U	1.2 J	0.98 U
Iron	1,660	3,040	127
Lead	62.1	90.2	6.7
Mercury	0.07	0.03 U	0.04 U
Nickel[1]	3.8 J	5.2 J	2.2 UJ
Potassium	137 U	272 J	147 U
Selenium	0.69 J	0.80 J	5.1
Vanadium	4.5 J	10.5 J	3.9 J
Zinc[2]	6.9 U	17.7	0.37 U

[1] Sample values and quantitation limits flagged J and UJ (estimated) because preparation blank exhibited negative bias for arsenic, beryllium, and nickel.
[2] Values flagged U as non-detected because of field blank contamination.

Notes: ft = feet.
mg/kg = milligrams per kilogram.
J = estimated value.
U = undetected, value is contract required quantitation limits.

4.5.4 Groundwater Sampling with Hydropunch™ I Groundwater samples were collected at depths of 23 and 25 feet using the Hydropunch™ I. The sampling technique used with the Hydropunch™ I is illustrated in Figure 2-2. The 23- and 25-foot samples were taken from grid locations M-18 and K-15, respectively.

These grid locations are shown on Figure 2-1. The resultant TPH values, using USEPA Method 418.1, were 500 milligrams per liter (mg/ℓ) at 23 feet and 90 mg/ℓ at 25 feet. The laboratory results are in Appendix E.

4.5.5 Compounds Detected in Groundwater Analytical results from the groundwater sampling of monitoring wells are presented in Table 4-8. Figure 4-2 shows the sampling locations. As with the soil samples, contaminated groundwater samples were sample GWG64 and the duplicate sample GWG64D, collected from GPT-6-4 located in the north pit. Sample GWG66, collected from the shallow well GPT-6-6, also indicated levels of contamination. Cross sections showing the estimated vertical extent of free-phase and dissolved-phase contamination are shown in Figures 4-3 and 4-4. The locations of these cross sections are shown in Figure 1-5. In cross section A-A', the estimated vertical extent of dissolved-phase product is delineated by well GPT-6-5, as concentrations in this well were low relative to concentrations detected in samples from other wells. The vertical extent of dissolved-phase product in cross section B-B' is estimated by well GPT-6-7. As in GPT-6-5, GPT-6-7 had very low concentrations detected.

Groundwater sampling results from the F-PPA indicated the presence of VOCs in the surficial aquifer. VOCs detected above Federal drinking water maximum contaminant levels (MCLs) were vinyl chloride, 1,2-dichloroethane, 1,1,1-trichloroethane, and benzene (Table 4-9). Groundwater extracted during product removal may contain these constituents and may require special treatment and disposal. The VOC contamination is limited to the upper 30 feet of the surficial aquifer.

Trace quantities of VOCs were detected in the deeper wells, GPT-6-5 and GPT-6-7. Sample GWG62, which was collected from well GPT-6-2, did not contain any measurable quantities of VOCs. Well GPT-6-2 is upgradient of the fire-fighting training pits. Well GPT-6-3 is downgradient of the pits and the corresponding sample, GWG63, contained small amounts of VOCs with the highest being 13 μg/ℓ xylene.

Samples analyzed for SVOCs exhibited similar patterns to those analyzed for VOCs. High concentrations of 2-methylphenol, 4-methylphenol, naphthalene, 2-methylnaphthalene, and phenanthrene were detected in the shallow well samples GWG64 and GWG66. Comparatively small amounts of naphthalene and 2-methylphenol and trace amounts of several other constituents were detected in samples from the deeper wells GWG64 and GWG66. No compounds were detected in sample GWG62 and a few compounds in relatively minor amounts were detected in GWG63.

Samples GWG64, GWG64D, and GWG66 were analyzed for herbicides, pesticides, PCBs, and TOC. Herbicides were not detected in any of the samples, and only GWG64D showed any sign of pesticides (approximately 0.14 μg/ℓ of alpha-chlordane). TOC values ranged from 270 to 302 mg/ℓ.

TPH was analyzed for and detected in samples GWG62, GWG63, GWG64, GWG64D,and GWG66. GWG62 and GWG63 only contained trace amounts, whereas the others had concentrations ranging from 72.5 to 295 mg/kg.

4.5.6 Dioxins and Furans in Groundwater As with the soil samples, the only compound detected when analyzing for dioxins and furans was OCDD. All three samples that were analyzed, GWG64, GWG64D, and GWG66, contained OCDD. Values ranged from 6,450 to 15,000 pg/ℓ. Table 4-8 presents the dioxin results.

Table 4-8
Compounds Detected in Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Analyte	GPT-6-2 GWG62	GPT-6-3 GWG63	GPT-6-4 GWG64[1,2,3]	GPT-6-4 GWG64D[1,2]
Volatile Organic Compounds (μg/ℓ)				
Chloromethane	10 U	2 J	12 J	10 U
Vinyl chloride	10 U	10 U	21 J	35 J
Chloroethane[4]	10 U	10 U	230 J	310 J
Methylene chloride[5]	10 U	10 U	51 J	95 J
Carbon disulfide	10 U	10 U	3 J	4 J
1,1-Dichloroethene	10 U	9 J	1,800	3,100
1,1-Dichloroethane	10 U	10	2,700	4,900
1,2-Dichloroethene (total)	10 U	11	89 J	63 J
Chloroform	10 U	10 U	14 J	20 J
1,2-Dichloroethane	10 U	9 J	890 J	1,200
2-Butanone	10 U	10 U	59 J	80 J
1,1,1-Trichloroethane	10 U	10 U	3,400	5,900
Trichloroethene	10 U	3 J	6 J	6 J
Benzene	10 U	12	71 J	83 J
4-Methyl-2-pentanone	10 U	10 U	74 J	100 J
Tetrachloroethene	10 U	1 J	32 J	12 J
Toluene[4]	10 U	10	340 J	260 J
Ethylbenzene	10 U	4 J	77 J	36 J
Xylene (total)	10 U	13	490 J	230 J
Semivolatile Organic Compounds				
Phenol	10 U	10 U	48 J	47 J
2-Methylphenol	10 U	2 J	380 J	370
4-Methylphenol	10 U	10 U	970 J	1,100
2,4-Dimethylphenol	10 U	10 U	51 J	56 J
Naphthalene	10 U	16	230 J	210
2-Methylnaphthalene	10 U	13	770 J	700
Acenaphthene	10 U	10 U	48 J	39 J
Phenanthrene	10 U	10 U	350 J	270

See notes at end of table.

Table 4-8 (Continued)
Compounds Detected in Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Analyte	GPT-6-2 GWG62	GPT-6-3 GWG63	GPT-6-4 GWG64[1,2,3]	GPT-6-4 GWG64D[1,2]
Herbicides	NA	NA	ND	ND
Pesticides				
alpha-Chlordane	NA	NA	0.25 R	0.14 J
Total Organic Carbon (mg/ℓ)	NA	NA	270	302
Total Petroleum Hydrocarbons (mg/ℓ)	0.88	0.10	295	250
Dioxins and Furans (pg/ℓ)				
Octachlorodibenzodioxin	NA	NA	8,630	6,450

Well No. Analyte	GPT-6-5 GWG65	GPT-6-6 GWG66	GPT-6-7 GWG67
Volatile Organic Compounds (μg/ℓ)			
Chloromethane	10 U	10 U	7 J
1,1-Dichloroethane	10 U	3 J	10 U
1,2-Dichloroethene (total)	10 U	170	10 U
1,2-Dichloroethane	10 U	23	10 U
2-Butanone	10 U	19	10 U
Trichloroethene	10 U	90	10 U
Benzene	3 J	21	10 U
Tetrachloroethene	2 J	2 J	10 U
Toluene	13	43	20
Ethylbenzene	4 J	28	12
Xylene (total)	25	190	73
Semivolatile Organic Compounds			
2-Methylphenol	10 U	19 J	10 U
4-Methylphenol	3 J	36 J	10 U
Naphthalene	16	250	16
2-Methylnaphthalene	48	250	31
Acenaphthene	3 J	11 J	1 J

See notes at end of table.

Table 4-8 (Continued)
Compounds Detected in Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well No. Analyte	GPT-6-5 GWG65	GPT-6-6 GWG66	GPT-6-7 GWG67
Fluorene	8 J	23 J	2 J
Phenanthrene	15	59 J	5 J
Herbicides	NA	ND	NA
Total Organic Carbon (mg/ℓ)	NA	264	NA
Total Petroleum Hydrocarbons (mg/ℓ)	NA	72.5	NA
Dioxins and Furans (pg/ℓ)			
Octachlorodibenzodioxin	NA	15,000	NA

[1] Volatile organic compound values estimated because surrogate recovery exceeded quality assurance and quality control limit.
[2] Values flagged "D" in favor of the diluted sample and "E" in favor of the original sample.
[3] Semivolatile organic compound (SVOC), pesticide, and polychlorinated biphenyl values and quantitation limits are flagged "J" and "UR" because recoveries were less than 10 percent.
[4] Value estimated because the concentration exceeded linear range.
[5] Values and quantitation limits flagged "J" and "U" because of method blank contamination.

Notes:
- µg/ℓ = micrograms per liter.
- U = undetected.
- J = estimated value.
- NA = not analyzed.
- ND = not detected.
- mg/ℓ = milligrams per liter.
- R = rejected.
- pg/ℓ = picograms per liter.

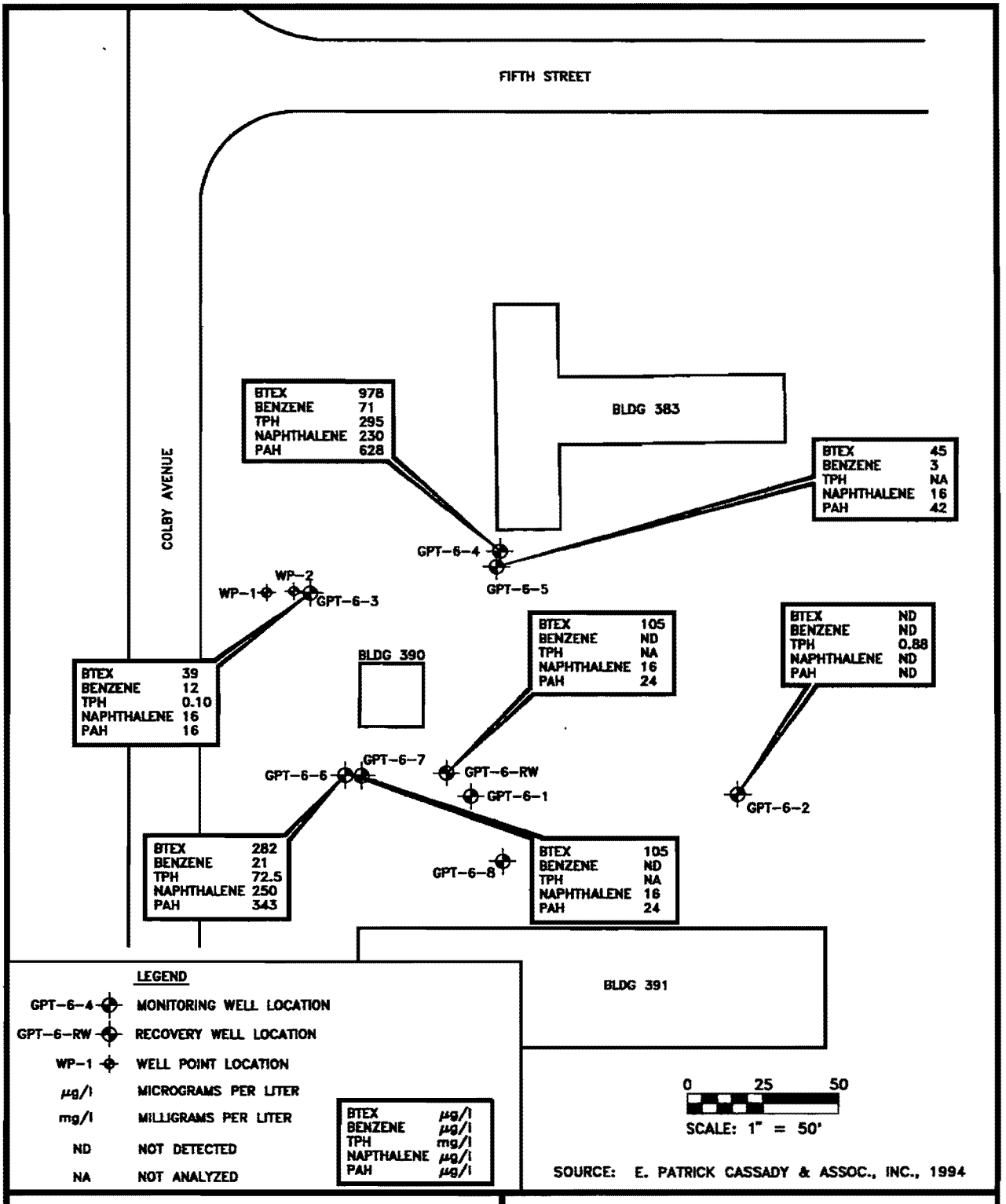

FIGURE 4-2

GROUNDWATER QUALITY MAP

F-PPA REPORT

NCBC GULFPORT
GULFPORT, MISSISSIPPI

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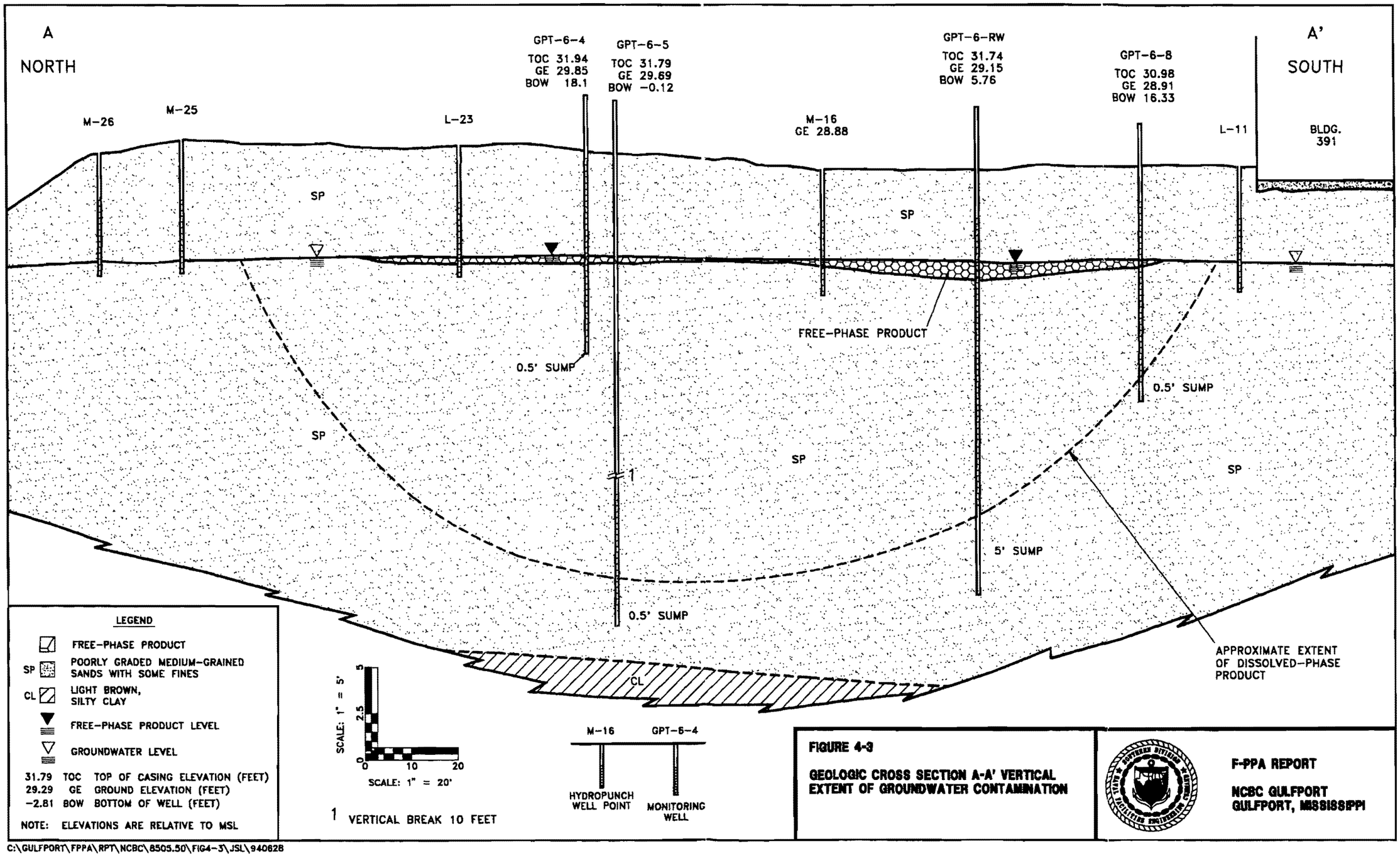

FIGURE 4-3

GEOLOGIC CROSS SECTION A-A' VERTICAL EXTENT OF GROUNDWATER CONTAMINATION

F-PPA REPORT

NCBC GULFPORT GULFPORT, MISSISSIPPI

C:\GULFPORT\FPPA\RPT\NCBC\8505.50\FIG4-3\JSL\940628

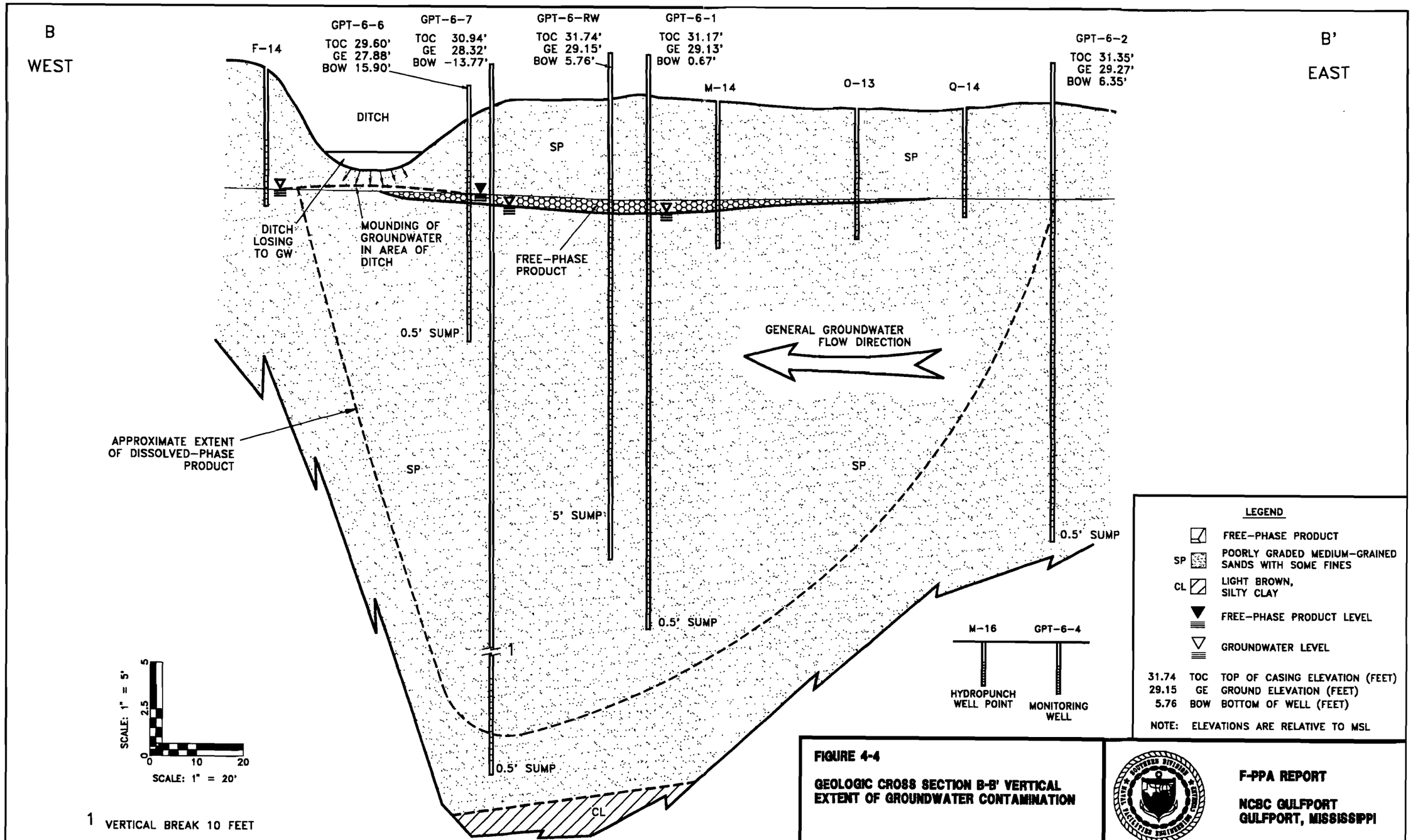

FIGURE 4-4

GEOLOGIC CROSS SECTION B-B' VERTICAL EXTENT OF GROUNDWATER CONTAMINATION

F-PPA REPORT

NCBC GULFPORT GULFPORT, MISSISSIPPI

C:\GULFPORT\FPPA\RPT\NCBC\8505.50\FIG4-4\JSL\940628

4.5.7 Inorganics Detected in Groundwater Inorganic analyses were run on two separate occasions. The first set of inorganic samples were analyzed following Level III protocol and data validation. This sample set was preserved onsite and met all holding times. The second set of inorganic samples were analyzed following Level V protocol to determine if the metals would filter out. The laboratory prepared, filtered, and preserved the samples from leftover sample volumes.

4.5.7.1 **Inorganics in Unfiltered Groundwater** Initially, two unfiltered samples from well GPT-6-4 and one sample from well GPT-6-6 were analyzed for inorganics. All three samples exhibited high concentrations of inorganics including aluminum, calcium, iron, magnesium, potassium, and sodium. Table 4-9 summarizes the analytes detected in the three samples.

4.5.7.2 **Inorganics in Filtered and Unfiltered Groundwater** Additional samples were analyzed for inorganics because of the high concentrations detected in initial samples. These samples met all holding time requirements; however, they were not filtered or preserved in the field. The samples were collected on December 13, 1993, and then filtered and preserved at the offsite laboratory on February 23, 1994.

Four samples were analyzed: three filtered and one unfiltered. GWG64 was analyzed as filtered and unfiltered to evaluate the effects of filtering. Filtering the sample reduced all of the detected concentrations, in particular, the aluminum, barium, chromium, iron, lead, vanadium, and zinc were reduced substantially. Table 4-10 summarizes the results for these samples.

Table 4-9
Inorganics Detected in Unfiltered Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	GWG64 (µg/ℓ)	GWG64D (µg/ℓ)	GWG66 (µg/ℓ)
Aluminum	194,000	127,000	80,200
Arsenic[1]	20.2 J	16.1 J	23.9 J
Barium	771	639	187 J
Beryllium[2]	0.73 J	0.29 J	1.7 J
Cadmium	5.4	3.4 J	3.2 U
Calcium	145,000	143,000	54,400
Chromium	238	159	92.6
Cobalt	18.5 J	14.2 J	18.0 J
Copper	79.8	53.4	25.2
Iron	34,100	31,500	28,200
Lead	533	178	48.6
Magnesium	11,200	10,800	3,370 J
Manganese	903	877	219
Mercury	1.4	0.68	0.26
Nickel	46.5	44.3	34.2 J
Potassium	5,900	6,130	1,620 J
Selenium[3]	36.0 J	3.5 J	4.9 J
Vanadium	53.8	41.9 J	108
Zinc	247	159	73.8
Cyanide	3.8 J	2.7 J	1.7 U

[1] Sample values and quantitation limits are estimated "J" and "UJ" because the matrix spike recoveries for arsenic and thallium were below the control limit.
[2] Sample values and quantitation limits flagged "J" and "UJ" (estimated) because the preparation blank exhibited negative bias.
[3] Sample values are flagged "J" (estimated) and non-detects are flagged "R" as rejected because the matrix spike for selenium was below 30 percent.

Notes: µg/ℓ = micrograms per liter.
J = estimated value.
U = undetected, value is the contract required quantitation limits.

Table 4-10
Inorganics Detected in Filtered and Unfiltered Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	GWG62 Filtered (µg/ℓ)	GWG63 Filtered (µg/ℓ)	GWG64 Filtered (µg/ℓ)	GWG64 Unfiltered (µg/ℓ)
Aluminum	203	125	111	83,100
Arsenic	1.0	ND	6.0	16.8
Barium	92.4	93.3	259	584
Calcium	4,790	5,530	127,000	149,000
Chromium	ND	ND	ND	88.2
Cobalt	ND	ND	7.6	13.6
Copper	ND	ND	ND	30.1
Iron	29.8	38.3	11,200	27,600
Lead	0.8	ND	1.5	378
Magnesium	1,000	1,050	10,300	11,300
Manganese	4.7	9.9	718	890
Nickel	ND	ND	ND	19.4
Potassium	ND	615	4,690	4,830
Selenium	21.7	ND	1.1	7.7
Vanadium	ND	ND	2.7	28.8
Zinc	62.3	42.0	20.3	142

Note: ND = Not detected at or above the reporting level.

4.5.8 Free-Phase Product Results Two sampling events involved sampling of free-phase product. The first sampling event was conducted by the USGS in August 1993. The sample was collected from well GPT-6-1 following Level V protocol. The second sampling event took place in November 1993 during the Hydropunch™ investigation. The sample was collected from grid location M-19 (see Figure 2-1). The samples were analyzed for hydrocarbons by a capillary analysis and for dioxins and furans by USEPA Method 1613.

4.5.8.1 **Free-Phase Product Fingerprint** The sample collected by the USGS in August contained almost 60 percent diesel components with only trace gasoline components. The remaining 40 percent mainly consisted of heavier hydrocarbons and waste oils.

The sample collected in November had similar results with 55 percent diesel, less than 10 percent gasoline and less than 40 percent waste oils. Paraffins accounted for approximately 18 percent of the constituents with less than 5 percent from aromatics and isoparaffins. The specific gravity of the sample was 0.8144. Laboratory results for both samples are in Appendix E.

4.5.8.2 **Dioxins and Furans in Free-Phase Product** Dioxins and furans were not detected in the sample collected in August; however, OCDD was detected at 235 pg/ℓ in the sample collected in November. Laboratory results for both of these samples are located in Appendix E.

4.6 CONCLUSIONS. Data quality for the samples collected was acceptable and within the completeness goal of 85 percent. VOCs, SVOCs, and inorganics were detected at significant concentrations. Table 4-11 compares the maximum concentration to the MCL for each analyte detected during sampling. The volatiles vinyl chloride, methylene chloride, 1,1-dichloroethene, 1,2-dichloroethane, 1,1,1-trichloroethane, trichloroethene, benzene, tetrachloroethene, and ethylbenzene were detected at concentrations that exceeded their MCLs.

OCDD was detected at a maximum value of 15,000 pg/ℓ. The USEPA developed Toxicity Equivalency Factors (TEFs) to rate the carcinogenicity of dioxin and furan compounds relative to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD). The TEF for OCDD is 0.001; therefore, the maximum OCDD value of 15,000 pg/ℓ has a toxicity equivalence of 15. The MCL for 2,3,7,8-TCDD is 30 pg/ℓ, which is greater than the maximum equivalent OCDD value. Maximum detected values for cadmium, chromium, copper, and lead exceeded their respective MCL values. Filtering the samples reduced all of the inorganic analytes to below their respective MCLs.

The inorganic constituents that may be present at concentrations of concern include chromium, lead, and iron. However, these inorganics appear to be present mainly in particulate form, as indicated by a comparison between unfiltered and filtered groundwater samples in Table 4-10.

Table 4-11
Maximum Chemical Concentrations in Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	Maximum Concentration	MCL
Volatile Organic Compounds (μg/ℓ)		
Chloromethane	12 J	NA
Vinyl chloride	35 J	2
Chloroethane	310 J	NA
Methylene chloride	95 J	5
Carbon disulfide	4 J	NA
1,1-Dichloroethene	3,100	7
1,1-Dichloroethane	4,900	NA
1,2-Dichloroethene (total)	170	70-cis 100-trans
Chloroform	20 J	100
1,2-Dichloroethane	1,200	5
2-Butanone	80 J	NA
1,1,1-Trichloroethane	5,900	200
Trichloroethene	90	5
Benzene	83 J	5
4-Methyl-2-pentanone	100 J	NA
Tetrachloroethene	32 J	5
Toluene	340 J	1,000
Ethylbenzene	77 J	700
Xylene (total)	490 J	10,000
Semivolatile Organic Compounds (μg/ℓ)		
Phenol	48 J	NA
2-Methylphenol	380 J	NA
4-Methylphenol	1,100	NA
2,4-Dimethylphenol	56 J	NA
Naphthalene	250	NA
2-Methylnaphthalene	770 J	NA
Acenaphthene	48 J	NA
Fluorene	23 J	NA
Phenanthrene	350 J	NA
Herbicides	ND	NA

See notes at end of table.

Table 4-11 (Continued)
Maximum Chemical Concentrations in Groundwater

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Analyte	Maximum Concentration		MCL
Pesticides			
alpha-Chlordane	0.14 J		NA
Total Organic Carbon	302,000		NA
Total Petroleum Hydrocarbons	295,000		NA
Dioxins (pg/ℓ)			
OCDD	15*		30**
Inorganics (μg/ℓ)	**Unfiltered**	**Filtered**	
Aluminum	194,000	203	NA
Arsenic	23.9	6.0	50
Barium	771	259	2,000
Beryllium	1.7 J	<1.0	4
Cadmium	5.4	<1.0	5
Calcium	145,000	127,000	NA
Chromium	238	<3.0	100
Cobalt	18.5 J	7.6	NA
Copper	79.8	<3.0	20
Iron	34,100	11,200	NA
Lead	533	1.5	15
Magnesium	11,200	10,300	NA
Manganese	903	718	NA
Mercury	1.4	<0.20	2
Nickel	46.5	<13.0	100
Potassium	6,130	4,690	NA
Selenium	36.0 J	21.7	50
Vanadium	108	2.7	NA
Zinc	247	62.3	NA
Cyanide	3.8 J	NA	200

* Using the toxicity equivalent factor for the concentration of 15,000 picograms per liter (pg/ℓ) for octachlorodibenzodioxin (OCDD) is equivalent to 15 pg/ℓ tetrachlorodibenzodioxin (TCDD).

** Maximum Contaminant Level for TCDD.

Notes:
MCL = Maximum Contaminant Level.
pg/ℓ = picograms per liter.
OCDD = octachlorodibenzodioxin.
μg/ℓ = micrograms per liter.
J = estimated.
NA = not available.
ND = not detected.
TCDD = tetrachlorodibenzodioxin.

5.0 F-PPA ENGINEERING EVALUATION

The objective of the Engineering Evaluation is to evaluate applicable technologies and to recommend removal alternatives to recover the free-phase product that is present at Site 6, the Fire-fighting Training Area. This chapter evaluates technologies for removal of the free-phase product based on site hydrogeology, time of remediation, implementability, and cost.

5.1 APPLICABLE TECHNOLOGIES.

5.1.1 Objective The purpose of the action is to recover the free-phase product from the surface of the groundwater to the extent practicable. Groundwater and soil remediation are not remedial goals at this time. However, some groundwater may be extracted during the removal action that may require treatment. The removal action chosen will contribute to the efficient performance of the long-term remedial action chosen for the site by reducing the primary source of contamination to the aquifer.

5.1.2 Identification of Technology Types Technologies that may be applicable to the recovery of the free-phase product and treatment of the accompanying groundwater will be identified in this section. *In situ* treatment methods, such as soil vapor extraction, will not be evaluated as primary free-phase product removal methods because they are more appropriate as long-term remedial action for soil and groundwater, not for free-phase product recovery. Long-term remedial objectives will be addressed in the future, as required.

Because some groundwater will be extracted during the free product removal, treatment of that groundwater must be considered. Treatment criteria for this groundwater are dependent on the requirements of the discharge point chosen. Therefore, discharge alternatives will be evaluated first, including the Harrison County Publicly Owned Treatment Works (POTW), surface water discharge, and re-infiltration to the groundwater. These options and the associated treatment criteria are discussed in Subsection 5.1.2.1. After defining the contaminants of concern, the applicable treatment standards, and the extent of contamination, a complete removal action can be developed.

5.1.2.1 Discharge Alternatives Options considered for the disposal of the treated groundwater effluent include discharge to the Harrison County POTW, surface water discharge, and re-infiltration to the groundwater.

Harrison County POTW. Discharging treated groundwater to the Harrison County POTW may be achieved through an industrial sewage permit. The Base currently discharges between 50 and 300 gpm to the POTW and is charged by the POTW on a volume basis. Specific treatment criteria for discharge to the POTW (Gulfport Water and Sewers Code, Section 11-96[e]) are listed on Table 5-1 and include lead below 100 $\mu g/\ell$, manganese below 500 $\mu g/\ell$, BOD_5 below 300 mg/ℓ, and TSS below 300 mg/ℓ. These criteria can be met with pretreatment of the groundwater. Federal regulations also require that discharges to the POTW cannot contain pollutants that pass through, interfere with, or are otherwise incompatible with the POTW. Therefore, groundwater discharged to the POTW may need to be treated for the reduction of organic compounds (evaluated in Subsection 5.1.2.5) to prevent the introduction of hazardous substances to the treatment facility.

Table 5-1
Pretreatment Requirements Prior to Discharge to the Harrison County Publicly Owned Treatment Works

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Parameter	Maximum Concentration (mg/ℓ)
BOD_5	300.0
Suspended solids	300.0
TKN	30.0
Arsenic	0.05
Barium	5.0
Boron	1.0
Cadmium	0.02
Chromium	0.05
Copper	0.02
Cyanide	0.05
Lead	0.10
Manganese	0.50
Mercury	0.002
Nickel	0.08
Selenium	0.02
Silver	0.01
Zinc	0.05

Source: Gulfport Water and Sewers Code, Section 11-96(e).

Notes: mg/ℓ = milligrams per liter.
BOD_5 = biochemical oxygen demand (5-day).
TKN = total kjeldahl nitrogen.

Surface Water Discharge. An intermittent flowing stormwater ditch that could be used as a treatment system discharge point is located adjacent to Site 6. Discharge to a surface water body requires a National Pollution Discharge Elimination System (NPDES) permit. The NPDES permit requirements of the Mississippi Office of Pollution Control define treatment requirements by the acute and chronic toxicity criteria for fresh water for organic and inorganic compounds, including an average discharge limit of 0.33 μg/ℓ for lead. This low concentration for lead is difficult to achieve, especially if the lead in the groundwater has complexed with organic matter in the subsurface. The treatment system requirements for this alternative are more difficult to satisfy than for the other alternatives.

Re-infiltration. An infiltration gallery is designed to allow water to infiltrate the soil and percolate vertically through the vadose zone until it encounters an impermeable layer or the water table. The infiltration is then controlled by water discharge through the transmissive zone. A steady state infiltration rate should be the basis for the selection of the design hydraulic loading rate, subject to aquifer characteristics and mounding effects.

The geology at the site is suitable for discharging of the treated effluent through a recharge gallery or recharge well. This technology would allow future biological enhancement during final remediation of the site by adding nutrients to the effluent prior to re-infiltration. Re-infiltration requires notification and a permit from the Office of Pollution Control. Treatment criteria for re-infiltration are MCLs (see Table 4-11) for organic compounds and metals.

5.1.2.2 **Free-Phase Product Recovery** Alternatives considered for free-phase product recovery include recovery wells, well points, and recovery trenches. Three models using Quickflow™ (Geraghty & Miller, 1991b) are presented here for the purpose of screening these three technologies. For the purposes of screening, head differences and duration of removal remain the same for all three models.

The hydraulic conductivity was calculated using slug test data. The transmissivity and storativity values were calculated from pumping test data using the distance-drawdown method (see Chapter 3.0).

Recovery Wells. A recovery well system consisting of two wells equipped with individual pumps to transfer product to the treatment system where groundwater will be separated from the product and treated prior to discharge was considered. Wells are designed based on the location of the free-phase product, the aquifer hydraulic conductivity, the hydraulic gradient of the water table, and the depth to the water table. The depth, diameter, screen length, pumping rate, and drawdown of each well, as well as the number and location of wells, are designed to produce the desired capture zone, as defined by modeling.

Free-phase product removal from recovery wells can be accomplished by three general methods: a single pump "total fluids" system, a dual pump system, or a single product pump system. The single product pump uses a product skimmer and level controls to achieve extraction of the free-phase product. A dual pump system uses the product pump and skimmer together with a groundwater pump to depress the groundwater table inclining the gradient toward the well and increasing product flow. The total fluids system can also be used to depress the groundwater table using one pump to extract product and groundwater. The total fluids system is less expensive than a dual pump system but results in a combined product and water stream that requires separation.

The pumping test indicated groundwater depression enhanced product recovery.

Horizontal Well. A horizontal well was considered as a remedial alternative. Theoretically, a horizontal well recovers product from the entire designed length. In practice, the large seasonal groundwater fluctuations at this site would severely reduce the efficiency of a horizontal well at this site because of a lack of head control. Specifically, during periods of high water table conditions, the horizontal well would have to depress the groundwater level downwards of 4 feet. The pumping amount could potentially cause product to remain in the unsaturated zone, which would severely reduce product recovery.

Well Point System. A well point system consists of a group of closely spaced wells equipped with drop tubes connected to a header pipe or manifold. A suction pump is used to lift the product or water from the well and transfer it to the treatment facility. Well point systems are frequently used because they are inexpensive, relatively easy to install, and adaptable to a wide range of site

conditions. Each well point can be controlled independently, allowing for optimum control of the contaminant plume. The systems are best suited for stratified soils where, in theory, the suction lift should support a water column of about 32 feet. In application, this method should be engineered on the basis of a 15- to 18-foot suction lift. This limits capture to relatively shallow contaminant plumes.

Interceptor Trenches. Interceptor trenches typically consist of perforated pipe laid in a trench, which is backfilled with a material that is more permeable than the surrounding soil. The trenches essentially function like a continuous slot that creates linear flow to the trench rather than radial flow, as with wells. Groundwater and free-phase product are influenced by head differences into the pipe and to a sump where it is collected and pumped to the treatment system.

For shallow contamination problems, trenches can be more cost-effective than conventional extraction wells, particularly in strata with low or variable hydraulic conductivity. Interceptor trenches may also be preferred over conventional extraction wells where groundwater and free-phase product removal is required over a period of several years. The most widespread use of interceptor trenches at hazardous waste sites is to intercept a groundwater plume hydraulically downgradient from its source. Recovery trenches at this site would consist of a trench running the length of the free-phase product, approximately 300 feet, equipped with two or three pumps, which induces a head difference and transfers recovered free-phase product to the process area. Groundwater that is recovered would require treatment for disposal, as with other recovery methods.

5.1.2.3 Free-Phase Product Separation Recovered free-phase product and groundwater will be pumped to an oil-water separator to remove the free-phase product from the waste stream. The oil-water separator may contain coalescing media capable of reducing free-phase product levels suspended in the groundwater to a concentration of 10 ppm. This separator can also act as an equalization tank to minimize fluctuations in treatment efficiencies due to variations in well pumping rates and water quality.

5.1.2.4 Treatment of Inorganic Constituents Inorganic constituents may need to be removed from the groundwater for two reasons. Heavy metals such as lead may need to be removed to meet discharge criteria. Additionally, certain inorganic water quality parameters pose operation and maintenance concerns for various water treatment technologies. Metals that may be present at concentrations of concern are listed in Table 5-2 together with applicable treatment technologies. The concentrations found in monitoring wells are generally higher than what is found in pumped systems. The primary TAL metal of concern is lead, at an estimated total concentration of 533 $\mu g/\ell$. Organically or particulately bound lead often can be removed to below detection limits by employing a filtration process incorporating a filter and, if needed, granular-activated carbon.

The primary inorganic water quality parameter of concern is iron. Iron can interfere with processes, pipes, equipment, and effluent quality. Iron is found in many groundwaters naturally. The total dissolved iron concentration is estimated to be 34.1 mg/ℓ. Iron can be removed by aeration or chemical addition followed by sedimentation or filtration. Otherwise, iron oxides may form as a by-product of some treatment systems, such as air stripping. Some process equipment can accept the presence of iron oxides more readily than others, such

as a diffused aeration tank, which is easier to clear of iron oxides than an air stripper tower.

Table 5-2
Treatment of Inorganic Constituents

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Inorganic	Treatment
Cadmium	Lime softening and filtration
Chromium	Coagulation, filtration, ion exchange, and lime softening
Copper	Coagulation, filtration, ion exchange, and lime softening
Iron	Aeration, precipitation, pH adjustment, and filtration
Lead	Coagulation, filtration, and ion exchange
Manganese	Aeration, pH adjustment, precipitation, and filtration

Filtration. Filtration is a physical process by which suspended solids are removed from solution by forcing the fluid through a porous medium. If metals are present in the process stream as particulate matter, a filtration process may be used to remove the particulates. Typically, lead can be removed with filtration processes to achieve a concentration of less than 50 $\mu g/\ell$. Iron oxides can also be removed by a filtration process.

Applicable filtration technologies include granular media and filter elements such as cartridge filters or bag filters. Granular media filters can be provided with automatic backwash abilities but need a fresh water source or storage of treated effluent to perform this. Filter elements can also be provided with either automatic backwash or as disposable elements. Generally, filter elements are used to remove smaller particles and smaller concentrations of solids than granular filters. Knowledge of particulate size is needed for filter selection.

A filter can be placed in front of other technologies if needed as a pretreatment or following a technology such as air stripping to remove all oxidized particulate before discharge.

Precipitation and Flocculation. Precipitation is a physiochemical process whereby some or all of a substance in solution is transformed into a solid phase. This process is based on alteration of the chemical equilibrium relationships affecting the solubility of inorganic species. Coagulation is the process by which small, unsettleable particles suspended in a liquid medium are made to agglomerate into large, more settleable particles. Once suspended particles have been flocculated into larger particles, they usually can be removed from the liquid by sedimentation.

If dissolved metals are present in the process stream, chemical treatment consisting of pH adjustments, precipitation, and flocculation may be used to remove dissolved metals. Chemical reagents are added to the process stream to oxidize and precipitate the metals as solid particulates. The chemical addition

would be followed by a sedimentation and/or filtering system in order to remove the metal particulates from the process stream. Additionally, sludge dewatering and disposal would be required for a sedimentation process. The sludge potentially could be hazardous.

Iron can be oxidized and removed from the process stream by the addition of chlorine in the form of calcium hypochlorite, chlorine gas, potassium permanganate, hydrogen peroxide, or another oxidizer. The pH of the water may need adjustment to an optimal value to allow precipitation. The resulting iron oxide must then be settled or filtered from the water stream and disposed.

Lime Softening. Lime applied to the groundwater precipitates phosphates and hardness cations along with organic matter. Reaction with alkalinity consumes most of the lime and produces calcium carbonate residue that aids in settling suspended solids. Use of excess lime in chemical treatment has two potential problems:

- scale formation on tanks, pipes, and other equipment; and
- disposal of the large quantity of lime sludge produced.

A combination of lime softening, clarification, and filtration can be used to remove cadmium, chromium, copper, selenium, and zinc from the groundwater.

Ion Exchange. If the treated discharge point is an NPDES point, arsenic, lead, and selenium may require removal through ion exchange to reach the discharge criteria. Ion exchange has the ability to remove and concentrate pollutants. Some exchangers, such as activated alumina, are selective for certain metals and can remove low concentrations of toxic metal from water containing a high background concentration of a nontoxic metal such as sodium or calcium. General limitations of ion exchange include:

- the contaminant is transferred to another medium which will require regeneration or disposal,
- resins are prone to fouling by some organic substances, and
- resins and equipment are expensive.

Aeration. Iron oxidation occurs readily at pH 7.0 to 7.5. By aerating the groundwater, insoluble iron oxides are formed that can be removed by gravity settling or filtration before the oxides affect the efficiency of downstream equipment. Aeration can be achieved by using pressurized reactors or as simply as introducing air through a slotted polyvinyl chloride pipe into a holding tank. Amounts of air vary from 0.04 to 1.5 cubic meters per cubic meter of water. A reaction time of up to 30 minutes should be allowed.

5.1.2.5 Treatment of Organic Compounds The organic constituents of concern are listed in Table 5-3. Treatment technologies considered for treating these organic constituents include oxidation, biological degradation, air stripping, and carbon adsorption. Diagrams of the treatment process for each alternative are provided in Figures 5-1, 5-2, 5-3, and 5-4.

UV OXIDATION

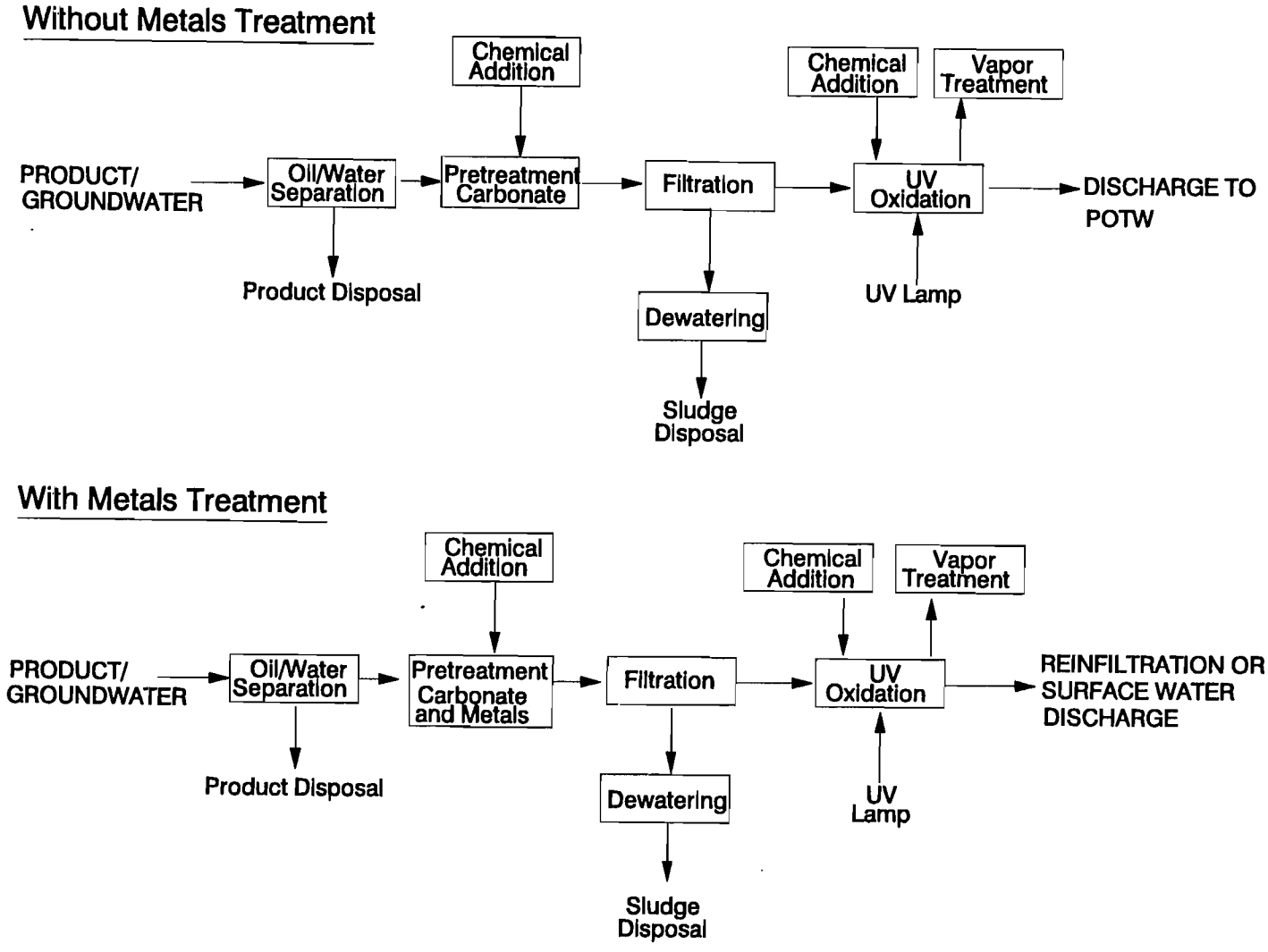

FIGURE 5-1

ULTRAVIOLET LIGHT OXIDATION

F-PPA REPORT

NCBC GULFPORT

GULFPORT, MISSISSIPPI

BIOLOGICAL TREATMENT

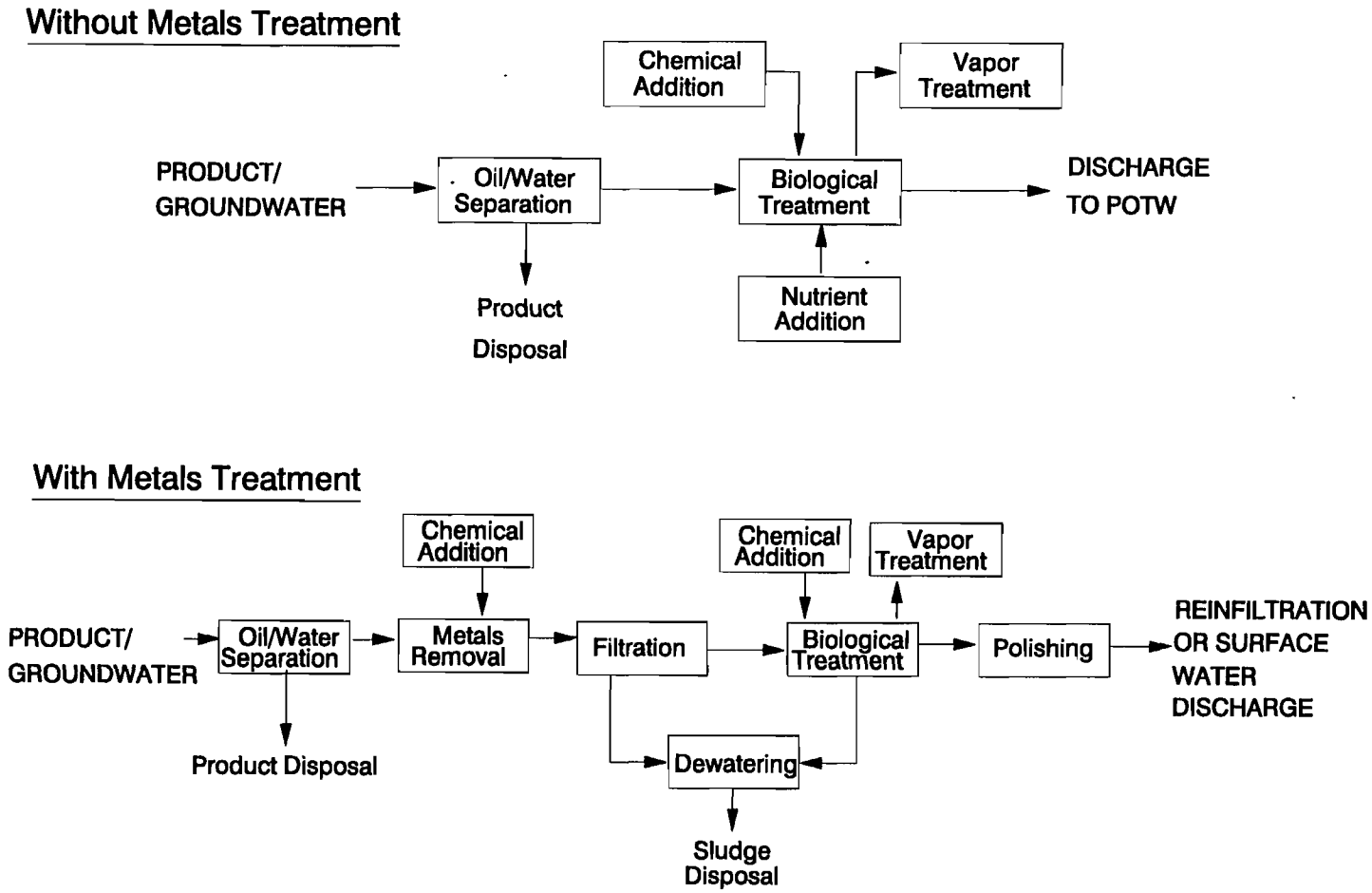

FIGURE 5-2

BIOLOGICAL TREATMENT

F-PPA REPORT

NCBC GULFPORT

GULFPORT, MISSISSIPPI

AIR STRIPPING

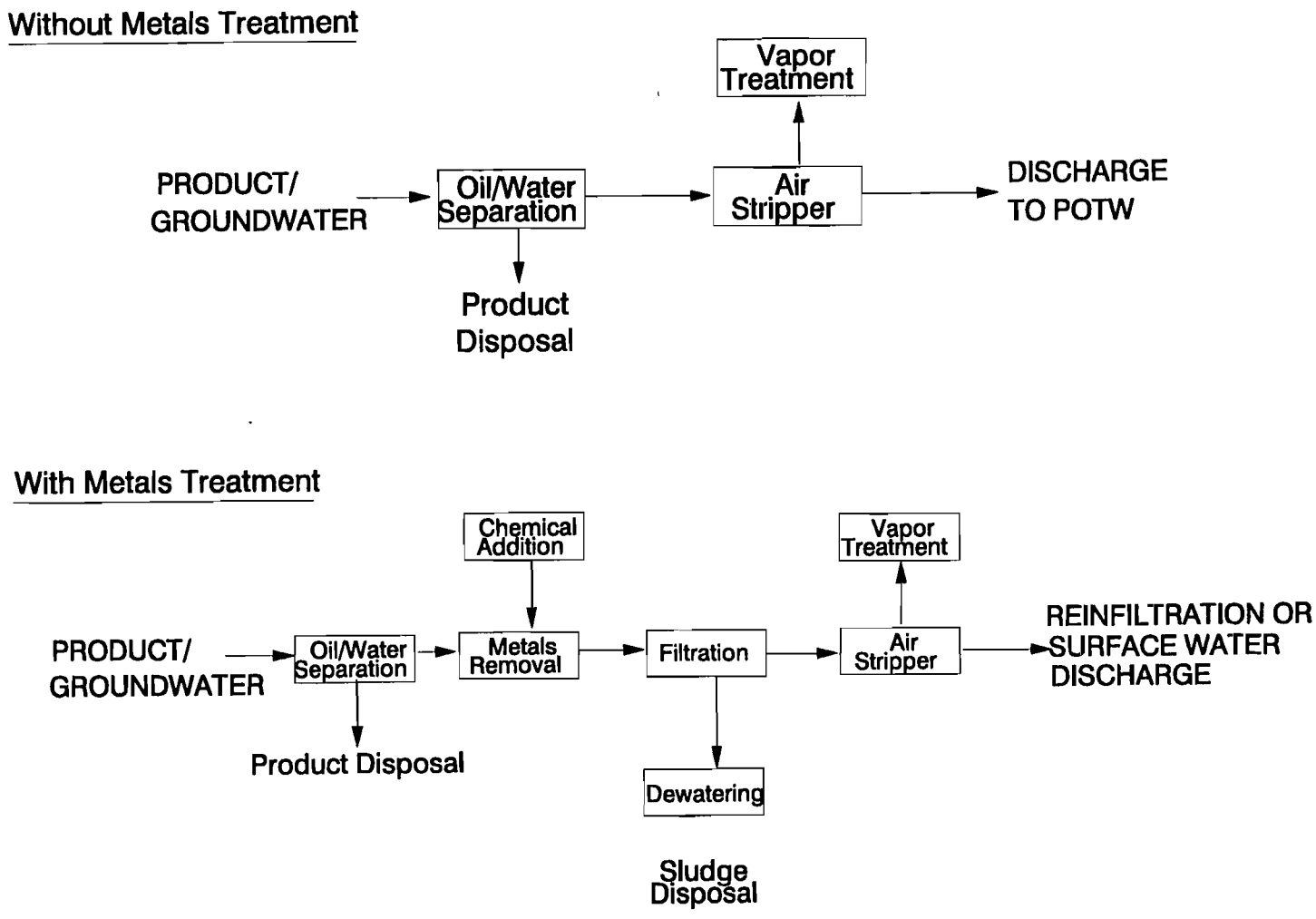

FIGURE 5-3
AIR STRIPPING

F-PPA REPORT
NCBC GULFPORT
GULFPORT, MISSISSIPPI

CARBON ADSORPTION

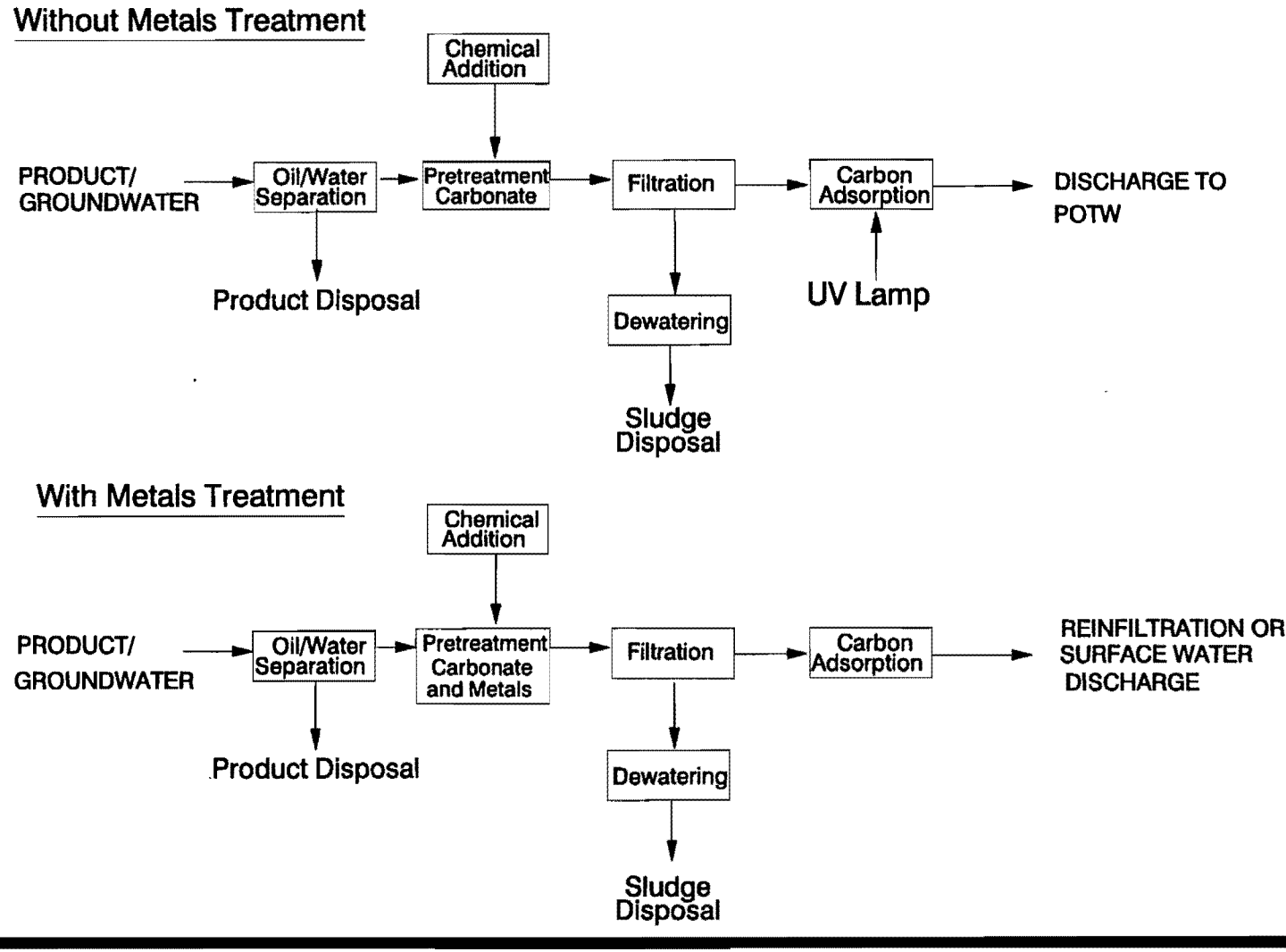

FIGURE 5-4
CARBON ADSORPTION

F-PPA REPORT
NCBC GULFPORT
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Table 5-3
Organic Constituents of Concern

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Vinyl chloride	Trichloroethane
Methylene chloride	Trichloroethene
Dichloroethene	Benzene
Dichloroethane	Tetrachloroethene

Oxidation. Chemical oxidation by ozone, hydrogen peroxide, or some other conventional oxidant induces decomposition of compounds by stripping electrons from the compounds, thereby breaking the bonds holding the compound together. The process destroys toxic compounds without creating hazardous residues or concentrates. Organic compounds with double bonds and high Henry's law constants and aromatic compounds such as phenol, toluene, benzene, and xylene are readily oxidized. In systems that use ozone, organic compounds without double bonds are also removed, primarily due to volatilization, creating vapors that may require treatment.

Ultraviolet light and oxidation (UV/oxidation) is an enhanced oxidation process in which organic contaminants in extracted groundwater are oxidized through simultaneous application of ultraviolet (UV) light with ozone and/or hydrogen peroxide. The UV light induces rapid photochemical oxidation of halogenated organic compounds and is able to consistently attain low effluent criteria at the system discharge. This UV technology may be needed to achieve oxidation of the chlorinated compounds present in the groundwater.

Treatment before UV/oxidation may be required to remove nontarget organic compounds, metals, and other "scavengers" because these consume chemical oxidants and provide an additional load on the system. Pretreatment to remove naturally occurring inorganic constituents (e.g., iron, carbonate, or manganese) also may be required to prevent fouling of the UV light and system components.

Biological Treatment. The function of biological treatment is to remove organic matter from the waste stream through microbial degradation. The most prevalent form of biological treatment is aerobic. Biological treatment requires a minimal carbon source or contaminant loading to feed the microbes and is commonly used to achieve a gross reduction in organic loading before a polishing technology such as air stripping or carbon adsorption. The discharge criteria for re-infiltration or surface water discharge are stringent; therefore, a polishing step would be required for these discharge alternatives. A polishing step for discharge to the POTW would probably not be required. This determination is made by the POTW at the time of application for discharge.

A number of biological treatment processes exist including activated sludge, trickling filters, biological towers, and rotating biological contactors. A number of parameters influence the performance of a biological treatment system. These parameters include the availability of nutrients and air, concentration of suspended solids, oil and grease concentrations, organic loading variations, presence of toxic concentrations of inorganic constituents, Ph, and temperature.

Additionally, the biological treatment process may result in a potentially hazardous sludge that would require disposal.

Air Stripping. Air stripping is a technology that is proven effective for removing VOCs. It reduces concentrations of VOCs through intimate contact of extracted groundwater with air. Air to water ratios commonly employed range from 25:1 to 250:1. In a packed tower design, water descends a packed column while air is forced up the column to promote mass transfer of organic compounds from aqueous to gaseous phase. Off gases may require further treatment to meet air regulations. Pretreatment for removal of naturally occurring inorganic constituents (e.g., iron, carbonate, manganese, and biological growth) may be required to prevent fouling of air strippers.

An alternative to the packed-tower air stripper would be the diffused aerator or bubble aeration air strippers. These systems are mainly applied to smaller flows and in situations that have high iron content or other material that may foul the packing of a packed-tower air stripper.

Carbon Adsorption. Carbon adsorption removes contaminants from aqueous wastes by contacting the stream with a solid activated carbon adsorbent. The activated carbon selectively adsorbs hazardous constituents by a surface attraction phenomenon in which molecules are attracted to the internal pores of the carbon granules. Adsorption depends on the strength of the molecular attraction between adsorbent and adsorbate, molecular weight, type and characteristic of adsorbent, electrokinetic charge, Ph, and surface area. In general, the technology works best in removing compounds that have a low water solubility, high molecular weight, low polarity, and a low degree of ionization.

Once the micropore surfaces are saturated with organics, the carbon is "spent" or exhausted and must be replaced. The time to reach exhaustion is the single most critical operating parameter. Carbon longevity balanced against influent concentration governs operating economics. Activated carbon is nonselective in that naturally occurring organics that are not considered hazardous can be adsorbed by the carbon as well as hazardous constituents. Shallow aquifers commonly contain high concentrations of dissolved minerals and organics that would be readily adsorbed by the carbon. Carbonate and suspended solids should be removed through pretreatment to prevent plugging the carbon bed. An added benefit of this alternative is that a carbon adsorption system would not require vapor treatment.

Carbon adsorption as a primary treatment method would not be cost effective due to the high concentrations of total organic compounds (302 mg/ℓ) present in the groundwater that would quickly exhaust the carbon. However, a carbon adsorption system may be necessary as a polishing step following a treatment process such as air stripping (for effluent or off gases).

5.1.2.6 Free-Phase Product Disposal The Base currently disposes of waste oils through Safety-Kleen Corporation, located in Mobile, Alabama. Recycling is preferred over disposal (incineration) by the USEPA.

The recovered free-phase product can also be sent directly to a cement kiln located in Alabama for use as fuel or incinerated by Marine Shale in Ameilia, Louisiana.

5.1.2.7 **Process Residuals Disposal** Process residuals, such as spent carbon and metal sludges, can be disposed in two ways: in a Resource Conservation and Recovery Act Code of Federal Regulation, Subtitle C or D landfill or by incineration. The landfill option may require solidification or stabilization of the metal sludges. A landfill and stabilization facility located in Emelle, Alabama, can accept these waste streams. Also, Marine Shale in Louisiana can accept these streams for incineration.

5.2 TECHNOLOGY SCREENING. The individual technologies are evaluated for effectiveness, implementability, and cost. Effectiveness criteria include protection of human health and the environment, reduction of the toxicity, mobility and volume of the free-phase product and process residuals, and compliance with discharge and other Applicable or Relevant and Appropriate Requirements (ARARs). Implementability criteria include technical feasibility, availability of necessary equipment and materials, and permitting and action-specific ARARS.

The feasibility of a treatment technology for organic compounds depends on the concentration requirements of the point of discharge. In turn, the pretreatment requirements for inorganic constituents are dependent on the discharge point and on the preferred treatment alternative for organic compounds. Therefore, the effluent disposal alternatives will be evaluated first, and the organic treatment technologies will be evaluated before the inorganic treatment technologies in this section.

5.2.1 Effluent Discharge Re-infiltration requires notification and permitting through the Mississippi Office of Pollution Control. The treated effluent is required to meet MCLs. Modeling of the effect of the infiltrating water on the site hydraulics and existing plume is necessary. The only costs for this discharge alternative are permit application costs and the installation of the re-infiltration gallery. Operating costs include system effluent monitoring to meet water quality requirements required by the permit.

Discharge to a nearby surface water body would require an NPDES permit. According to Steve Spangler of the Mississippi Office of Pollution Control (personal communication), this alternative has a discharge requirement for lead of 0.33 $\mu g/\ell$. This concentration may be difficult to meet. The capital costs associated with this discharge alternative include a permit application fee, preparation of the permit, and the installation of the piping to the NPDES outfall point. Operating costs include monitoring of effluent quality.

Discharge to Harrison County's POTW would require less stringent discharge criteria for metals and VOCs than the other discharge options. Discharges to the POTW cannot contain pollutants that pass through, interfere with, or are otherwise incompatible with the POTW. The POTW pretreatment requirement for lead is 100 $\mu g/\ell$.

The Base currently discharges between 50 and 300 gpm to the POTW. The groundwater treatment system discharge piping can be connected to the Base's existing sewer piping for one of the nearby buildings. The estimated operating costs for this alternative include the charge by volume discharged to the POTW and required analytical sampling for monitoring the system.

Discharge to the POTW is the simplest discharge alternative to implement, requiring minimal pretreatment of the groundwater and minor piping connection requirements. Additionally, even with the POTW charges, a cost savings is achieved with this discharge option because no pretreatment for inorganic constituents (lead or iron) or disposal of filtered solids is needed, as with the other alternatives (see Figures 5-1, 5-2, and 5-3). Therefore, discharge to the POTW is the recommended discharge alternative.

5.2.2 Free-Phase Product Recovery The pumping test at the existing recovery well indicated that groundwater depression will facilitate the removal of free-phase product. Quickflow™ (Geraghty & Miller, 1991b), an analytical, two-dimensional, groundwater flow model, was used to screen three technologies for effectiveness of removing free-phase product based on site hydrogeological conditions. The three technologies were a dual recovery well system, shallow well points, and an interceptor trench. The models supported an interceptor trench running the length of the free-phase product. This scenario yielded the most time efficient recovery of the product of the three analyzed. Further modeling with more complex programs will focus on optimizing interceptor trench configurations and flow rates.

Recovery Wells. The hydrogeologic parameters used to evaluate these alternatives are as follows:

hydraulic conductivity	8.22 feet per day
transmissivity	1,500 square feet per day
storativity	0.2 assumed for fine-grained sand

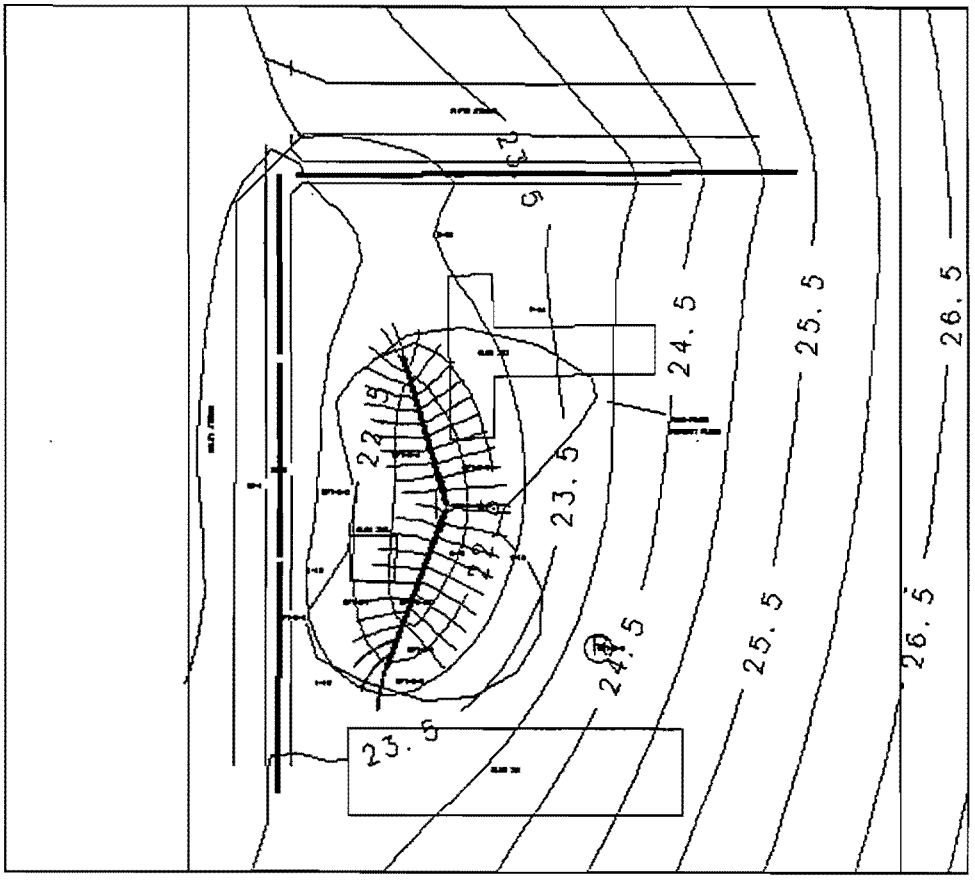
Initial groundwater modeling was performed using Quickflow™ (Geraghty and Miller, 1991b). The resultant model for two recovery wells (Figure 5-5) for a pumping duration of 10 years shows large stagnant areas and the least capture of the 3 technologies screened. Influence of the entire plume could not be achieved with this configuration. The advantages and disadvantages of each system are provided with each figure.

Well Points. The model generated for a wellpoint system (Figure 5-6) suggested a better capture than recovery wells, but a problem with stagnant area remains a possibility, and the time required for cleanup is estimated at 50 years.

Intercept Trench. An interceptor trench was modeled with the configuration shown in Figure 5-7. This model displayed more influence on the plume after 10 years than the other two models. The estimated time for this run to complete recovery was twice as rapid when compared to well points.

It should be noted here that these models were used only to screen applicable technologies, and to this end, head differences and time of recovery were kept the same between the models to attempt to evaluate each technology on performance, based on the hydrogeologic conditions at this site. Actual recovery time for the free-phase product will be reduced with further modeling. Using the data from this screening, additional modeling will focus on interceptor trench recovery of the product.

5.2.3 Free-Phase Product Separation An oil-water separator will be needed to separate the free-phase product from the groundwater as it is extracted by the recovery system.



Recovery Trench Modeling Parameters

- 150-foot-long trench
- 8 gallons per minute system
- 1.5- to 2.5-foot head difference
- Partially penetrating

Pros

- Best option to capture entire plume without stagnant areas
- fastest recovery time
- best hydraulic controls

Cons

- More expensive than other two options

FIGURE 5-5

QUICKFLOW™ MODEL GENERATED FOR A TRENCH AT 10 YEARS

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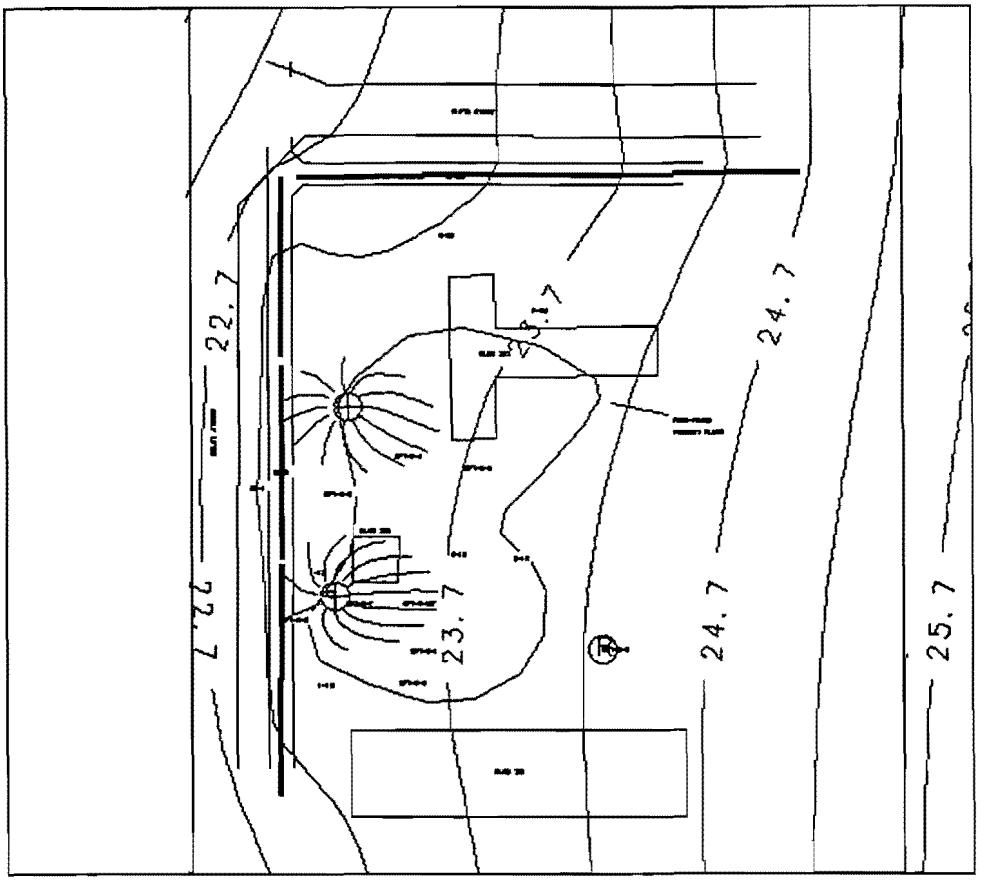

Recovery Well Modeling Parameters

- 10 gallons per minute system
- 1.5 to 3.0 feet of drawdown
- considered fully penetrating

Pros

- Easy to implement with existing recovery well

Cons

- Does not adequately capture the entire plume. Greatest probability of trapping product across larger capture zones, would require more drawdown to be effective.
- longer remediaiton time

FIGURE 5-6

QUICKFLOW™ MODEL GENERATED FOR RECOVERY WELL SYSTEM AT 10 YEARS

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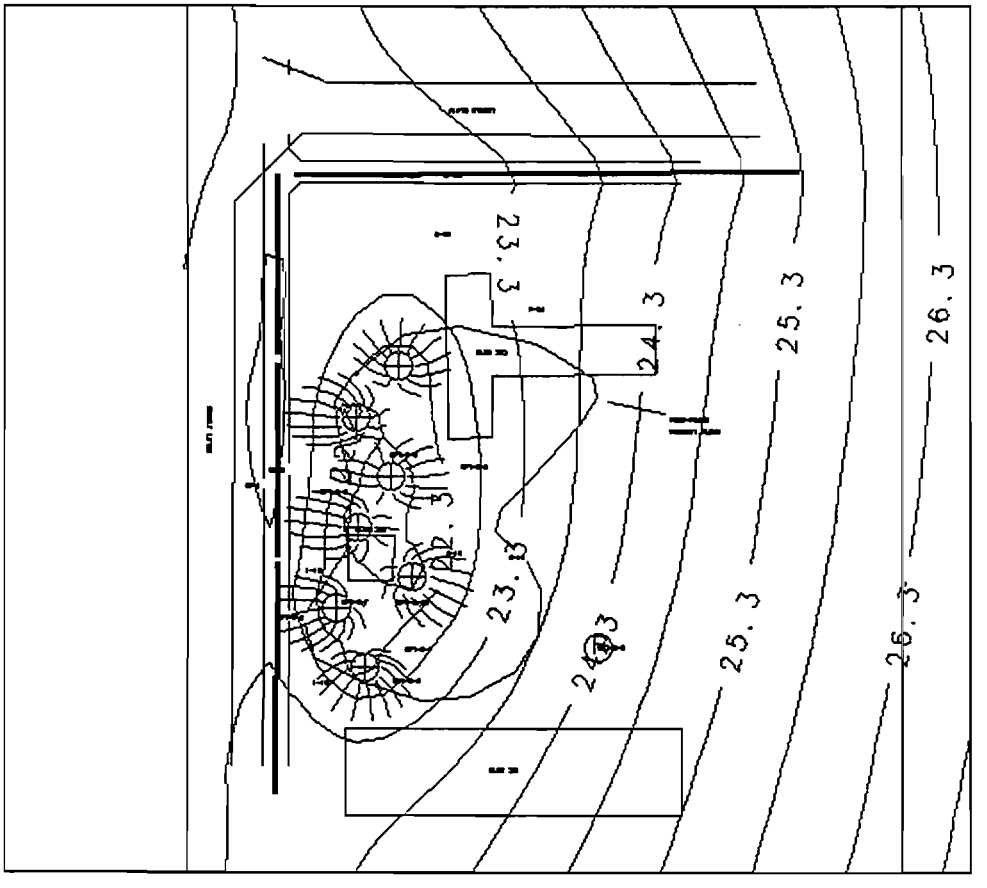

Well Point Modeling Parameters

- 7 well points
- 3.5 gallons per minute system
- 2 feet of drawdown
- partially penetrating

Pros

- Inexpensive

Cons

- Several "stagnant" areas where no product is captured
- longer remediaiton time than trench

FIGURE 5-7

QUICKFLOW™ MODEL GENERATED FOR WELL POINT SYSTEM AT 10 YEARS

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5.2.4 Treatment of Organic Compounds This evaluation only compares biological treatment, air stripping by diffused aerator, and oxidation. Table 5-4 lists the advantages and disadvantages of each technology for reference. Carbon adsorption is not considered further because of the high operation and maintenance costs associated with the high concentrations of organic compounds present in the groundwater. Carbon adsorption may be used for vapor treatment associated with the groundwater treatment, if needed to meet air quality requirements.

Table 5-4
Treatment of Organic Constituents

Free-Phase Product Assessment Report
Site 6 - Fire-fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Method	Advantages	Disadvantages
Air stripping	Removes volatiles compounds Low operation and maintenance cost Low capital cost Can be used for future groundwater remediation	High vapor treatment potential
UV oxidation	Oxidizes chlorinated compounds Minimizes vapor unless ozone used Minimal process residuals	Oxidant consumed by scavengers Requires pretreatment High capital cost High operation and maintenance cost
Biological treatment	Degrades organic compounds Some metals removed in sludge	May need polishing step High vapor treatment potential Medium operation and maintenance cost Sludge disposal
Carbon adsorption	Degrades organic compounds Does not require vapor treatment May be used for vapor treatment for the technologies.	May need polishing step High vapor treatment potential Medium operation and maintenance cost Sludge disposal

5.2.4.1 **Oxidation** Oxidation is effective in reducing VOCs in groundwater to meet the requirements for POTW discharge. UV light enhancement may be needed to achieve oxidation of the chlorinated organic compounds present in the groundwater. UV/oxidation typically destroys many organics, resulting in a clean effluent stream and volatilization of few organic compounds. In contrast, oxidation through the use of ozone increases the potential for volatilization of compounds before destruction is achieved. Activated carbon can be used to treat the vapor stream if needed to achieve air emission standards, although the carbon then requires incineration or disposal. With the appropriate vapor treatment controls, UV/oxidation is very protective of human health and the environment.

Due to the high concentrations of dissolved minerals and organics that typify a shallow aquifer, UV/oxidation would require pretreatment of the groundwater to reduce dissolved constituent loadings to maintain system effectiveness and to protect the UV lamp and other system components. Treatment system components may include chemical pretreatment and filtration equipment, an ozone generator, desiccant dryer, UV lamp assembly, and a vapor treatment system. Special training or an outside service contract may be required for maintenance of system components. Daily monitoring of the process operation is required. Process

residuals needing disposal include filtered solids from pretreatment and vapor phase carbon.

Permit requirements (that must be considered whether or not a permit must actually be issued) for implementation of UV/oxidation include:

- air permit for discharge of vapor stream to the atmosphere,
- permit to discharge to the county's POTW, and
- construction permits for treatment system, recovery wells, and associated piping.

UV/oxidation is the most expensive organic treatment technology to implement and to operate.

5.2.4.2 **Biological Treatment** Biological treatment is effective at reducing VOCs and at meeting the requirements for POTW discharge. Although biological treatment is typically used for gross removal of organics, a polishing step such as air stripping or carbon adsorption is probably not needed to meet POTW pretreatment criteria. Bioreactors using air as an oxygen source may transfer as much as 60 percent or more of the VOCs to the vapor stream due to the stripping effect of the aeration bubbles. As with the other technologies, VOCs can be captured with activated carbon, if needed, and the vapor stream can be released at a height sufficient to allow mixing such that air quality standards are met.

The biological treatment system also would include chemical storage, monitoring, and addition systems. Although pretreatment is not needed for this technology for discharge to the POTW, solids dewatering equipment is required for biological sludge disposal. Biological treatment requires careful monitoring and process control. Process residuals include sludge and activated carbon for vapor treatment.

Permit requirements for this technology are the same as for oxidation.

Biological treatment is less expensive than UV/oxidation to implement and operate but more expensive than air stripping.

5.2.4.3 **Air Stripping** Air stripping is effective at reducing VOCs in groundwater to meet the requirements for POTW discharge. Air stripping and diffused aeration do not destroy the VOCs as does UV/oxidation or biological treatment but transfers them to the vapor stream. The VOC emissions can be captured with activated carbon, if needed, and the vapor stream can be released at a height sufficient to allow mixing such that air quality standards are met. Chlorinated compounds typically degrade quickly (within 1 to 2 days) once volatilized. With the appropriate vapor treatment controls (dispersion and/or removal), air stripping is protective of human health and the environment.

A diffused aeration unit applied at this site would not require pretreatment for iron or carbonate. Although iron may be oxidized, POTW-effluent criteria should still be achievable without filtration. A preventative maintenance program can include periodic cleaning of the system to control scaling. If a preventative maintenance program is not followed, the efficiency of the system will reduce

with scale buildup. Diffused aerators are relatively simple to install with minimal equipment requirements. The system can be designed to be self-operating requiring minimal attention. The only process residual is the activated carbon used for vapor treatment.

Permit requirements for this technology are the same as for oxidation.

Air stripping is the least expensive organic treatment technology to implement and operate.

Based on the effectiveness, ease of implementation, and cost effectiveness, air stripping using a diffused aerator is recommended as the organic treatment technology.

5.2.5 Treatment of Inorganic Constituents Pretreatment of the groundwater for inorganic constituents is not recommended. Laboratory results indicate that the metals of concern are already mostly in particulate form. It is anticipated that with a well developed recovery system, the concentrations of many of these metals will be reduced. Because the preferred discharge point is the POTW, the dissolved metals present in the groundwater already meet pretreatment requirements (see Table 5-1). Additionally, a trench-design, groundwater recovery system will draw water from across the site, which should minimize metal concentrations in the recovered stream due to dilution affects. If suspended solids are determined to be a problem during final design or at start-up, a filter unit can be installed to meet discharge requirements.

Air stripping is the recommended treatment technology for the groundwater. A diffused aeration unit will not require pretreatment for iron removal because iron oxide formation in these units can be removed during a preventative maintenance program.

5.2.6 Disposal Recycling of the free-phase product is preferred by the USEPA. This can be achieved through a treatment facility, such as Safety-Kleen, or by using the product as fuel at a cement kiln. The Base currently uses Safety-Kleen for disposal of other wastes.

For disposal of the process residuals, incineration provides a long-term solution to minimize future liabilities when compared to landfill disposal. However, if the process residuals do not contain regulated constituents at concentrations of concern, disposal in a Subtitled D landfill may be less expensive. This decision can be made appropriately as process residuals are produced.

CHAPTER 6.0

6.0 CONCLUSIONS AND RECOMMENDATIONS

To delineate the horizontal and vertical extent of free-phase product, Hydropunch™ I and II tools were employed during field operations in November 1993. Delineation of the floating product revealed a hourglass-shaped plume oriented north to south. This shape appears to be the result of the two fire-fighting training pits that existed at the site. The areal extent of the product was 170 north to south and 110 feet east to west at the maximum width. Product thicknesses varied to a maximum of 2.5 feet in the southern end and to 1 foot in the northern end of the plume.

Analyses of product samples indicated that diesel and fuel oil were the largest constituents. Free-phase product exists in wells GPT-6-1, GPT-6-4, GPT-6-6, and GPT-6-8 and the recovery well (GPT-6-RW).

Although the potential for DNAPL contamination exists due to the presence of the free-phase product, groundwater samples collected from GPT-6-4 and GPT-6-6 near the clay layer did not contain any DNAPL contamination. In the deeper wells GPT-6-5 and GPT-6-7, a clay layer was discovered at 35 and 47 feet, respectively. This unit may be a locally confining layer, but the areal extent of this clay has not been confirmed by drilling or geophysical methods. DNAPL contamination will be characterized in future site investigations.

Groundwater flow is generally westward at Site 6 except along the western edge where the gradient is reversed, probably as a the result of groundwater mounding near the ditch. This reversal of groundwater flow near the ditch may explain why further westward migration of the plume has not occurred.

Aquifer properties were calculated from slug testing and a short duration stepped pumping test. Hydraulic conductivity ranges on the order of 10^{-3} cm/sec in the surficial aquifer down to 12 to 15 feet bls. Below that range, conductivities range on the order of 10^{-3} cm/sec. Transmissivity values ranging from 978 to 2,142 ft^3/day were obtained from the pumping test using the Jacob straight-line (time versus drawdown) solution and the Neuman methods. The storativity (specific yield in an unconfined aquifer) values obtained were not acceptable due to the short duration of the pumping test. The capture zone obtained by the pumping test was not large enough to adequately remediate the free-phase product plume. Additional recovery wells, piezometers, or recovery trenches could be necessary to remediate the plume. These options were evaluated in Chapter 5.0, and the recovery trench was determined to be the best option based on the modeling used to screen three applicable technologies.

A wide range of VOCs were detected in the soil and groundwater including benzene (71 $\mu g/\ell$ maximum), toluene (4.3 $\mu g/\ell$ maximum), and xylene (190 $\mu g/\ell$ maximum) in the groundwater. SVOCs, such as 2-methylnaphthane (770 $\mu g/\ell$ maximum), were also detected in the groundwater. Inorganics were detected in both soil and groundwater with highest concentrations of aluminum, iron, and lead. Herbicides were not detected in any groundwater samples and only the duplicate of well GPT-6-4 contained any pesticides (0.14 $\mu g/\ell$). Trace amounts of OCDD were found in GPT-6-4 and GPT-6-6. The highest levels were well below MCLs for this compound.

For the interim recovery of the free-phase product, three technologies were considered: recovery wells, well points, and an interceptor trench. The models

used to screen the technologies were produced by Quickflow™ (Geraghty and Miller, 1991b). For all three models, head differences and pumping time remained constant so each technology could be evaluated on recovery of product during a 10-year time interval. The resulting models favored the interceptor trench both in the extent of the plume recovered and in the lack of stagnant zones seen with recovery wells and well points. Additionally, when the models were run until the entire plume was influenced, the trench offers nearly a 2 to 1 time difference.

From this initial modeling, the interceptor trench was selected at the best alternative. More sophisticated modeling will be performed using various interceptor trench configurations and flow rates to optimize free-phase product recovery.

The recovered stream will contain product and groundwater. The product will be separated from the groundwater in an oil and water separator and transferred to a product storage tank.

The groundwater will require removal of VOCs before discharge to the Harrison County POTW. The treatment alternatives evaluated for the treatment of the VOCs in the groundwater include carbon adsorption, biological treatment, UV/oxidation, and air stripping. Air stripping is effective at removing VOCs and is the most cost efficient of the treatment technologies evaluated. A diffused aeration tank is an air stripping device that has minimal pretreatment requirements and the tank design facilitates equipment maintenance requirements. Using a diffused aeration tank will minimize capital and operating costs compared to the other technologies evaluated. A carbon adsorption system may be used to treat the vapor stream from the diffused aerator, if vapor treatment is required to meet air quality requirements.

Treatment of inorganic compounds is not planned at this time. The analytical results of site groundwater sampling does not support the necessity for metals treatment. Discharge of treated groundwater to the Harrison County POTW also minimizes treatment requirements of inorganic compounds, because acceptance criteria for the groundwater is tolerant of most of the metals present in the groundwater. The observational approach method will be used for treatment of inorganic compounds. If, after installation of the trench when a realistic sample of groundwater that is to be captured long-term by the trench is collected, it is determined that treatment for inorganic compounds is needed, a system will be installed at that time.

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APPENDIX A

APPENDIX A

SOIL BORING LOGS

APPENDIX A

About this Appendix

This appendix contains information obtained during drilling activities at Site 6. Borings 6-1, 6-2, and 6-3 were installed in 1987 under the guidance of Harding Lawson and Associates.

Definition of Acronyms

HSA - hollow stem auger

OVA - organic vapor analyzer. During this field operation, a flame ionizing detector was employed to measure organic vapor readings. Readings are measured in parts per million (ppm).

HLA - Harding Lawson and Associates

FIELD BORING LOG			BORING NO.: GPT-6-1
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: Southwestern Laboratories, Inc.	DRILLER: -	DATE STARTED: 3/17/87	COMPLETED: 3/17/87
METHOD: HSA	AUGER SIZE: 4.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 6.0'	TOTAL DEPTH: 29.5'
LOGGED BY: HLA	CHECKED BY: HLA	DATE: 3/17/87	

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. / REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 0.5			Tan and orange sand					
	0.5 - 1			Dark brown silty sand					
	1 - 27.5			Tan and gray silty sand					
	27.5 - 29.5			Gray fat clay					

FIELD BORING LOG			BORING NO.: GPT-6-2
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: Southwestern Laboratories, Inc.	DRILLER: -	DATE STARTED: 3/17/87	COMPLETED: 3/17/87
METHOD: HSA	AUGER SIZE: 4.25"	OVA:	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 6.65'	TOTAL DEPTH: 23'
LOGGED BY: HLA	CHECKED BY: HLA		DATE: 3/17/87

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. / REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 0.3			Brown topsoil					
	0.3 - 5.2			Tan clayey sand					
	5.2 - 23			Tan and brown sand					
	23			Gray fat clay					

FIELD BORING LOG			BORING NO.: GPT-6-3
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: Southwestern Laboratories, Inc.	DRILLER: -	DATE STARTED: 3/16/87	COMPLETED: 3/16/87
METHOD: HSA	AUGER SIZE: 4.25"	OVA:	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 4.0'	TOTAL DEPTH: 24'
LOGGED BY: HLA	CHECKED BY: HLA	DATE: 3/16/87	

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. / REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 0.3			Brown topsoil					
	0.3 - 22			Tan and brown sand					
	22 - 24			Gray fat clay					

FIELD BORING LOG			BORING NO.: GPT-6-4
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: GPI	DRILLER: Bowman	DATE STARTED: 12-7-93	COMPLETED: 12-7-93
METHOD: HSA	AUGER SIZE: 4.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: ≈ 5'	TOTAL DEPTH: 13'
LOGGED BY: R. Fisher	CHECKED BY: R. Fisher		DATE: `12-7-93

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 2	PH		Light brown/yellow silt and gravel fill material		0 ppm			
	2 - 3	PH		Dark brown silty sand with gravel		100 ppm			
	3 - 13	HSA		Dark brown fine to medium sand with some silt		100 ppm			

FIELD BORING LOG			BORING NO.: GPT-6-5
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: GPI	DRILLER: Bowman	DATE STARTED: 12-10-93	COMPLETED: 12-10-93
METHOD: HSA	AUGER SIZE: 4.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: ≈ 5.0'	TOTAL DEPTH: 34'
LOGGED BY: R. Fisher	CHECKED BY: R.Fisher		DATE: 12-10-93

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. / REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 2		HSA	Light brown fine sand with some clay, fill material					
SBG6503	2 - 4	10,8,4,4	24/18	Dark brown fine sand, with little medium sand and little silt.		500 ppm			
		5,3,56	24/16	Dark brown fine sand, with little medium sand and little silt.		500 ppm			
	4 - 7	HSA		Dark brown fine sand, with little medium sand and little silt.					
SBG6508	7 - 9	6,10,9,8	24/12	Dark brown medium sand with some fine sand and little silt.		300 ppm			
		8,15,30,41	24/12	6,14,19,22 on the third spoon		300 ppm			
	9 - 20	HSA		Dark brown medium sand with some fine sand and little silt.		100 ppm			
SBG6520	20 - 22	8,11,10,12	24/10	Dark brown medium sand with some fine sand and little silt.		50 ppm			
	23 - 25	1,WOH,3,2	24/5	Dark brown medium sand with some fine sand and little silt.		15 ppm			
	25 - 27	8,10,14,27	24/24	Medium brown sand with some fine sand and little silt.		0 ppm			
	27 - 29	5,5,9,14	24/18	Medium brown sand with some fine sand and little silt.		0 ppm			
	29 - 31	2,3,7,11	24/16	Light brown sand with some fine sand and little silt.		0 ppm			
	31 - 33	4,5,6,7	24/18	Light brown sand with some clay nodules present.		0 ppm			
	33 - 34	HSA		Dark gray silty clay		0 ppm			

FIELD BORING LOG			BORING NO.: GPT-6-6
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: GPI	DRILLER: Bowman	DATE STARTED: 12-8-93	COMPLETED: 12-8-93
METHOD: HSA	AUGER SIZE: 4.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: ≈ 4'	TOTAL DEPTH: 13'
LOGGED BY: R. Fisher	CHECKED BY: R. Fisher		DATE: 12-8-93

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. / REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 3	PH		Light brown clayey silt, fill material		10 ppm			
	3 - 13	HSA		Dark brown fine sand with some silt		50 ppm			

FIELD BORING LOG			BORING NO.: GPT-6-7
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: GPI	DRILLER: Bowman	DATE STARTED: 12-10-93	COMPLETED: 12-11-93
METHOD: HSA	AUGER SIZE: 4.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 5'	TOTAL DEPTH: 45
LOGGED BY: R. Fisher	CHECKED BY: R.Fisher		DATE: 12-10-93

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 8	HSA		Medium brown fine sand with some medium sand and little silt.					
SBG6708	8 - 12	8,6,16,25	24/16	Medium brown fine sand with some medium sand and little silt.		110 ppm			
	12 - 14	9,15,17,20	24/24	Second spoon to ensure enough sample.		150 ppm			
	14 - 20	HSA		No apparent lithology change.					
SBG6720	20 - 22	2,2,4,5	24/22	Light brown,medium sand with some fine sand and little silt.		1 ppm			
	22 - 25	HSA							
	25 - 27	4,4,5,6	24/20	Light brown medium sand with some fine sand and little silt.		0 ppm			
	27 - 30	HSA							
	30 - 32	4,5,5,6	24/20	Light brown medium sand with some fine sand and little silt.		0 ppm			
	32 - 35	HSA							
	35 - 37	5,6,9,10	24/20	Light brown medium sand with some fine sand and little silt.		0 ppm			
	37 - 40	HSA							
	40 - 42	3,4,7,11	24/20	Dark brown medium sand with some fine sand and little silt. Clay modules present.		0 ppm			
	43 - 45	1,2,2,4	24/16	Dark brown medium sand with some fine sand and little silt. Clay modules present.		0 ppm			
SBG6745	45 - 47	7,8,9,40	24/18	Dark brown, medium sand. Dark gray silty clay in bottom 2 inches.		0 ppm			

FIELD BORING LOG			BORING NO.: GPT-6-8
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: GPI	DRILLER: Bowman	DATE STARTED: 12-8-93	COMPLETED: 12-8-93
METHOD: HSA	AUGER SIZE: 4.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Silty Sand	WATER LEVEL: 4'	TOTAL DEPTH: 13'
LOGGED BY: R. Fisher	CHECKED BY: R.Fisher		DATE: 12-8-93

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. / REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 4	HSA		Light brown silty sand with some clay and shell fill material.		10 ppm			
	4 - 13	HSA		Brown, fine silt sand with some medium sand and little silt.		100 ppm			

FIELD BORING LOG			BORING NO.: GPT-6-RW
PROJECT NO.: 08505	PROJECT NAME: NCBC FPPA		PAGE 1 OF 1
DRILLING CONTRACTOR: GPI	DRILLER: Bowman	DATE STARTED: 12-12-93	COMPLETED: 12-12-93
METHOD: HSA	AUGER SIZE: 8.25"	OVA: PORTA FID	PROTECTION LEVEL: MODIFIED LEVEL D
GROUND ELEV.: NA	SOIL DRILLED: Sand	WATER LEVEL: 8.5	TOTAL DEPTH: 26'
LOGGED BY: R. Fisher	CHECKED BY: R. Fisher	DATE: 12-12-93	

SAMPLE NO.	DEPTH IN FEET	BLOWS PER 6-INCHES	PEN. REC.	DESCRIPTION	LAB	FIELD SCREENING		MONITORING	
						FID	UV\IR	TIP	LEL
	0 - 2	HSA		Silty clay with sand fill, light brown		0			
	2 - 26	HSA		Medium sand, dark brown with some fine sand and little silt. Strong petroleum odor.		800 - 1,400 ppm			

APPENDIX B

APPENDIX B

MONITORING WELL CONSTRUCTION LOGS

APPENDIX B

About this Appendix

This appendix contains well construction details in a Navy department format and another generated by Geotechnical Graphical Software (1987). Additionally, well development data shells are included for wells 6-4 through 6-8, including the recovery well.

Definition of Acronyms

SP	-	poorly graded sands, little or no fines
SM	-	sand-silt mixture
CL	-	inorganic clays of low to medium plasticity
conductivity	-	measurement of sample conductivity in micromohs (μmohs)

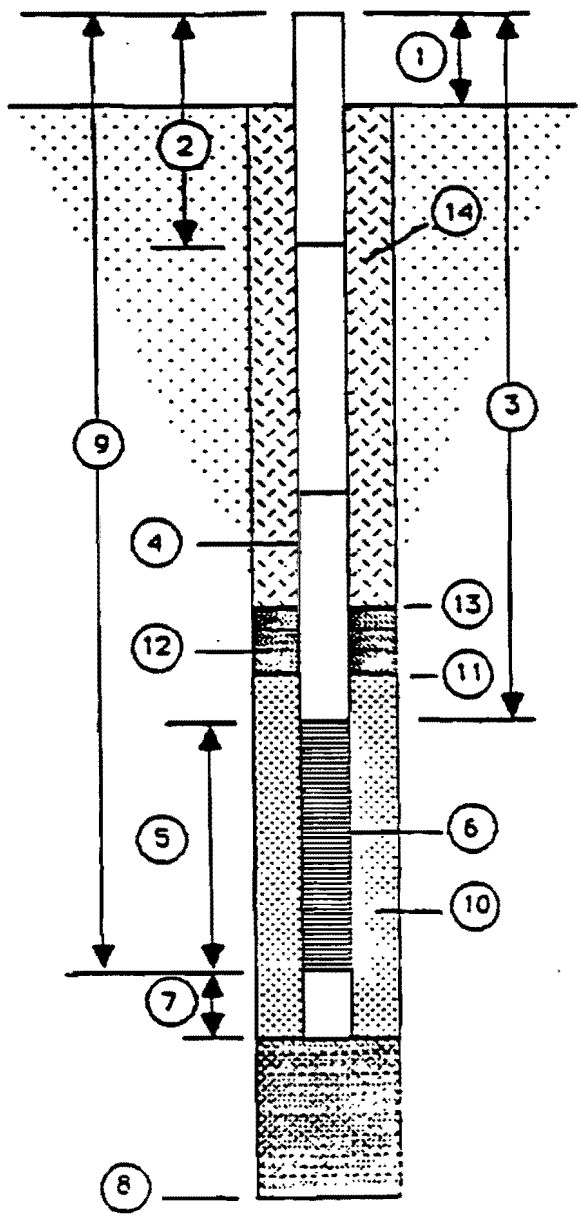
Well GPT-6-1

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P.O. BOX 10068
CHARLESTON S.C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER GPT - 6-1

DATE OF INSTALLATION 3/17/87



1. Height of Casing above ground 2.5 ft
2. Depth to first Coupling 5.5 ft

   Coupling Interval Depths 15.5 ft, 25.5 ft
3. Total Length of Blank Pipe 5.5 ft
4. Type of Blank Pipe Schedule 40 PVC
5. Length of Screen 24.5 ft
6. Type of Screen Sch. 40 PVC, 0.020 slotted
7. Length of Sump N/A
8. Total Depth of Boring 29.5 ft Hole Diameter 6-3/4 in
9. Depth To Bottom of Screen 30.0 ft
10. Type of Screen Filter # 1 sand

    Quantity Used 550 lbs. Size 10/20 U/C
11. Depth To Top of Filter 2.5 ft
12. Type of Seal 1/2-inch bentonite pellets

    Quantity Used 25 pounds
13. Depth To Top of Seal 0.5 ft
14. Type of Grout cement-bentonite

    Grout Mixture 20:1

    Method of Placement poured

COMMENTS ON INSTALLATION

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR P O BOX 10068
CHARLESTON, S C 29411-0068

WELL DATA REPORT

WELL NUMBER GPT - 6-1 AREA 6

DATE OF INSTALLATION 3/17/87

WELL HOLE DATA

Drill Date 3/17/87 Well Driller Southwestern Laboratories, Inc.

Depth of Boring 29.5 ft Purpose of Boring Soil Sampling and Monitoring Well Installation

Drilling Method Hollow-stem auger Mud Type None

WATER LEVEL DATA (All measurements from top of casing)

Water Level 6.0 ft Date of Measurement 3/24/87

DEVELOPMENT DATA

Development Method Pumped

Length of Time Developed 15 minutes

LOCATION OF BOREHOLE INFORMATION

Drillers Log X Geophysical Log

Physical Core X Cutting Samples

Water Level Observations 6.89' on 3/30/87

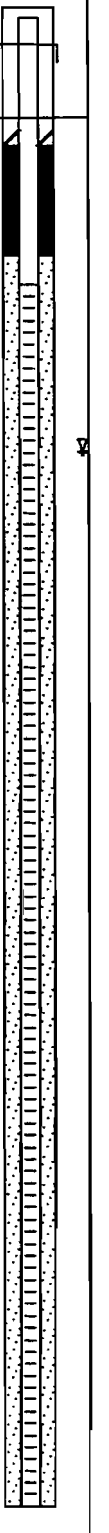
DRILLED BY S.W. Labs SCCWD#

DEVELOPED BY HLA SCCWD#

TECHNICAL OVERSIGHT BY HLA

TITLE: Gulfport Site 6		**LOG of WELL:** GPT-6-1	**BORING NO.** GPT-6-1
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:**
CONTRACTOR: Southwestern Laboratories, Inc.		**DATE STARTED:** 03/17/87	**COMPLTD:** 03/17/87
METHOD: HSA	**CASE SIZE:** 2"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.17 FT.	**MONITOR INST.:**	**TOT DPTH:** 29.5FT.	**DPTH TO ▽** 8.0 FT.
LOGGED BY: Harding Lawson Associates	**WELL DEVELOPMENT DATE:** 3/24/87		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					Sand, tan and orange		SP	
					Silty sand, dark brown		SM	
					Silty sand, tan and gray, dense			
5								
10								
15								
20								
25								

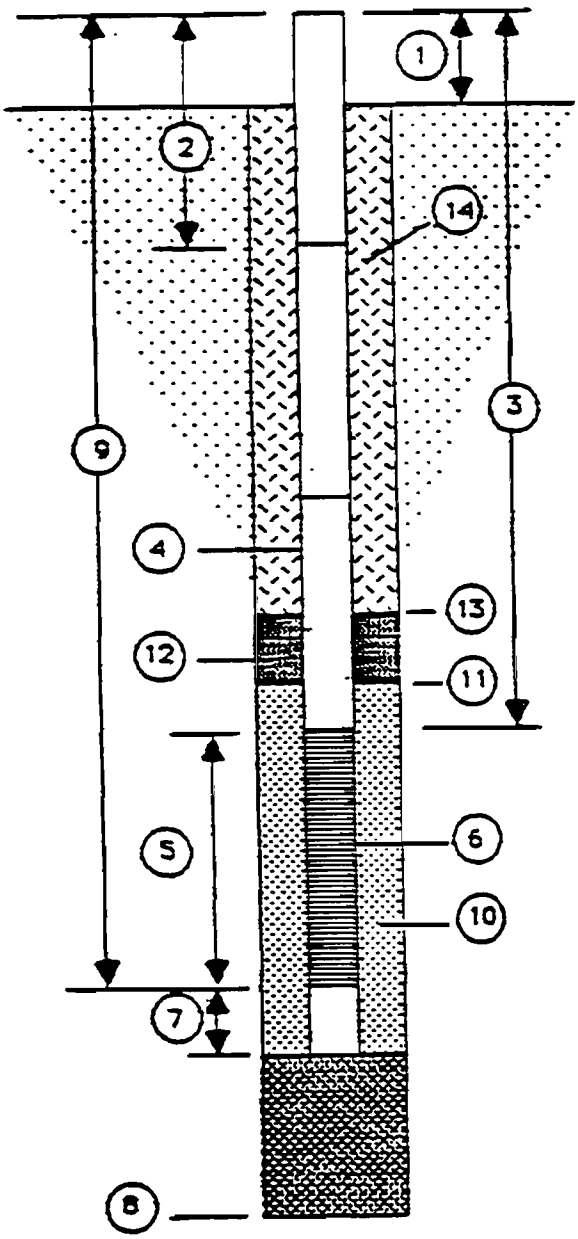


TITLE: Gulfport Site 6		**LOG of WELL:** GPT-6-1	**BORING NO.** GPT-6-1
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:**
CONTRACTOR: Southwestern Laboratories, Inc.		**DATE STARTED:** 03/17/87	**COMPLTD:** 03/17/87
METHOD: HSA	**CASE SIZE:** 2"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.17 FT.	**MONITOR INST.:**	**TOT DPTH:** 29.5FT.	**DPTH TO ∇** 6.0 FT.
LOGGED BY: Harding Lawson Associates	**WELL DEVELOPMENT DATE:** 3/24/87		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					Continued from PAGE 1			
							SM	
					Clay, gray		CL	
30					total depth = 29.5 ft.			
35								
40								
45								
50								

Well GPT-6-2

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-2

DATE OF INSTALLATION 3/17/87

1. **Height of Casing Above Ground** 2.5 ft
2. **Depth to first Coupling** 5.5 ft

   Coupling Interval Depths 15.5 ft
3. **Total Length of Blank Pipe** 5.5 ft
4. **Type of Blank Pipe** Schedule 40 PVC
5. **Length of Screen** 19 ft
6. **Type of Screen** Schedule 40 PVC, 0.020 slotted
7. **Length of Sump** N/A
8. **Total Depth of Boring** 23 ft **Hole Diameter** 6 ¾ in
9. **Depth to Bottom of Screen** 24.5 ft
10. **Type of Screen Filter** No. 1 sand

    Quantity Used _____ **Size** 10/20 **U/C** _____
11. **Depth to Top of Filter** 2.5 ft
12. **Type of Seal** ½-inch Bentonite Pellets

    Quantity Used 30 lbs.
13. **Depth to Top of Seal** 0.5 ft
14. **Type of Grout** Cement-bentonite

    Grout Mixture 20:1

    Method of Placement Poured

COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR P O BOX 10068
CHARLESTON, S C. 29411-0068

WELL DATA REPORT

WELL NUMBER GPT - 6-2 AREA 6

DATE OF INSTALLATION 3/17/87

WELL HOLE DATA

Drill Date 3/17/87 Well Driller Southwestern Laboratories, Inc.

Depth of Boring 23 ft Purpose of Boring Soil Sampling and Monitoring Well Installation

Drilling Method Hollow-stem auger Mud Type None

WATER LEVEL DATA (All measurements from top of casing)

Water Level 6.65 Date of Measurement 3/24/87

DEVELOPMENT DATA

Development Method Pumped

Length of Time Developed 30 minutes

LOCATION OF BOREHOLE INFORMATION

Drillers Log X Geophysical Log

Physical Core X Cutting Samples

Water Level Observations 6.72' on 3/30/87

DRILLED BY S. W. Labs SCCWD#

DEVELOPED BY HLA SCCWD#

TECHNICAL OVERSIGHT BY HLA

TITLE: Gulfport Site 6	**LOG of WELL:** GPT-6-2	**BORING NO.** GPT-6-2
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM		**PROJECT NO:**
CONTRACTOR: Southwestern Laboratories, Inc.	**DATE STARTED:** 03/17/87	**COMPLTD:** 03/17/87
METHOD: HSA	**CASE SIZE:** 2" / **BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.35 FT.	**MONITOR INST.:** / **TOT DPTH:** 23FT.	**DPTH TO ∇** 6.72 FT.
LOGGED BY: Harding Lawson Associates	**WELL DEVELOPMENT DATE:** 3/24/87	**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					topsoil, brown			
					Clayey sand, tan		SC	
5					Sand, tan and brown		SP	
10								
15								
20								
					total depth = 23 ft.			
25								

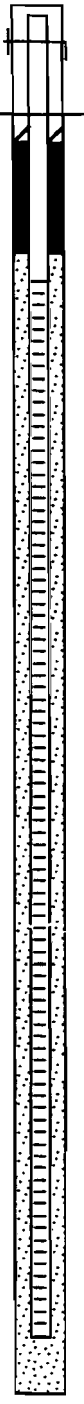


 ABB ENVIRONMENTAL SERVICES, INC.

WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-2 DATE OF DEVELOPMENT: 12-12-93

DATE OF WELL INSTALLATION: N/A PERSONNEL: R. Fisher/H. Faircloth

STATIC WATER LEVEL BEFORE DEVELOPMENT: 8.09' btoc BOTTOM OF WELL: 24.5' btoc

HEIGHT OF WATER COLUMN: 16.41' WELL I.D.: 2.0" HEIGHT OF SATURATED SANDPACK: 16.41'

GALLONS\VOLUME: 2.6 GAL X 3 VOLUMES = 7.8 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (20 GAL)	VOLUME NO. 3 (40 GAL)	VOLUME NO. 4 (50 GAL)
pH	6.65	5.93	5.57	5.58
Conduct.	125	65	63	65
Turbid.	slight	mild	mild	slight
Descrip.	17.6 °C	21.2 °C	21.0 °C	21.0 °C

TOTAL VOLUME REMOVED: 50 GAL FINAL FIELD PARAMETERS: pH - 5.58

Conduct. - 65 microohms

Turbid. - slight

Descrip. - 21.0 °C

WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 8.13'

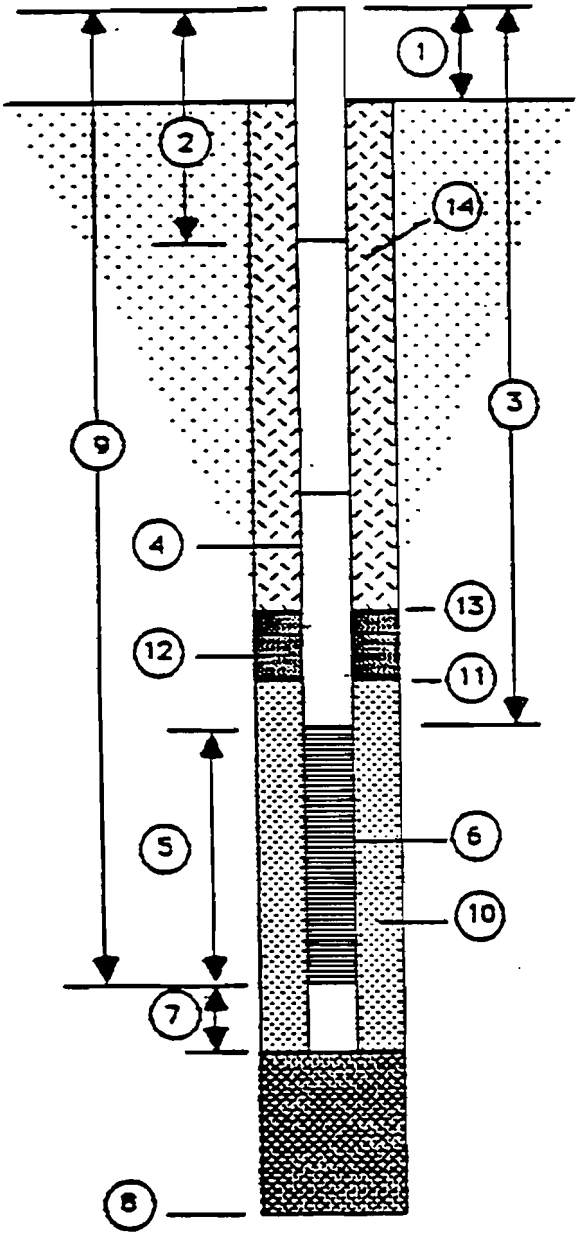
* All development was performed with a surg block and submergible pump.

Comments:

Redevelopment of a previously installed monitoring well.

Well GPT-6-3

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-3

DATE OF INSTALLATION 3/16/87

1. **Height of Casing Above Ground** 2.1 ft
2. **Depth to first Coupling** 5.1 ft

   Coupling Interval Depths 15.1 ft
3. **Total Length of Blank Pipe** 5.1 ft
4. **Type of Blank Pipe** Schedule 40 PVC
5. **Length of Screen** 19 ft
6. **Type of Screen** Schedule 40 PVC, 0.020 slotted
7. **Length of Sump** N/A
8. **Total Depth of Boring** 24 ft **Hole Diameter** 6¾-n
9. **Depth to Bottom of Screen** 24.1 ft
10. **Type of Screen Filter** No. 1 sand

    Quantity Used 500 lbs. **Size** 10/20 **U/C** _____
11. **Depth to Top of Filter** 2 ft
12. **Type of Seal** ½-inch Bentonite Pellets

    Quantity Used 25 lbs.
13. **Depth to Top of Seal** 0.5 ft
14. **Type of Grout** Cement-bentonite

    Grout Mixture 20:1

    Method of Placement Poured

COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR P O BOX 10068
CHARLESTON, S C. 29411-0068

WELL DATA REPORT

WELL NUMBER GPT - 6-3 AREA 6

DATE OF INSTALLATION 3/16/87

WELL HOLE DATA

Drill Date 3/16/87 Well Driller Southwestern Laboratories, Inc.

Depth of Boring 24 ft Purpose of Boring Soil Sampling and Monitoring Well Installation

Drilling Method Hollow-stem auger Mud Type None

WATER LEVEL DATA (All measurements from top of casing)

Water Level 4.0 ft Date of Measurement 3/23/87

DEVELOPMENT DATA

Development Method Pumped

Length of Time Developed 15 minutes

LOCATION OF BOREHOLE INFORMATION

Drillers Log X Geophysical Log

Physical Core X Cutting Samples

Water Level Observations

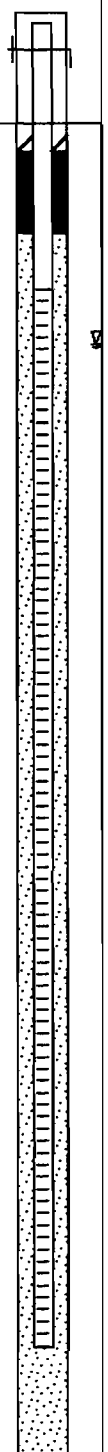
DRILLED BY S.W. Labs SCCWD#

DEVELOPED BY HLA SCCWD#

TECHNICAL OVERSIGHT BY HLA

TITLE: Gulfport Site 8		**LOG of WELL:** GPT-8-3	**BORING NO.** GPT-8-3
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:**
CONTRACTOR: Southwestern Laboratories, Inc.		**DATE STARTED:** 03/18/87	**COMPLTD:** 03/18/87
METHOD: HSA	**CASE SIZE:** 2"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 27.59 FT.	**MONITOR INST.:**	**TOT DPTH:** 24FT.	**DPTH TO ▽** 4 FT.
LOGGED BY: Harding Lawson Associates	**WELL DEVELOPMENT DATE:** 3/23/87		**SITE:** Site 8

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					topsoil, brown			
					Sand, tan and brown		SP	
5								
10								
15								
20								
					Clay, gray		CL	
					total depth = 24 ft.			
25								

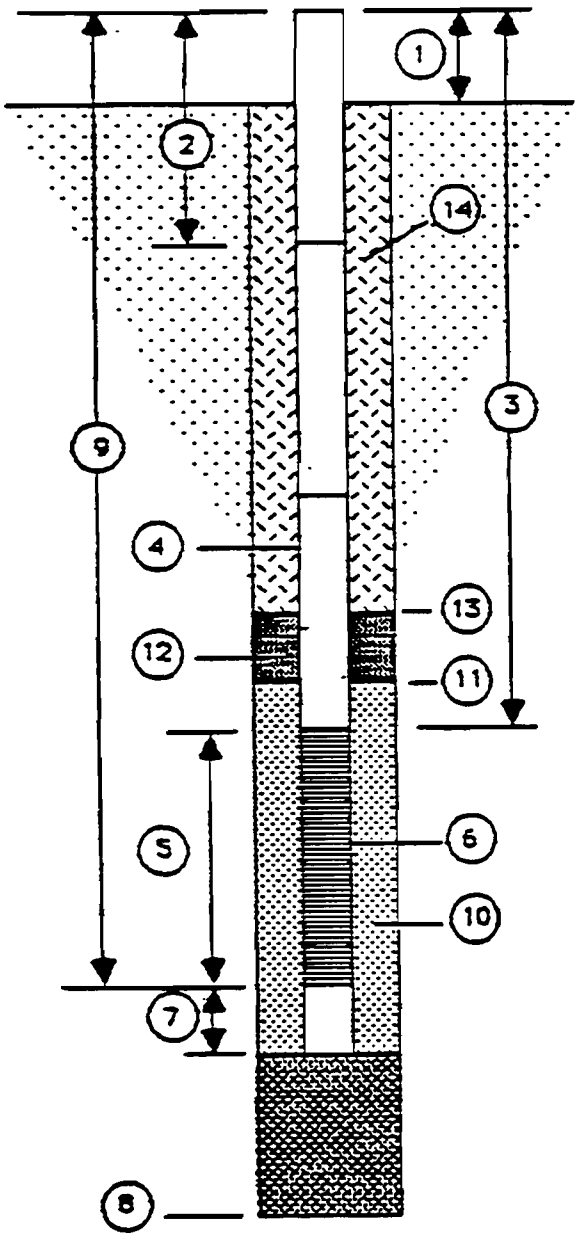


PAGE 1 of GPT-8-3 **ABB ENVIRONMENTAL SERVICES, INC.**

FPPA[RPT]#034
06.94.mlv

Well GPT-6-4

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-4

DATE OF INSTALLATION 12-7-93

1. **Height of Casing Above Ground** 2.09'
2. **Depth to first Coupling** 4.59'

   Coupling Interval Depths 4.59'

3. **Total Length of Blank Pipe** 4.59'
4. **Type of Blank Pipe** 2" SCH 40 PVC
5. **Length of Screen** 10'
6. **Type of Screen** 0.020-slot, 2" SCH 40 PVC
7. **Length of Sump** 0.5'
8. **Total Depth of Boring** 13' **Hole Diameter** 8.75'
9. **Depth to Bottom of Screen** 14.59'
10. **Type of Screen Filter** Silica Sand

    Quantity Used 440 lbs. **Size** 16/30 **U/C** _____

11. **Depth to Top of Filter** 1.5'
12. **Type of Seal** Bentonite Pellets

    Quantity Used 50 lbs.

13. **Depth to Top of Seal** 1.0'
14. **Type of Grout** Neat Cement

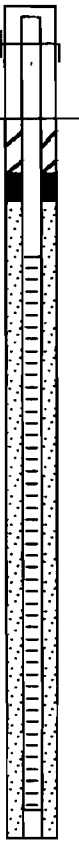
    Grout Mixture 5% Bentonite

    Method of Placement Tremie

COMMENTS ON INSTALLATION:

TITLE: NCBC Gulfport FPPA		**LOG of WELL:** GPT-6-4	**BORING NO.** GPT-6-4
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection		**DATE STARTED:** 12/7/93	**COMPLTD:** 12/7/93
METHOD: HSA	**CASE SIZE:** 2.0"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.84 FT.	**MONITOR INST.:** FID	**TOT DPTH:** 13.0FT.	**DPTH TO ∇** 5.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/12/93		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					Silty sand, light brown to yellow, with gravel		SM	
				0	Silty sand, dark brown, with gravel			
				100	Silty sand, dark brown, fine/medium sand with some silt			
5								
10								
				100	total depth = 13.0 ft.			
15								
20								
25								



PAGE 1 of GPT-6-4 **ABB ENVIRONMENTAL SERVICES, INC.**

FPPA[RPT]#034
06.94.mlv

WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-4 DATE OF DEVELOPMENT: 12-9-93

DATE OF WELL INSTALLATION: 12-7-93 PERSONNEL: R. Fisher/H. Faircloth

STATIC WATER LEVEL BEFORE DEVELOPMENT: 5.5' btoc BOTTOM OF WELL: 15.09' btoc

HEIGHT OF WATER COLUMN: 9.59' WELL I.D.: 2.0" HEIGHT OF SATURATED SANDPACK: 9.59'

GALLONS\VOLUME: 1.5 GAL X 3 VOLUMES = 4.5 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (20 GAL)	VOLUME NO. 3 (40 GAL)	VOLUME NO. 4 (55 GAL)
pH	6.11	6.17	6.37	6.33
Conduct.	900	1,000	900	900
Turbid.	some	mild	mild	none
Descrip.	20 °C	22 °C	22 °C	22 °C

TOTAL VOLUME REMOVED: 55 GAL

FINAL FIELD PARAMETERS:

pH - 6.33

Conduct. - 900 microohms

Turbid. - none/little

Descrip. - 22 °C

WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 9.45' DTW 8.91' DTP

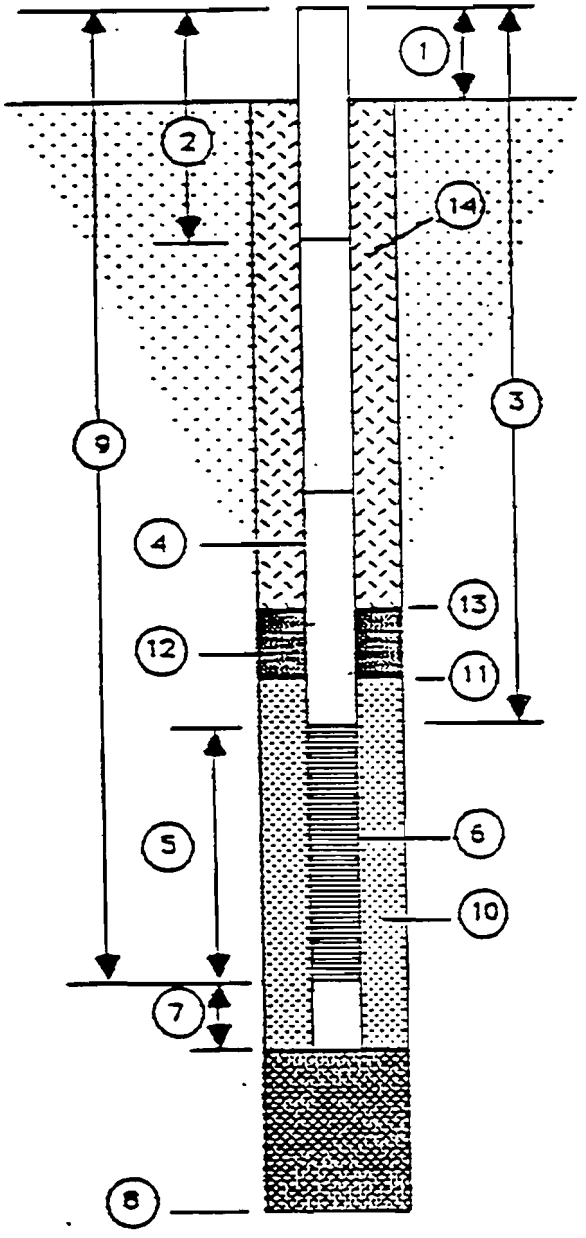
* All development was performed with a surg block and submergible pump.

Comments:

Very contaminated.

Well GPT-6-5

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-5

DATE OF INSTALLATION 12-10-93

1. **Height of Casing Above Ground** 2.1'
2. **Depth to first Coupling** 9.1'

   Coupling Interval Depths 9.1', 19.1', 29.1'
3. **Total Length of Blank Pipe** 29.1'
4. **Type of Blank Pipe** 2" Sch 40 PVC
5. **Length of Screen** 5'
6. **Type of Screen** 0.020-slot, 2" Sch 40 PVC
7. **Length of Sump** 1'
8. **Total Depth of Boring** 34' **Hole Diameter** 8.75"
9. **Depth to Bottom of Screen** 34.1'
10. **Type of Screen Filter** Silica Sand

    Quantity Used 240 lbs **Size** 16/30 **U/C** _____
11. **Depth to Top of Filter** 25'
12. **Type of Seal** Bentonite

    Quantity Used 50 lbs
13. **Depth to Top of Seal** 23.5'
14. **Type of Grout** Neat Cement

    Grout Mixture 5% Bentonite

    Method of Placement Poured

COMMENTS ON INSTALLATION:

TITLE: NCBC Gulfport FPPA		**LOG of WELL:** GPT-6-5	**BORING NO.** GPT-6-5
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection		**DATE STARTED:** 12/10/93	**COMPLTD:** 12/10/93
METHOD: HSA	**CASE SIZE:** 2.0"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.79 FT.	**MONITOR INST.:** FID	**TOT DPTH:** 33.0FT.	**DPTH TO ∇** 5.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/13/93		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
							SM	
	SBG6503		18"	500	Silty sand, dark brown, with some silt			10,8,4,4
5								
	SBG6506		12"	300	Silty sand, dark brown, medium sand with some fine sand and a little silt			6,10,9,8
				100				
10								
15								
20	SBG6520		10"	50				8,11,10,12
			5"	15	Silty sand, dark brown, medium sand with some fine and a little silt			1,WOH,3,2
25				0				8,10,14,27

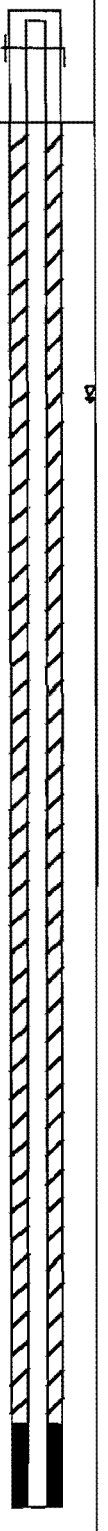
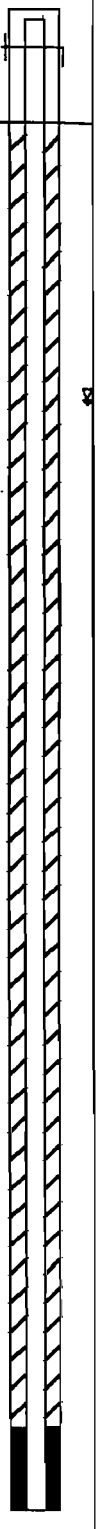


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NCBC Gulfport FPPA		**LOG of WELL:** GPT-6-5	**BORING NO.** GPT-6-5
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection		**DATE STARTED:** 12/10/93	**COMPLTD:** 12/10/93
METHOD: HSA	**CASE SIZE:** 2.0"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.79 FT.	**MONITOR INST.:** FID	**TOT DPTH:** 33.0FT.	**DPTH TO ∇** 5.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/13/93		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
							SM	
	SBG8503		18"	500	Silty sand, dark brown, with some silt			10,8,4,4
5								
	SBG8508		12"	300	Silty sand, dark brown, medium sand with some fine sand and a little silt			6,10,9,8
				100				
10								
15								
20	SBG8520		10"	50				8,11,10,12
			5"	15	Silty sand, dark brown, medium sand with some fine and a little silt			1,WOH,3,2
25				0				8,10,14,27

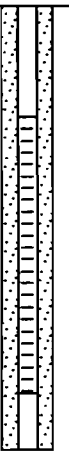


PAGE 1 of GPT-6-5 ABB ENVIRONMENTAL SERVICES, INC.

FPPA[RPT]#034
06.94.mlv

TITLE: NCBC Gulfport FPPA	**LOG of WELL:** GPT-6-5	**BORING NO.** GPT-6-5
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM		**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection	**DATE STARTED:** 12/10/93	**COMPLTD:** 12/10/93
METHOD: HSA	**CASE SIZE:** 2.0" / **BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.79 FT.	**MONITOR INST.:** FID / **TOT DPTH:** 33.0FT.	**DPTH TO ∇** 5.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/13/93	**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					Continued from PAGE 1			
			24"		Silty sand, medium brown, medium sand with some fine sand and a little silt.		SM	
				0				5,5,9,14
			18"					
				0	Silty sand, light brown, with some silt			2,3,7,11
30			18"					
				0	Silty sand, light brown, clay nodules present			4,5,6,7
			18"					
					total depth = 33.0 ft.			
35								
40								
45								
50								



WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-5 DATE OF DEVELOPMENT: 12-13-93

DATE OF WELL INSTALLATION: 12-10-93 PERSONNEL: R. Fisher

STATIC WATER LEVEL BEFORE DEVELOPMENT: 8.59' btoc BOTTOM OF WELL: 35.1' btoc

HEIGHT OF WATER COLUMN: 26.51' WELL I.D.: 2.0" HEIGHT OF SATURATED SANDPACK: 7.0'

GALLONS\VOLUME: 4.2 GAL X 3 VOLUMES = 12.6 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (40 GAL)	VOLUME NO. 3 (80 GAL)	VOLUME NO. 4 (150 GAL)
pH	9.65	7.24	7.02	6.90
Conduct.	290	120	100	90
Turbid.	slight	very	mild	mild
Descrip.	17 °C	21 °C	22 °C	22 °C

TOTAL VOLUME REMOVED: 150 GAL FINAL FIELD PARAMETERS: pH - 6.90

Conduct. - 90 microohms

Turbid. - mild

Descrip. - 22 °C

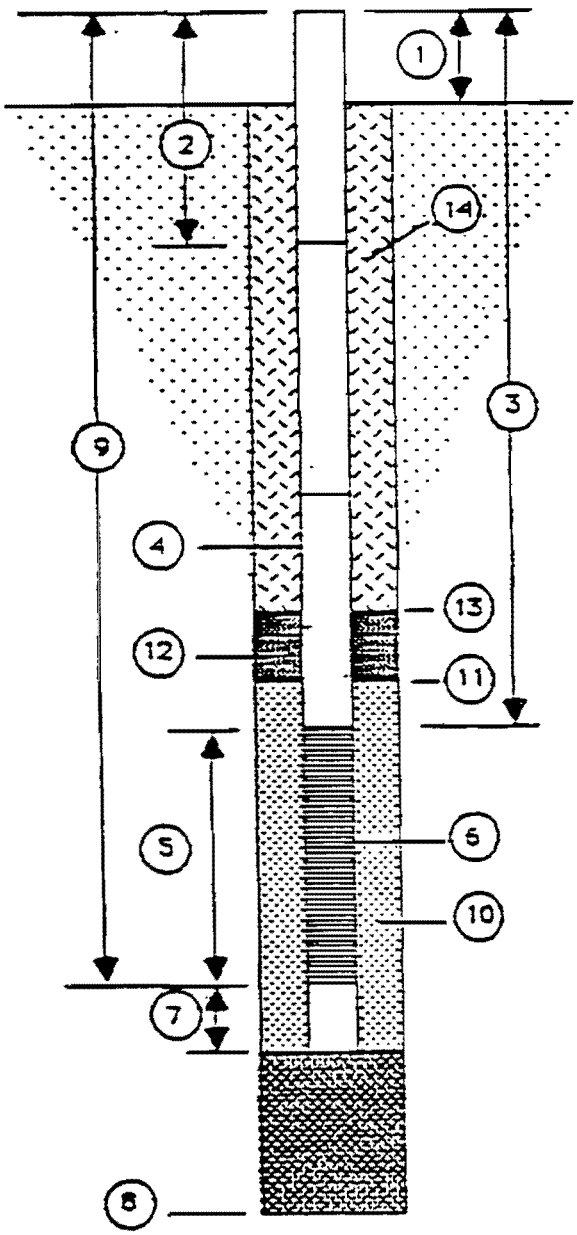
WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 8.82'

* All development was performed with a surg block and submergible pump.

Comments:

Well GPT-6-6

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-6

DATE OF INSTALLATION 12-8-93

1. **Height of Casing Above Ground** 1.72'
2. **Depth to first Coupling** 4.22'

   Coupling Interval Depths 4.22'
3. **Total Length of Blank Pipe** 4.22'
4. **Type of Blank Pipe** 2" Sch 40 PVC
5. **Length of Screen** 10'
6. **Type of Screen** 0.020-slot, 2" SCH 40 PVC
7. **Length of Sump** 0.5'
8. **Total Depth of Boring** 13.0' **Hole Diameter** 8.75"
9. **Depth to Bottom of Screen** 14.22'
10. **Type of Screen Filter** Silica Sand

    Quantity Used 440 lbs. **Size** 16/30 **U/C** _____
11. **Depth to Top of Filter** 1.5'
12. **Type of Seal** Bentonite Pellets

    Quantity Used 50 lbs.
13. **Depth to Top of Seal** 1.0'
14. **Type of Grout** Neat Cement

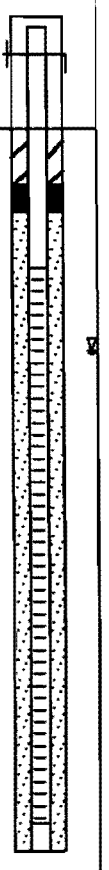
    Grout Mixture 5% Bentonite

    Method of Placement Poured

COMMENTS ON INSTALLATION:

TITLE: NCBC Gulfport FPPA		**LOG of WELL:** GPT-6-6	**BORING NO.** GPT-6-6
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection		**DATE STARTED:** 12/8/93	**COMPLTD:** 12/8/93
METHOD: HSA	**CASE SIZE:** 2.0"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 29.80 FT.	**MONITOR INST.:** FID	**TOT DPTH:** 13.0FT.	**DPTH TO ∇** 4.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/12/93		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
				10	Clayey silt, light brown		CL	
				50	Sand, fine, dark brown, with strong fuel odor		SM	
					total depth = 13.0 ft.			



PAGE 1 of GPT-6-6 ABB ENVIRONMENTAL SERVICES, INC.

FPPA[RPT]#034
06.94.mlv

WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-6

DATE OF DEVELOPMENT: 12-11-93

DATE OF WELL INSTALLATION: 12-8-93

PERSONNEL: R. Fisher/H. Faircloth

STATIC WATER LEVEL BEFORE DEVELOPMENT: 6.62' btoc

BOTTOM OF WELL: 14.72' btoc

HEIGHT OF WATER COLUMN: 8.1'

WELL I.D.: 2.0"

HEIGHT OF SATURATED SANDPACK: 8.1'

GALLONS\VOLUME: 1.3 GAL X 3 VOLUMES = 3.9 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (20 GAL)	VOLUME NO. 3 (40 GAL)	VOLUME NO. 4 (60 GAL)	VOLUME NO. 5 (110 GAL)
pH	6.15	6.28	6.36	6.77	6.85
Conduct.	320	170	130	130	130
Turbid.	mild	very turbid	turbid	turbid	mild
Descrip.	17 °C	19 °C	19 °C	19 °C	19 °C

TOTAL VOLUME REMOVED: 110 GAL

FINAL FIELD PARAMETERS:

pH - 6.85

Conduct. - 130 microohms

Turbid. - mild

Descrip. - 19 °C

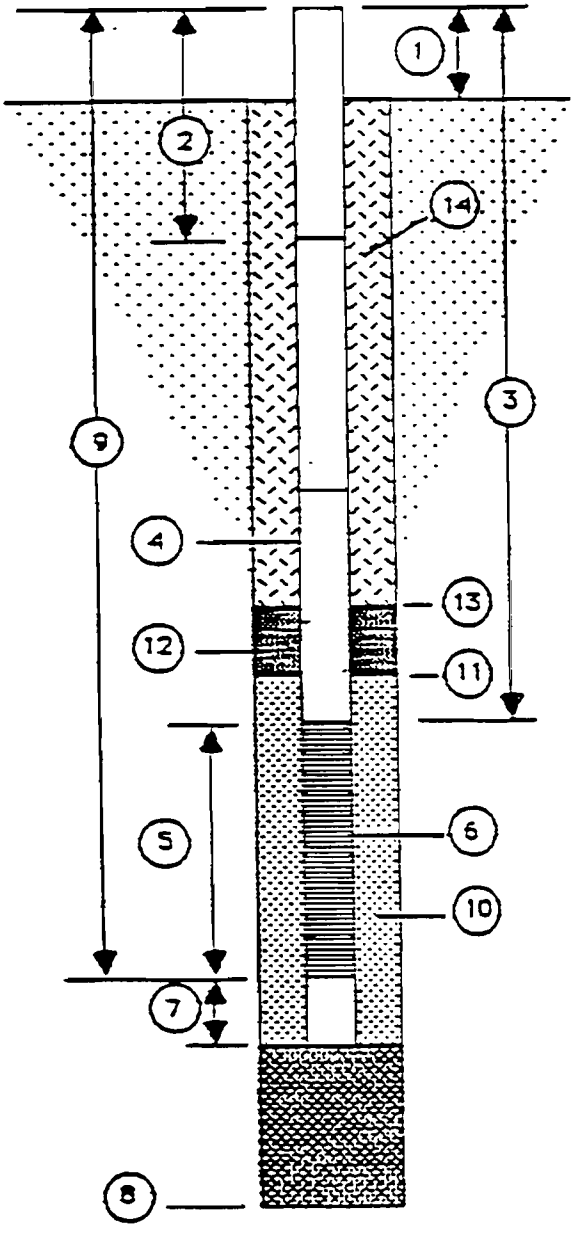
WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 7.50' DTW 6.56' DTP

* All development was performed with a surg block and submergible pump.

Comments:

Well GPT-6-7

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-7

DATE OF INSTALLATION 12-11-93

1. **Height of Casing Above Ground** 2.62'
2. **Depth to first Coupling** 10'

   Coupling Interval Depths 10', 20', 30', 40', 42'
3. **Total Length of Blank Pipe** 42'
4. **Type of Blank Pipe** 2" Sch 40 PVC
5. **Length of Screen** 5'
6. **Type of Screen** 0.020-slot, 2.0" SCH 40 PVC
7. **Length of Sump** 6"
8. **Total Depth of Boring** 47' **Hole Diameter** 8.75"
9. **Depth to Bottom of Screen** 47'
10. **Type of Screen Filter** Silica Sand

    Quantity Used 440 lbs. **Size** 16/30 **U/C** _____
11. **Depth to Top of Filter** 37.5'
12. **Type of Seal** Bentonite Pellets

    Quantity Used 50 lbs.
13. **Depth to Top of Seal** 36'
14. **Type of Grout** Neat Cement

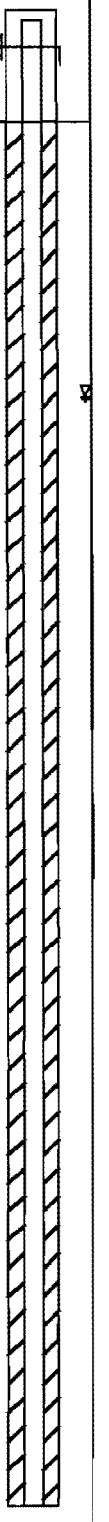
    Grout Mixture 5% Bentonite

    Method of Placement Poured

COMMENTS ON INSTALLATION:

TITLE: NCBC Gulfport FPPA	**LOG of WELL:** GPT-6-7		**BORING NO.** GPT-6-7
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection		**DATE STARTED:** 12/11/93	**COMPLTD:** 12/11/93
METHOD: HSA	**CASE SIZE:** 2.0"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 30.94 FT.	**MONITOR INST.:** FID	**TOT DPTH:** 47.0FT.	**DPTH TO ∇** 5.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/13/93		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
							SM	
5								
	SBG6708		18"	110	Silty sand, medium brown, fine sand with some medium sand and a little silt			8,8,18,25
10								
			24"	150				9,15,17,20
15								
20	SBG6720		22"	1	Silty sand, light brown, medium sand with some fine sand and a little silt			2,2,4,5
25				0				4,4,5,6



PAGE 1 of GPT-6-7 **ABB ENVIRONMENTAL SERVICES, INC.**

TITLE: NCBC Gulfport FPPA	**LOG of WELL:** GPT-6-7	**BORING NO.** GPT-6-7
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM		**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection	**DATE STARTED:** 12/11/93	**COMPLTD:** 12/11/93
METHOD: HSA	**CASE SIZE:** 2.0" / **BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 30.94 FT.	**MONITOR INST.:** FID / **TOT DPTH:** 47.0FT.	**DPTH TO ∇** 5.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/13/93	**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					Continued from PAGE 1			
							SM	
			20"					
30				0				4,5,5,6
			20"					
35				0				5,8,8,10
			20"					
40				0	Silty sand, dark brown, medium sand with some fine sand and a little silt, clay nodules present			3,4,7,11
			20"					
				0				1,2,2,4
			16"					
45				0				7,8,9,40
			24"		Silty sand, medium dark brown, dark gray silty clay in bottom 2 inches			
					total depth = 47.0 ft.			
50								

PAGE 2 of GPT-6-7 **ABB ENVIRONMENTAL SERVICES, INC.**

WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-7 DATE OF DEVELOPMENT: 12-13-93

DATE OF WELL INSTALLATION: 12-11-93 PERSONNEL: R. Fisher

STATIC WATER LEVEL BEFORE DEVELOPMENT: 11.23' btoc BOTTOM OF WELL: 47.5' btoc

HEIGHT OF WATER COLUMN: 36.27' WELL I.D.: 2.0" HEIGHT OF SATURATED SANDPACK: 7.0'

GALLONS\VOLUME: 5.8 GAL X 3 VOLUMES = 17.4 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (40 GAL)	VOLUME NO. 3 (80 GAL)	VOLUME NO. 4 (120 GAL)
pH	6.98	6.93	6.81	6.73
Conduct.	120	90	90	110
Turbid.	very	very	very	mild
Descrip.	18 °C	22 °C	22 °C	23 °C

TOTAL VOLUME REMOVED: 110 GAL FINAL FIELD PARAMETERS: pH - 6.73

Conduct. - 110 microohms

Turbid. - mild

Descrip. - 23 °C

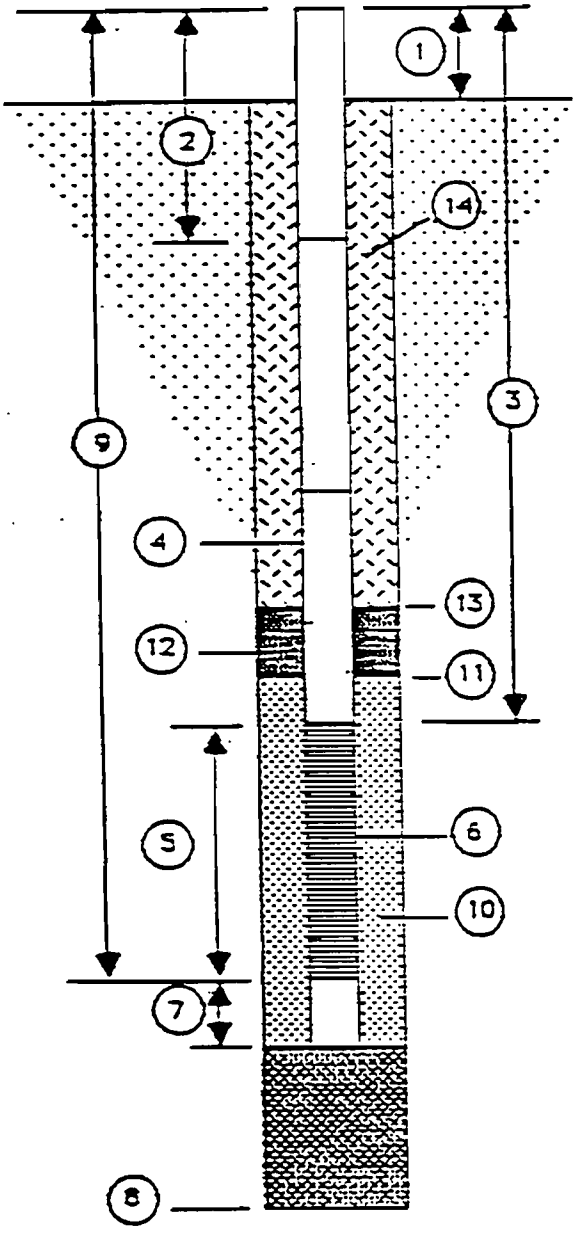
WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 11.19'

* All development was performed with a surg block and submergible pump.

Comments:

Well GPT-6-8

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-8

DATE OF INSTALLATION 12-8-93

1. **Height of Casing Above Ground** 2.07'
2. **Depth to first Coupling** 4.57'

   Coupling Interval Depths 4.57'
3. **Total Length of Blank Pipe** 4.57'
4. **Type of Blank Pipe** 2.0" SCH 40 PVC
5. **Length of Screen** 10.0'
6. **Type of Screen** 0.020-slot, 2" SCH 40 PVC
7. **Length of Sump** 0.5'
8. **Total Depth of Boring** 13.0' **Hole Diameter** 8.75'
9. **Depth to Bottom of Screen** 14.57'
10. **Type of Screen Filter** Silica Sand

    Quantity Used 440 lbs. **Size** 16/30 **U/C** _____
11. **Depth to Top of Filter** 1.5'
12. **Type of Seal** Bentonite Pellets

    Quantity Used 50 lbs.
13. **Depth to Top of Seal** 0.75
14. **Type of Grout** Neat Cement

    Grout Mixture 5% Bentonite

    Method of Placement Poured

COMMENTS ON INSTALLATION: Grout poured due to shallow copletion.

TITLE: NCBC Gulfport FPPA		**LOG of WELL:** GPT-6-8	**BORING NO.** GPT-6-8
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM			**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection		**DATE STARTED:** 12/8/93	**COMPLTD:** 12/8/93
METHOD: HSA	**CASE SIZE:** 2.0"	**BORING DIA.:** 4.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 30.98 FT.	**MONITOR INST.:** FID	**TOT DPTH:** 13.0FT.	**DPTH TO ∇** 4.0 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/12/93		**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					Silty sand, light brown, with some clay and shell fill		SM	
				10				
					Silty sand, fine with some medium sand and little silt, brown			
5								
				100				
10								
					total depth = 13.0 ft.			
15								
20								
25								

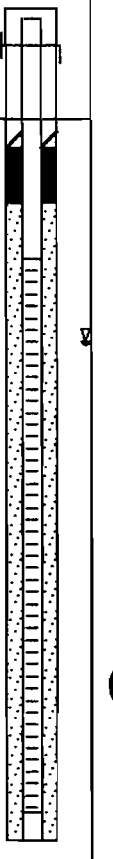


 ABB ENVIRONMENTAL SERVICES, INC.

WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-8

DATE OF DEVELOPMENT: 12-12-93

DATE OF WELL INSTALLATION: 12-8-93

PERSONNEL: R. Fisher/H. Faircloth

STATIC WATER LEVEL BEFORE DEVELOPMENT: 6.87' btoc

BOTTOM OF WELL: 15.07' btoc

HEIGHT OF WATER COLUMN: 8.2'

WELL I.D.: 2.0"

HEIGHT OF SATURATED SANDPACK: 7.14'

GALLONS\VOLUME: 1.3 GAL X 3 VOLUMES = 3.9 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (30 GAL)	VOLUME NO. 3 (55 GAL)	VOLUME NO. 4 (85 GAL)	VOLUME NO. 5 (110 GAL)
pH	6.32	5.55	5.86	5.70	5.66
Conduct.	170	160	155	150	150
Turbid.	very	very	mild	slight	clear
Descrip.	14.5 °C	20.3 °C	20.8 °C	21.5 °C	21.5 °C

TOTAL VOLUME REMOVED: 110 GAL

FINAL FIELD PARAMETERS:

pH - 5.66

Conduct. - 150 microohms

Turbid. - clear

Descrip. - 21.5 °C

WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 7.77' DTW 7.55 DTP

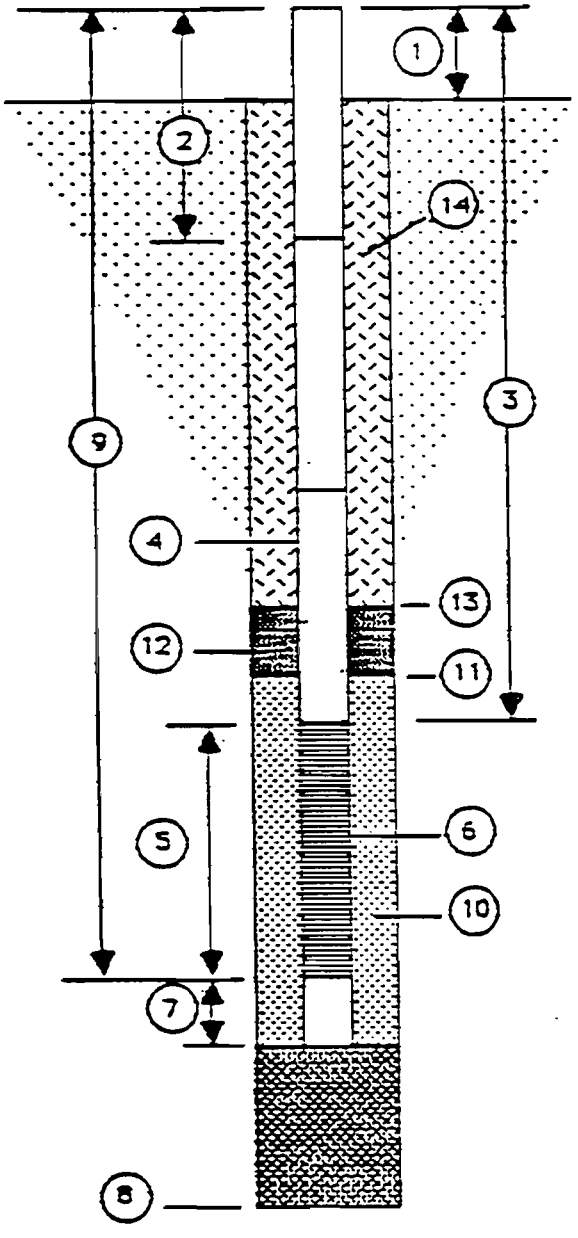
* All development was performed with a surg block and submergible pump.

Comments:

Developed well until groundwater was clear. Well will not be sampled.

Well GPT-6-RW

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE, P. O. Box 190010
NORTH CHARLESTON, S.C. 29419-9010



WELL CONSTRUCTION DETAILS

WELL NUMBER GPT-6-RW

DATE OF INSTALLATION 12-12-93

1. **Height of Casing Above Ground** 2.59'
2. **Depth to first Coupling** 7.59'

   Coupling Interval Depths 7.59', 12.59', 22.59'
3. **Total Length of Blank Pipe** 7.59'
4. **Type of Blank Pipe** 5.4" 10S stainless steel
5. **Length of Screen** 15'
6. **Type of Screen** 0.020-slot, 10S stainless steel
7. **Length of Sump** 5'
8. **Total Depth of Boring** 26' **Hole Diameter** 12.75"
9. **Depth to Bottom of Screen** 22.59'
10. **Type of Screen Filter** Silica Sand

    Quantity Used 1300 lbs. **Size** 16/30 **U/C** _____
11. **Depth to Top of Filter** 3'
12. **Type of Seal** Bentonite Pellets

    Quantity Used 75 lbs.
13. **Depth to Top of Seal** 1.5'
14. **Type of Grout** Neat Cement

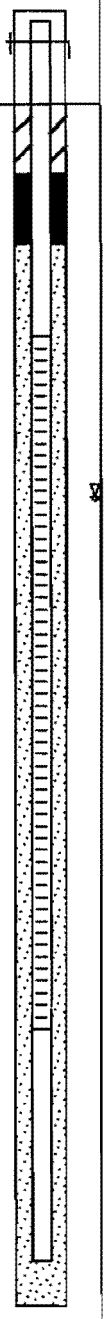
    Grout Mixture 5% Bentonite

    Method of Placement Poured

COMMENTS ON INSTALLATION:

TITLE: NCBC Gulfport FPPA	**LOG of WELL:** GPT-6-RW	**BORING NO.** GPT-6-RW
CLIENT: U.S. NAVY, SOUTHNAVFACENGCOM		**PROJECT NO:** 8505-30
CONTRACTOR: Ground Water Protection	**DATE STARTED:** 12/12/93	**COMPLTD:** 12/12/93
METHOD: HSA	**CASE SIZE:** 5.4" / **BORING DIA.:** 12.25"	**PROTECTION LEVEL:** D
TOC ELEV.: 31.74 FT.	**MONITOR INST.:** FID / **TOT DPTH:** 28FT.	**DPTH TO ∇** 8.5 FT.
LOGGED BY: R. Fisher	**WELL DEVELOPMENT DATE:** 12/15/93	**SITE:** Site 6

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
				0	Silty clay, light brown, with sand fill		CL	
					Silty sand, dark brown, medium sand, some silt, strong petroleum odor		SM	
5								
10								
15				800-1400				
20								
25								
					total depth = 28.0 ft.			
30								



PAGE 1 of GPT-6-RW **ABB ENVIRONMENTAL SERVICES, INC.**

FPPA[RPT]#034
06.94.mlv

WELL DEVELOPMENT DATA SHEET

ABB-ES

WELL DESIGNATION: GPT-6-RW

DATE OF DEVELOPMENT: 12-15-93

DATE OF WELL INSTALLATION: 12-12-93

PERSONNEL: R. Fisher

STATIC WATER LEVEL BEFORE DEVELOPMENT: 8.58' btoc

BOTTOM OF WELL: 27.59' btoc

HEIGHT OF WATER COLUMN: 19.01'

WELL I.D.: 5.4"

HEIGHT OF SATURATED SANDPACK: 19.01'

GALLONS\VOLUME: 300 GAL X 3 VOLUMES = 900 GAL TOTAL DEVELOPMENT VOLUME

FIELD MEASUREMENTS

	VOLUME NO. 1 (INITIAL SAMPLE)	VOLUME NO. 2 (1,000 GAL)	VOLUME NO. 3 (1,700 GAL)
pH	7.41	6.48	6.45
Conduct.	190	120	120
Turbid.	very turbid	slightly turbid	clear
Descrip.	22 °C	21.6 °C	18.9 °C

TOTAL VOLUME REMOVED: 1,700 GAL

FINAL FIELD PARAMETERS:

pH - 6.45

Conduct. - 120 microohms

Turbid. - clear

Descrip. - 18.9 °C

WATER LEVEL 24 HOURS AFTER DEVELOPMENT: 8.49' DTW 8.69' DTP

* All development was performed with a surg block and submergible pump.

Comments:

APPENDIX C

AQUIFER RESULTS

APPENDIX C

About this Appendix

Appendix C includes water level measurement data, aquifer slug test results, pumping flow rate sheets, distance drawdown plots, and time drawdown plots.

The slug test results were plotted and calculated using Geraghty and Miller's AQTESOLV™ (1989) software. Hydraulic conductivity is represented by the "k" in feet per minute (ft/min). The "y_o" symbol represents the y-axis intercept.

Time-drawdown data collected during the pumping test was plotted on a log-linear graph. The solution was performed using the Jacob straight-line analysis. The equation is as follows:

$$T = \frac{2.3Q}{4\pi\Delta(h_o - h)}$$

Where:

Q	= constant rate of pumpage (cubic feet per day [ft^3/day])
$\Delta(h_o-h)$	= drawdown per log cycle of time (feet)
T	= transmissivity (square feet per day [ft^2/day])
S	= storativity (dimensionless)
r	= the distance to the pumping well (feet)
t_o	= time at zero drawdown from straight line extension (days)

The time-drawdown data requires that data for the straight-line analysis occurs after a sufficient amount of time (approximately 10 minutes, Section 3.0). $\Delta(h_o-h)$ is the change in head over one log cycle of time. Hydraulic conductivity (k) is calculated by dividing transmissivity (T) by the saturated thickness of the aquifer.

For distance-drawdown plots, a modification of the Jacob straight-line method may be used. If drawdown is simultaneously measured in several wells, it is found to vary with the distance from the pumping well in accordance with this equation (Fetter, 1988).

Specifically:

$$T = \frac{2.3Q}{2\pi\Delta(h_o - h)}$$

Which is similar to the time-drawn solution, with the exception of 2π in place of 4π. Hydraulic conductivity is calculated the same as in the previous example.

Definition of Acronyms

B	-	saturated thickness of aquifer
T_o	-	time at zero drawdown from straight line extension (days)
r_o	-	intercept of the straight-line with the zero-drawdown axis
r^2	-	square of the radius to the pumping well

Water Level Measurement Data

Table C-1
Water Level Data

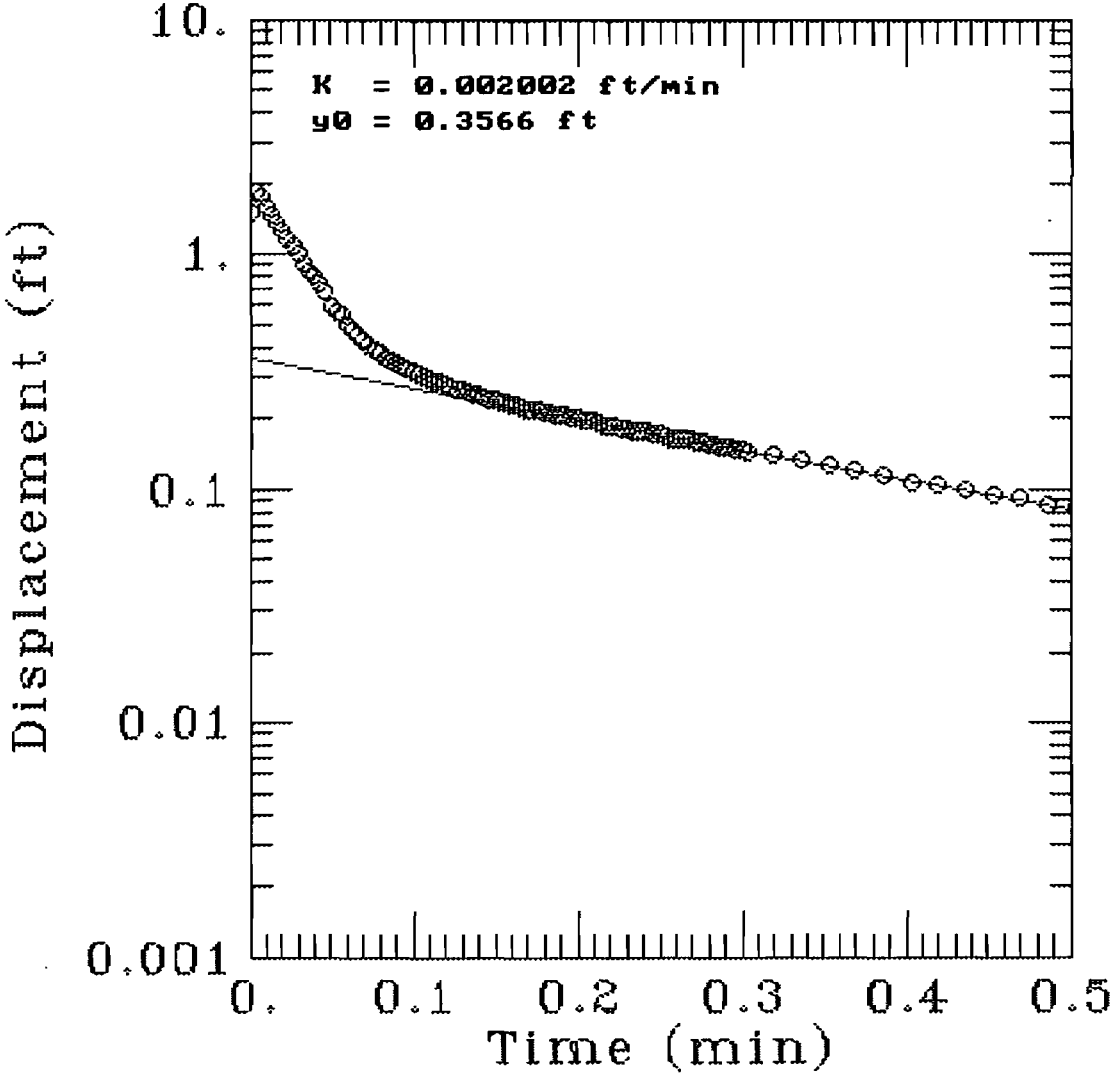
Free-Phase Product Assessment Report
Site 6 - Fire Fighting Training Area
Naval Construction Battalion Center
Gulfport, Mississippi

Well Number	Date	Depth to Product (feet btoc)	Depth to Water (feet btoc)	Product Thickness (feet)	Well Top Elevation (feet msl)	Water Level Elevation (feet msl)
GPT-6-1	01/11/94	7.59	8.65	1.06	31.17	23.37
	01/13/94	7.52	9.21	1.69		23.31
	04/12/94	8.27	9.13	0.86		22.73
GPT-6-2	01/10/94	-	8.13	-	31.35	23.22
	01/11/94	-	7.67	-		23.68
	01/13/94	-	7.61	-		23.74
	04/12/94	-	8.39	-		22.96
GPT-6-3	01/10/94	-	4.74	-	27.59	22.85
	01/11/94	-	4.28	-		23.31
	01/13/94	-	4.23	-		23.36
	04/12/94	-	4.97	-		22.62
GPT-6-4	01/10/94	8.91	9.45	0.54	31.94	22.92
	01/11/94	8.51	8.84	0.33		23.36
	01/13/94	8.49	9.08	0.59		23.33
	04/12/94	9.11	10.03	0.92		22.65
GPT-6-5	01/10/94	-	8.82	-	31.79	22.97
	01/11/94	-	8.38	-		23.41
	01/13/94	-	8.32	-		23.47
	04/12/94	-	9.07	-		22.72
GPT-6-6	01/10/94	6.56	7.50	0.94	29.60	22.85
	01/11/94	6.16	6.67	0.51		22.85
	01/13/94	6.16	6.94	0.78		23.28
	04/12/94	6.71	8.54	1.83		22.52
GPT-6-7	01/10/94	-	11.19	-	30.94	19.75
	01/11/94	-	11.15	-		19.79
	01/13/94	-	11.14	-		19.80
	04/12/94	-	11.59	-		19.35
GPT-6-8	01/11/94	-	7.77	-	30.98	23.21
	01/13/94	7.41	7.88	0.47		23.45
	04/12/94	8.06	8.81	0.75		22.77
GPT-6-RW	01/10/94	8.69	9.49	0.8	31.74	22.89
	01/13/94	8.34	8.57	0.23		23.35
	04/12/94	8.89	10.03	1.14		22.62

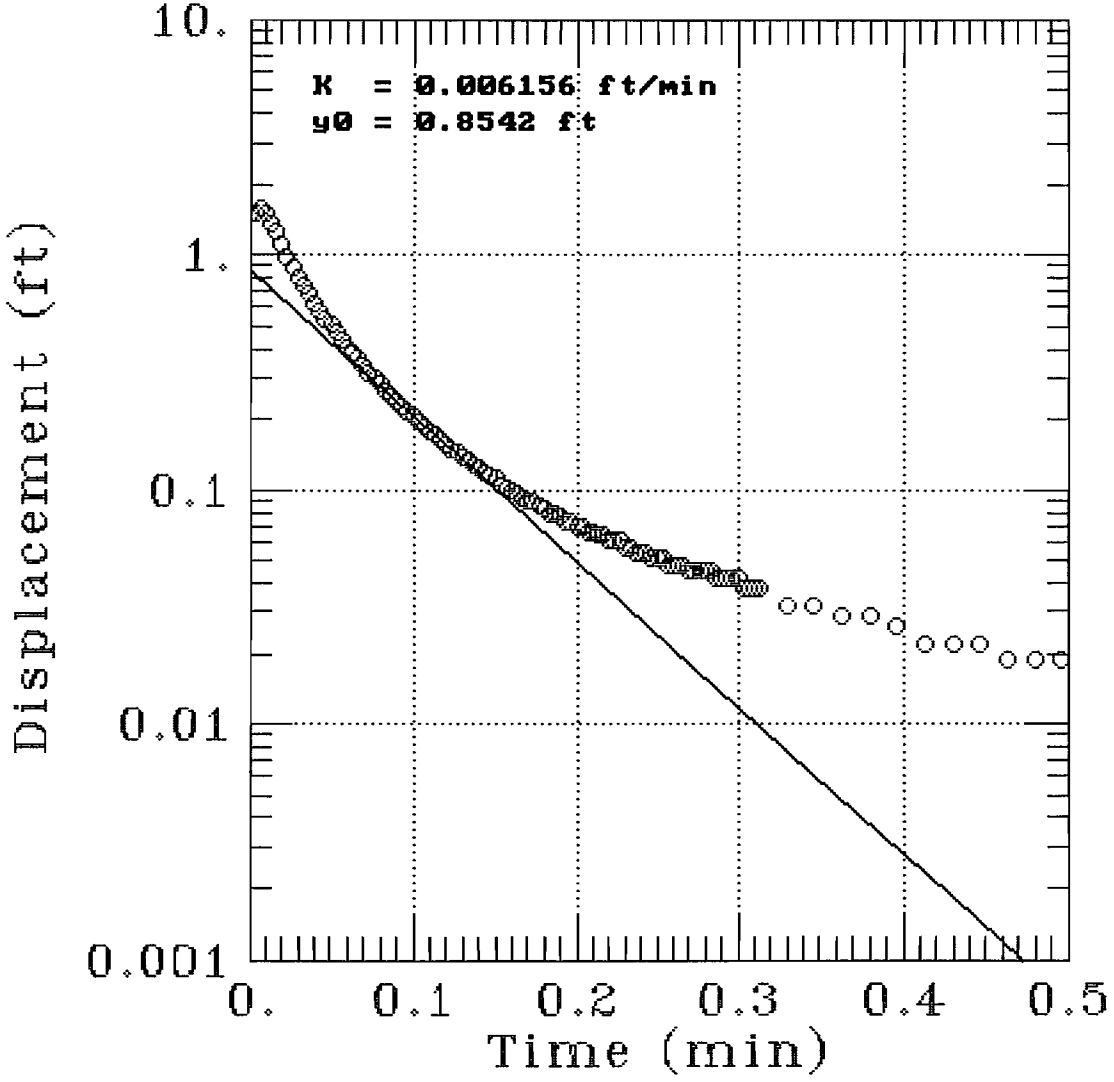
Notes: btoc = below top of casing.
msl = mean sea level.

Aquifer Slug Test Results

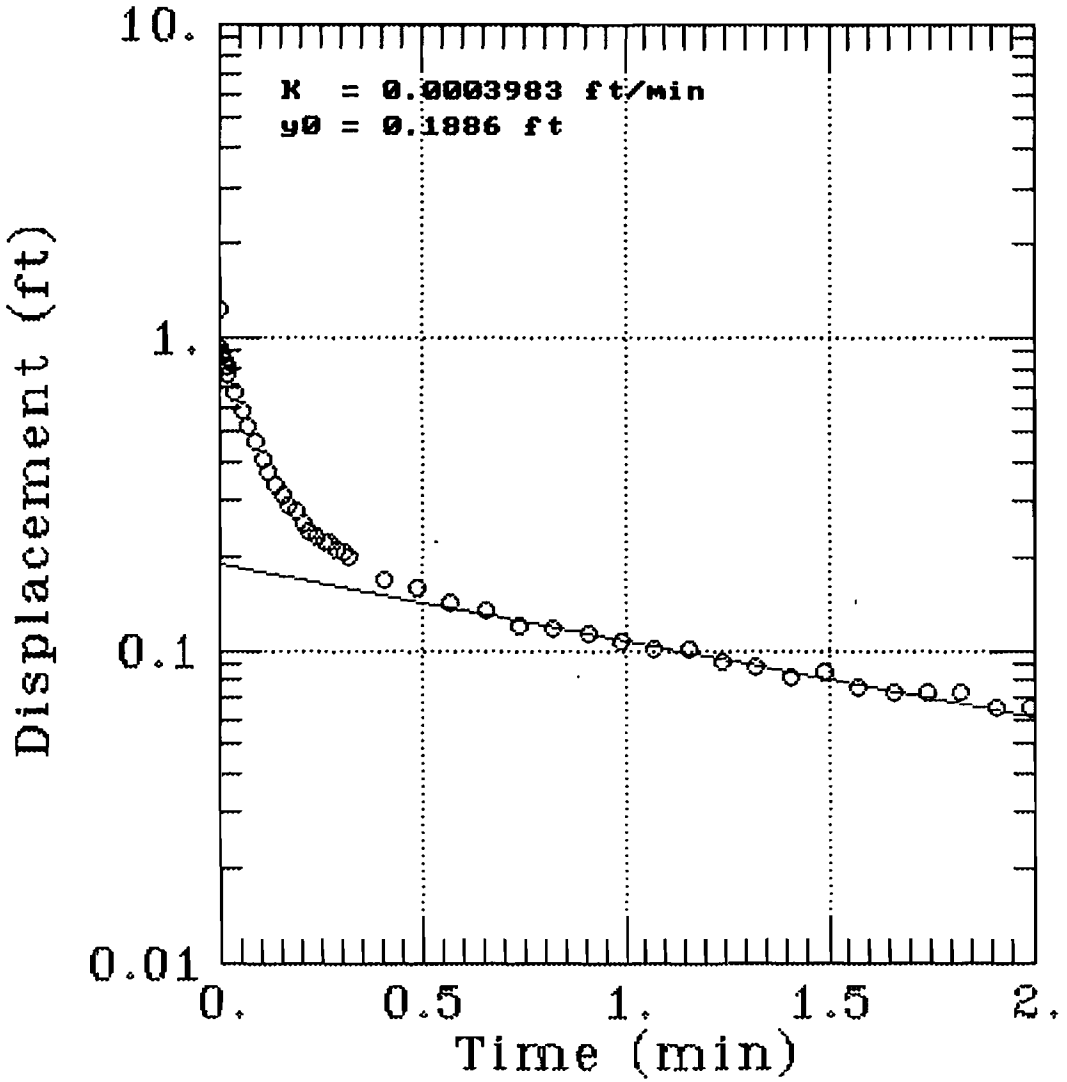
GPT-6-2 RISING HEAD SLUG TEST



GPT-6-3 RISING HEAD SLUG TEST



GPT-6-4 RISING HEAD SLUG TEST #0



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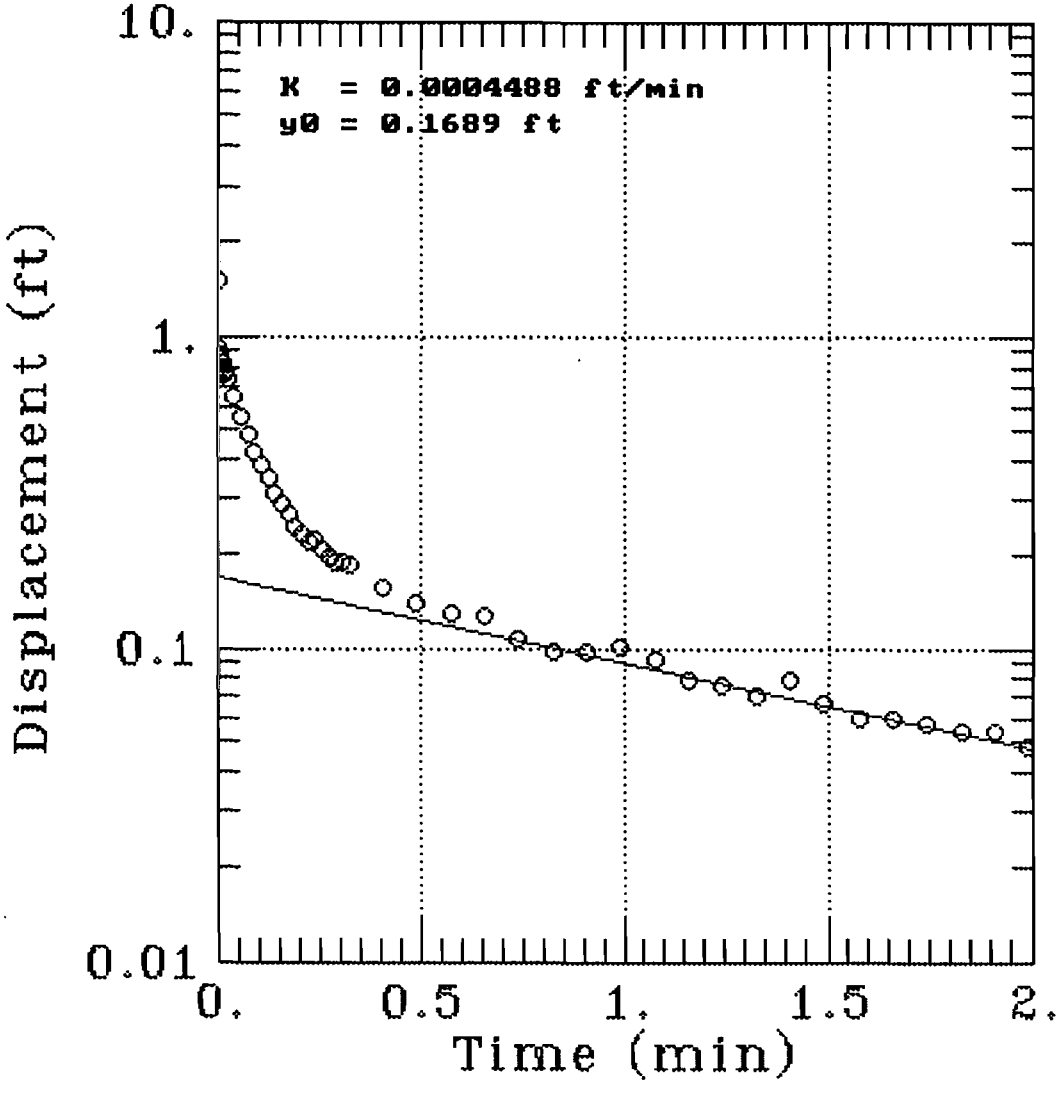
GPT-6-4 RISING HEAD SLUG TEST #1



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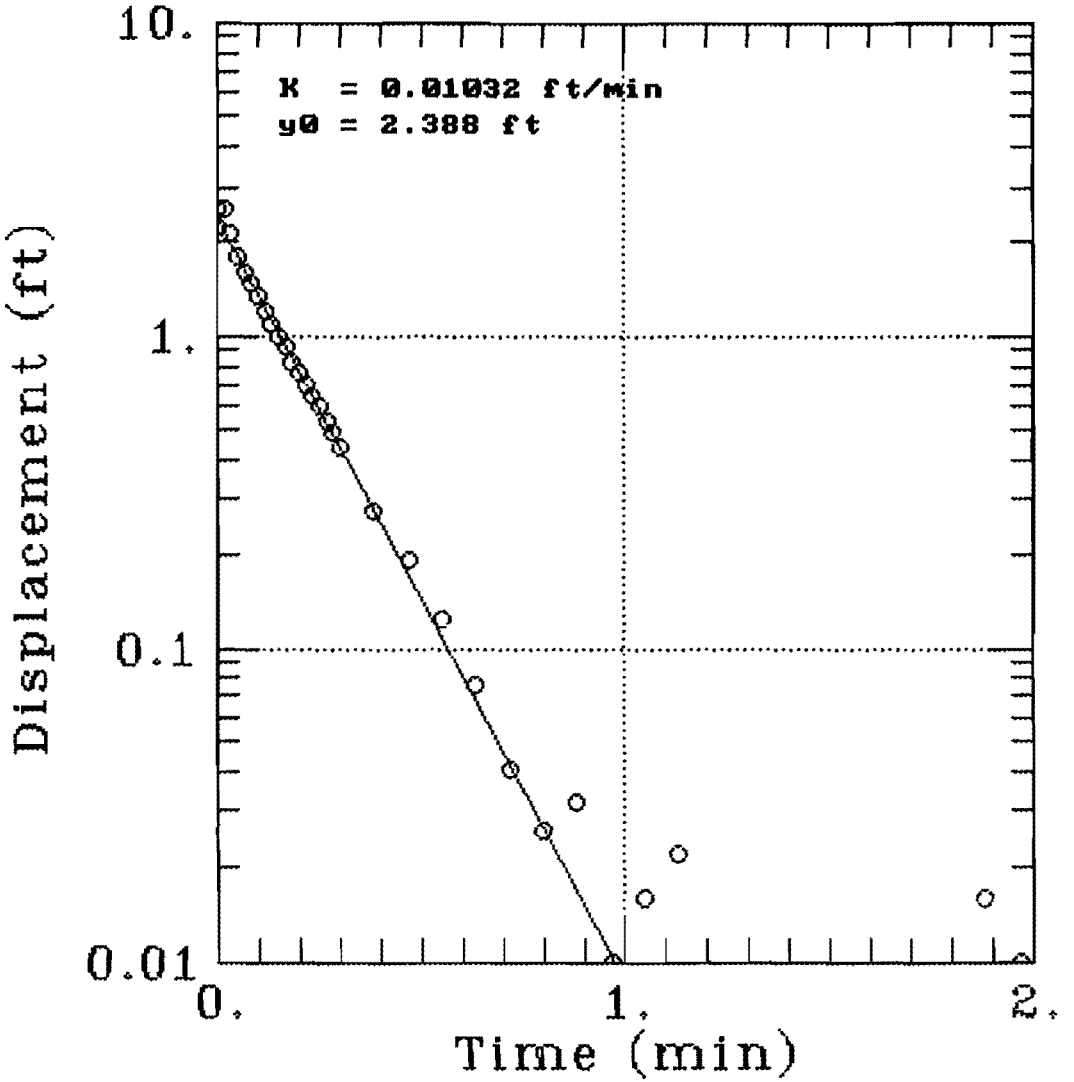
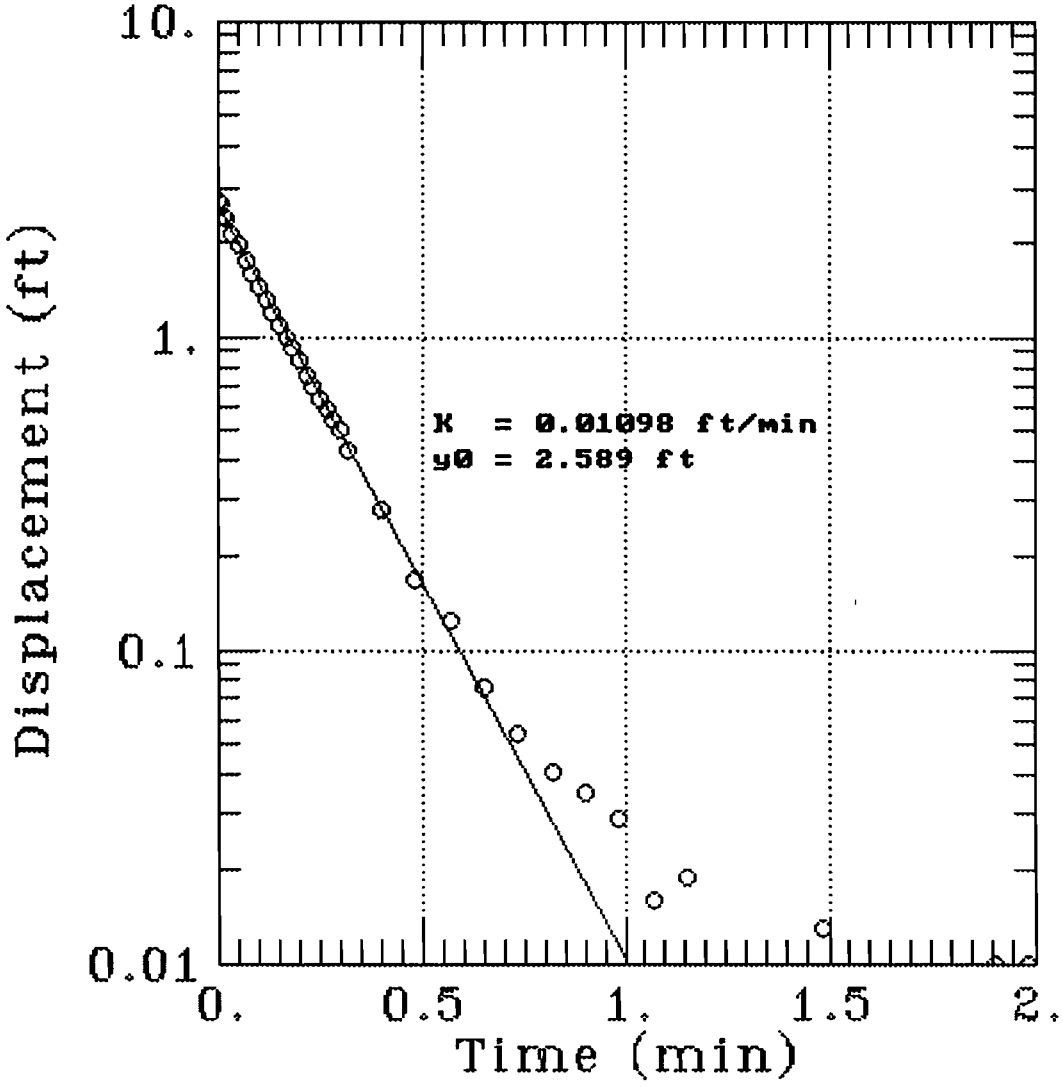
06.94.mlv

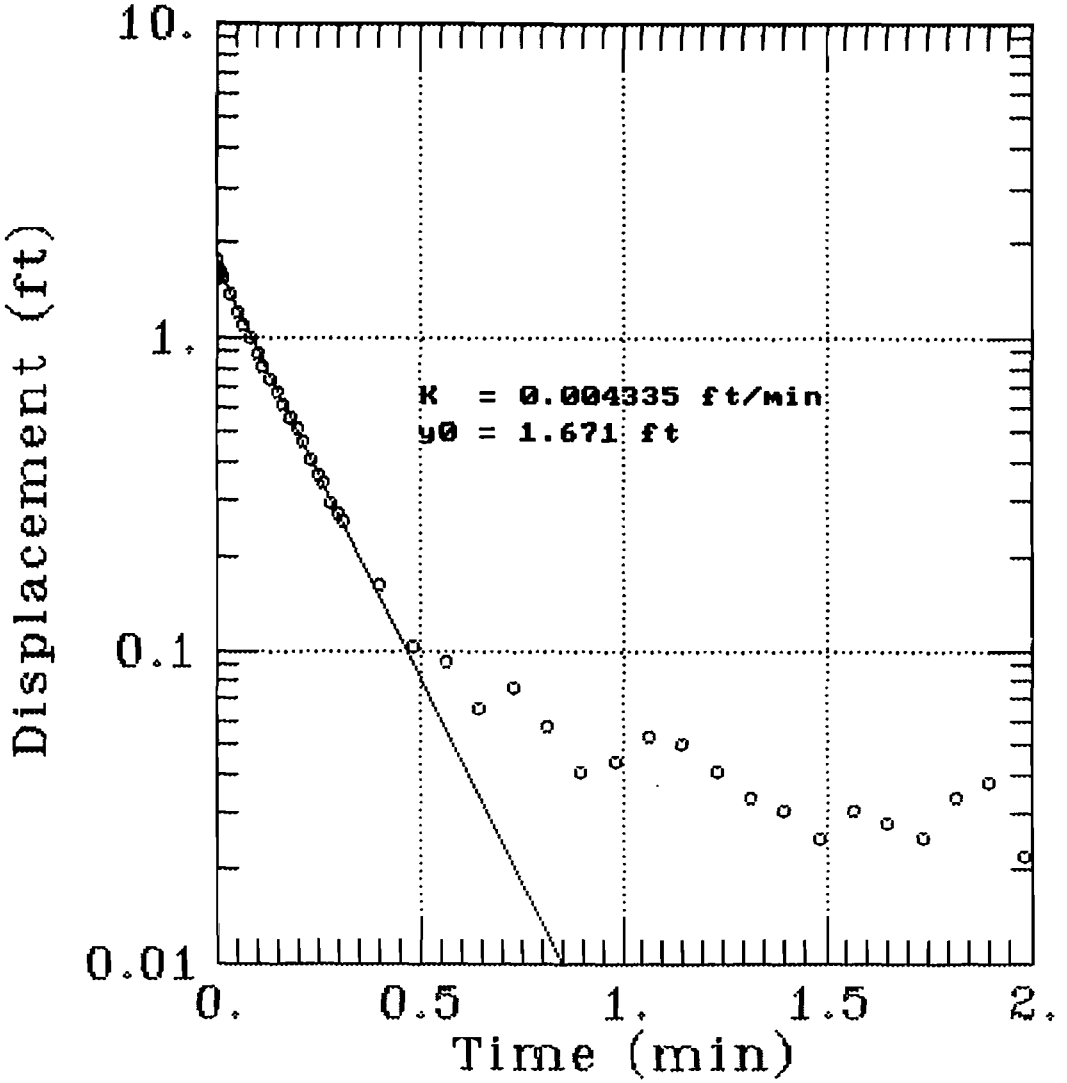
GPT-6-5 FALLING HEAD SLUG TEST #6



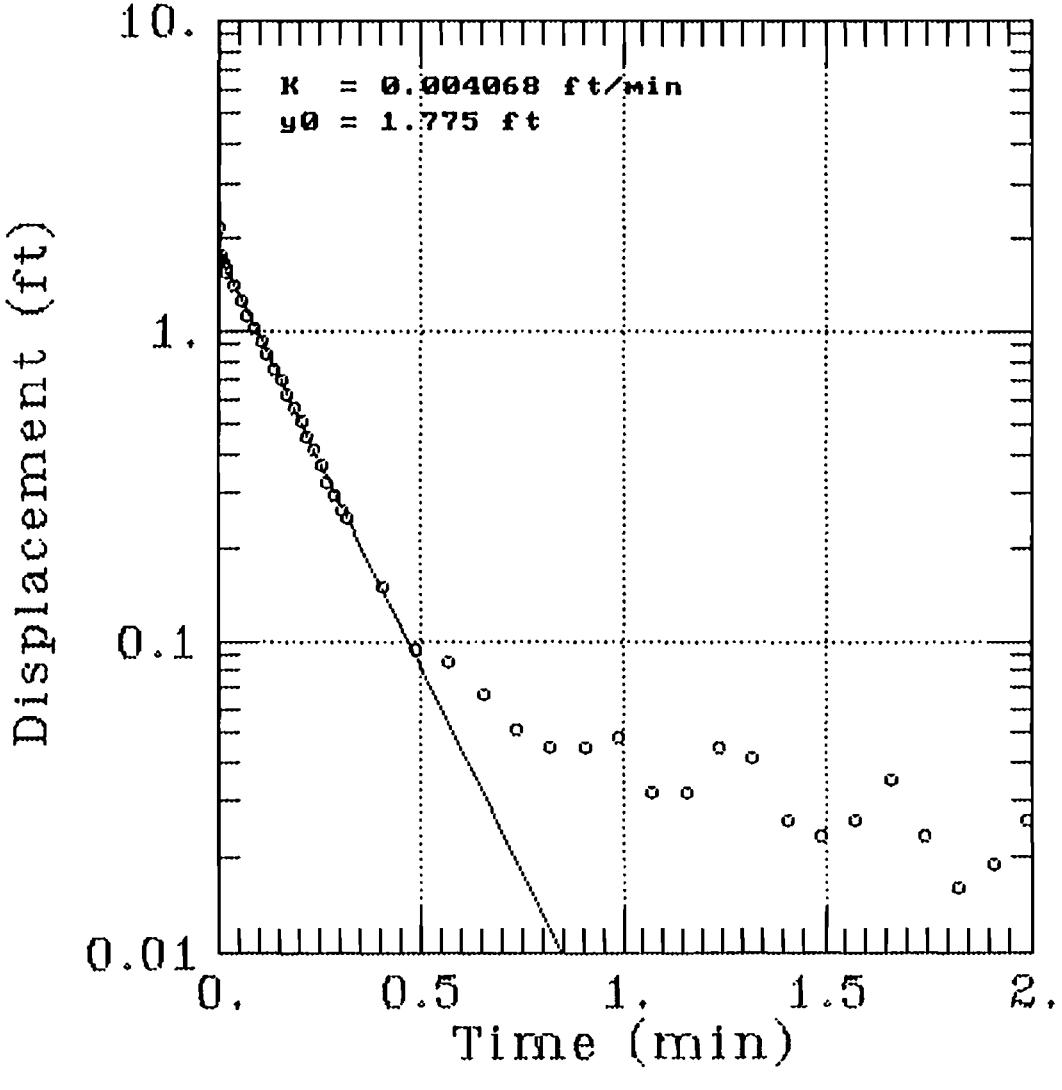
GPT-6-5 RISING HEAD SLUG TEST #7



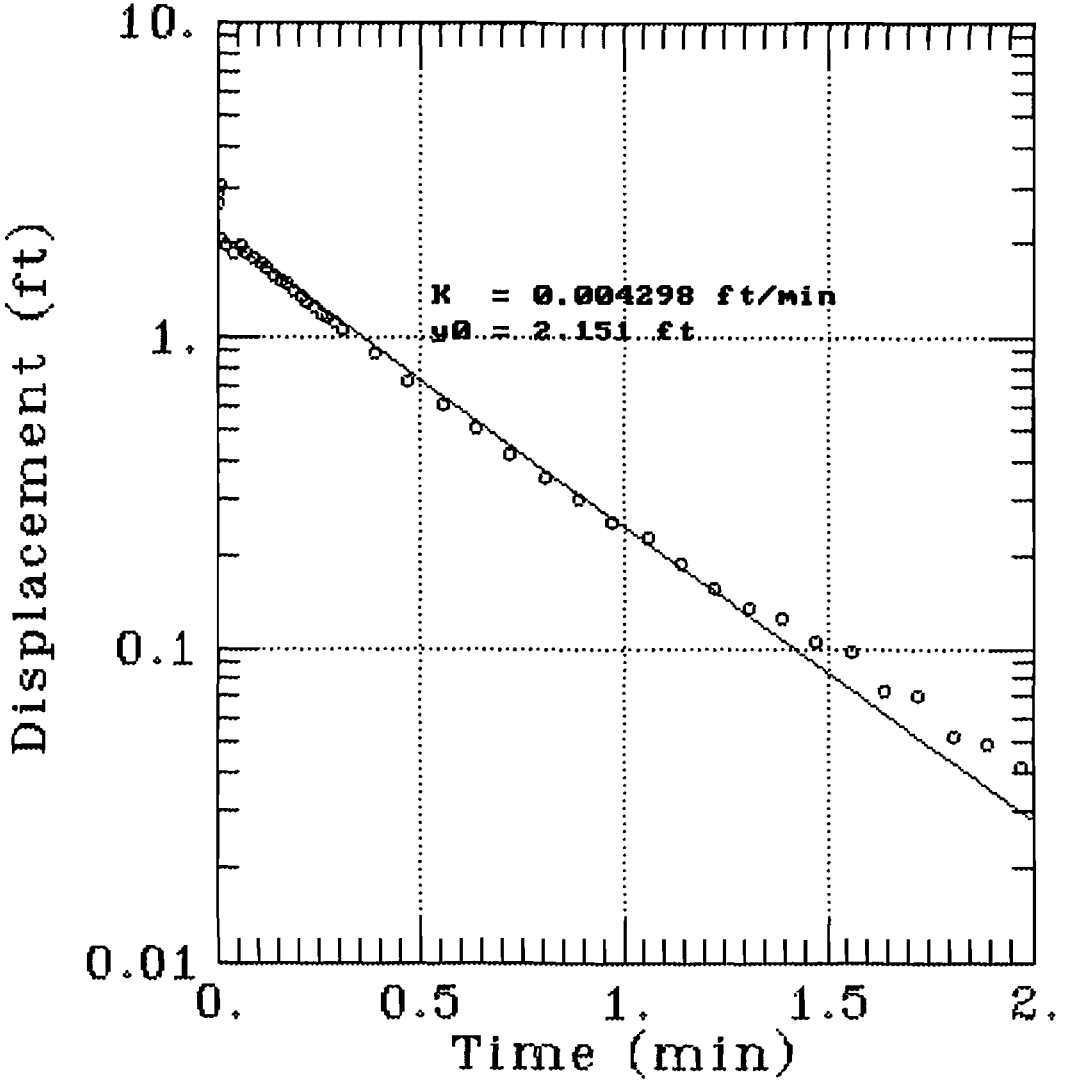
GPT-6-6 RISING HEAD SLUG TEST #2



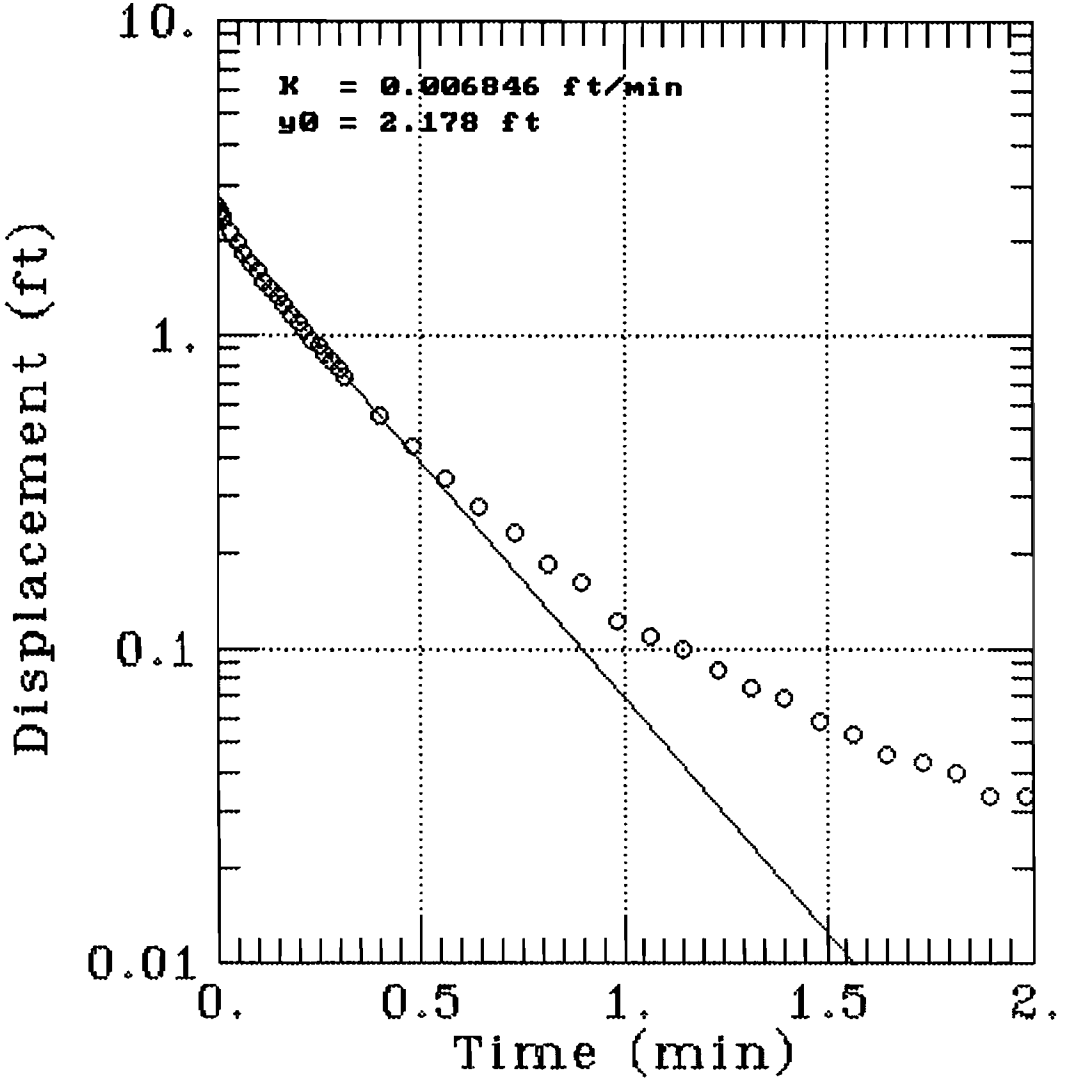
GPT-6-6 RISING HEAD SLUG TEST #3



GPT-6-7 FALLING HEAD SLUG TEST #8



GPT-6-7 RISING HEAD SLUG TEST #9



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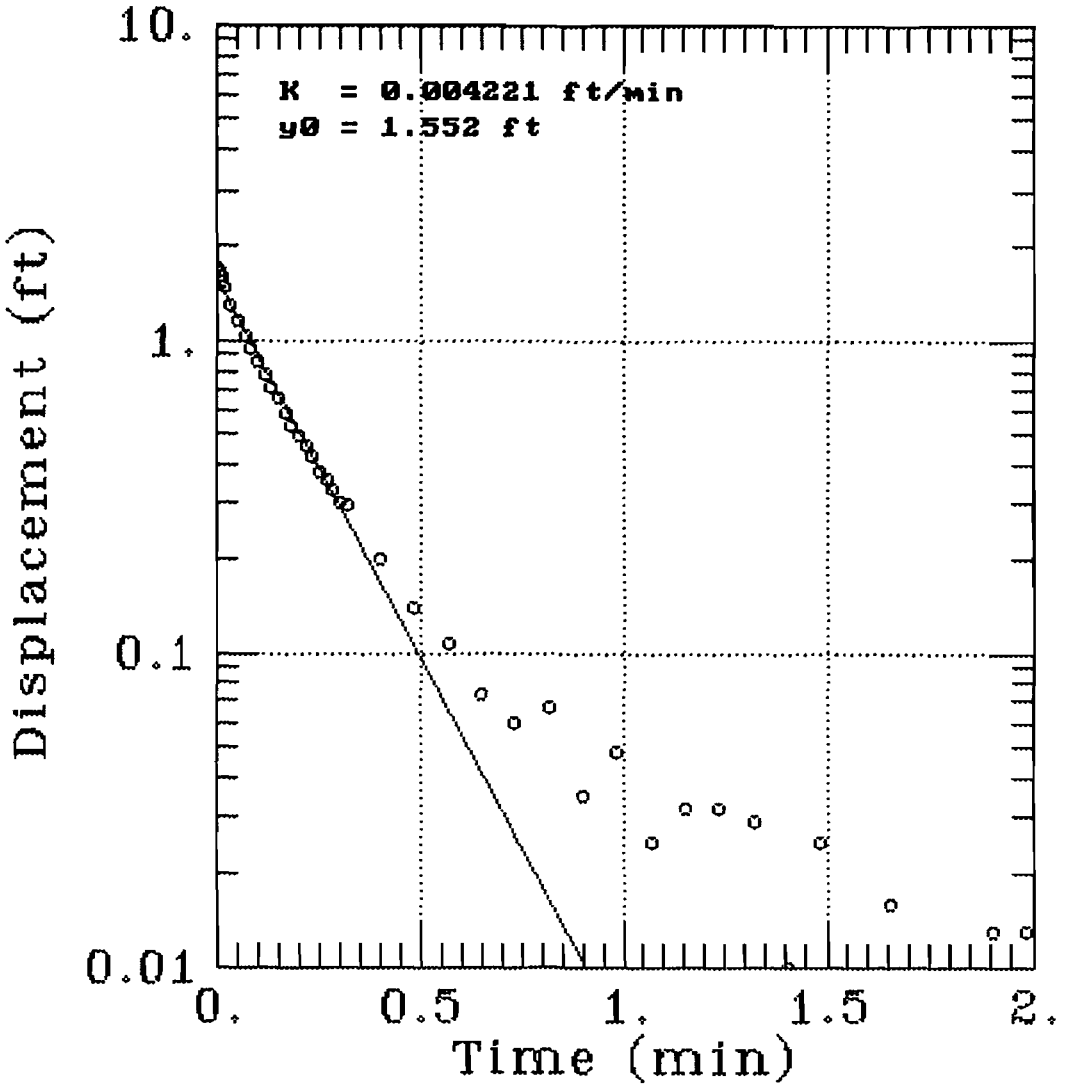
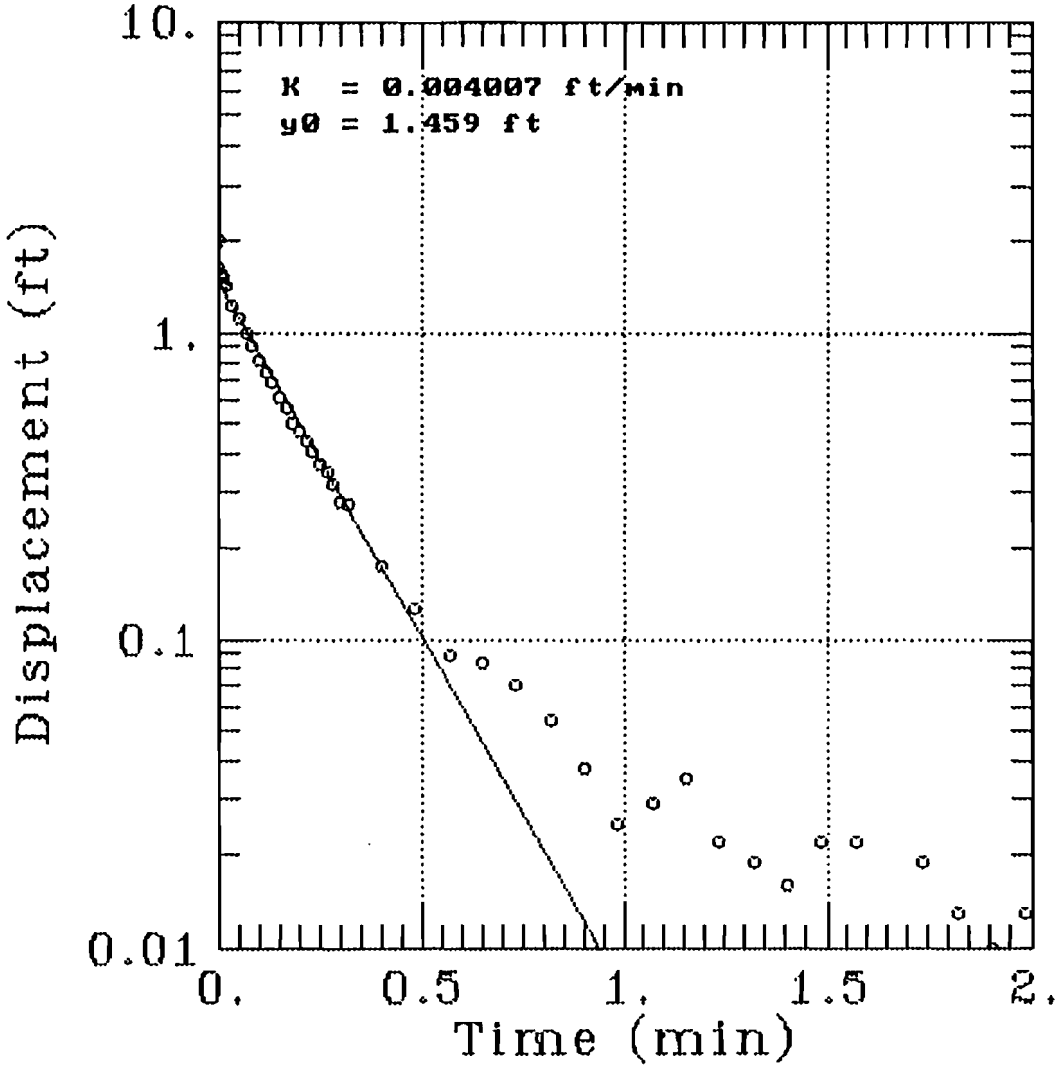
GPT-6-8 RISING HEAD SLUG TEST #4



GPT-6-8 RISING HEAD SLUG TEST #5



Pumping Flow Rate Sheets

ABB
ASEA BROWN BOVERI

SITE NAME Gulfport Site 6 PROJECT NO. 085505.03 Page 1 of 2

PUMPING WELL GPT-6-RW REFERENCE POINT ELEVATION

DEPTH OF PUMPING WELL 26. GROUND SURFACE ELEVATION

SCREEN SETTING PUMP TYPE GRUNDFOS 10E5

PUMP SETTING 25.3' to 23.6' btoc INTAKE @ 24.4'-24.3'

PUMP INTAKE SETTING 24.4' to 24.3' btoc

DATE	TIME			DISCHARGE			REMARKS
	(CLOCK) TIME :	TOTAL ELAPSED TIME (in min)	TIME INTERVAL (in min)	FLOW METER READING (in gal.)	VOLUME (in gal.)	FLOW RATE (in gpm)	
1/12/94	11:30	0	0	0000044.6			INITIAL
	11:31	1	1	54.2	9.6	9.6	
	11:32	2	1	62.0	7.8	7.8	
	11:33:30	3½	1.5	70.5	7.5	5.0	
	11:35:30	5½	2.0	77.5	7	3.5	
	11:37	7	1.5	82.0	~~6~~ 4.5	3.0	
	11:44	14	7.0	103.3	21.3	3.04	RF notes product in RW has increased ~0.02'
	11:53	23	9.0	130.7	27.4	3.04	
	12:00	30	7.0	152.1	21.4	3.06	
	13:41	131	101	459.2	307.1	3.04	
	15:26	236	105	778.9	319.7	3.05	
	16:30	300	64	973.7	194.8	3.04	PRODUCT IN RW CONTINUES TO INCREASE ~0.1'
	1907	457	157	1453.0	479.3	3.05	
	1910	460	3	1462.2	9.2	3.07	
	1928	478	18	1517.1	54.9	3.05	
35	1930	480	2	1523.5			
	1930:30	480.5	½	1525.9			Step Test
	1931	481	½	1528.6			Q = 7.0
	1932	482	1	1534.9	6.3	6.3	
	1933:30	483½	1½	1544.7	~~9.8~~ 9.5	6.53	
	1935	485	1½	1555.1	10.4	6.93	
	1936	486	1	1562.0	6.9	6.9	
	1937	487	1	1569.0	7.0	7.0	
	2003	513	26	1754.4	185.4	7.13	

GRUNDFOS p. 1

ABB
ASEA BROWN BOVERI

SITE NAME Gulfpoint Site 6
PUMPING WELL GPT-6-RW
DEPTH OF PUMPING WELL 26.
SCREEN SETTING

PROJECT NO. 08505.30 Page 2 of 2
REFERENCE POINT ELEVATION
GROUND SURFACE ELEVATION
PUMP TYPE GRUNDFOS 10E5
PUMP SETTING 25.3' to 23.6 btoc
PUMP INTAKE SETTING 24.4 to 24.5' btoc

DATE	TIME			DISCHARGE			REMARKS
	(CLOCK) TIME :	TOTAL ELAPSED TIME (in min)	TIME INTERVAL (in min)	FLOW METER READING (in gal.)	VOLUME (in gal.)	FLOW RATE (in gpm)	
1/12/94	20:07	517	4	1782.8	28.4	7.1	
"	22:37	667	150	2850.7	1067.9	7.12	(Recorded)
1/13/94	00:04	754	178	3470.2	620.5	7.38	? Miss Read 7.12
"	00:10	760	6	3513.0	42.8	7.13	✓
"	01:20	830	70	4009.8			

GRUNDFOS p. 2

MASTERFLEX

ABB
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SITE NAME GULFPORT Site 6 PROJECT NO. 08505.30 Page 1 of 1

PUMPING WELL GPT-6-RW REFERENCE POINT ELEVATION

DEPTH OF PUMPING WELL 26. GROUND SURFACE ELEVATION

SCREEN SETTING PUMP TYPE MASTERFLEX

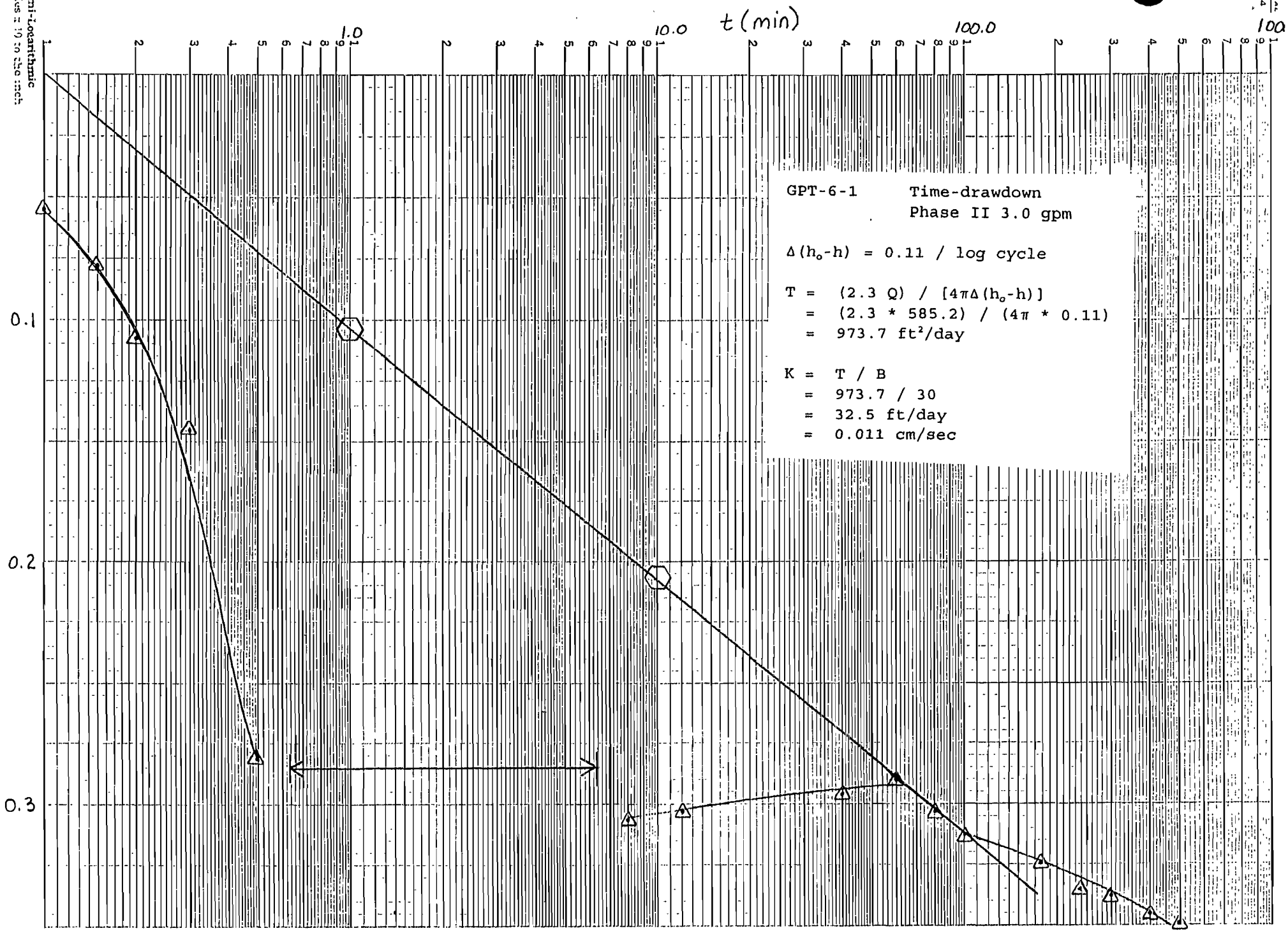
PUMP SETTING

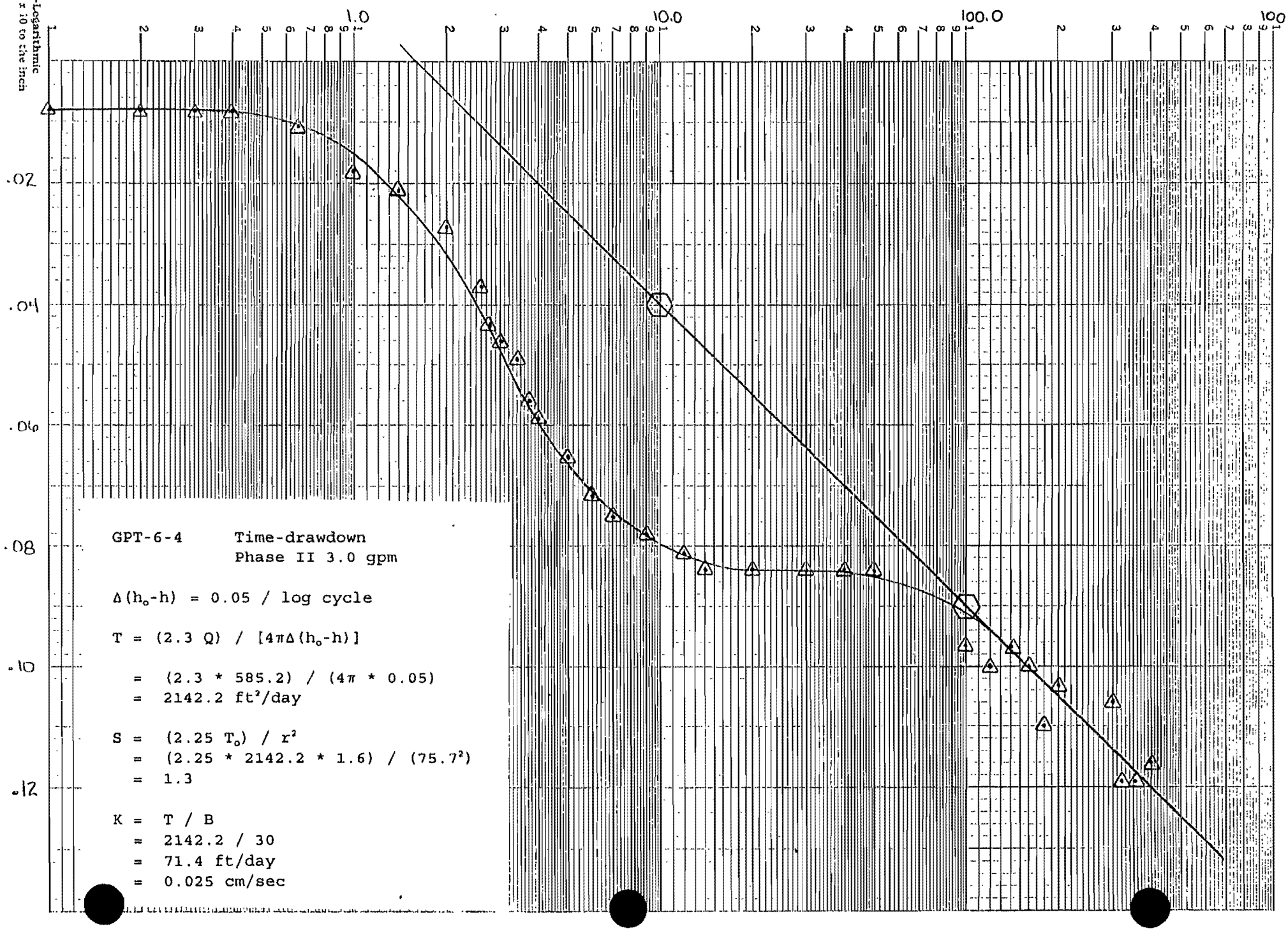
PUMP INTAKE SETTING 8.3' - 8.7'
open end - lowered as product level dropped

DATE	TIME			DISCHARGE			REMARKS
	(CLOCK) TIME :	TOTAL ELAPSED TIME (in min)	TIME INTERVAL (in ~~min~~) SEC	~~FLOW METER READING (in gal.)~~	VOLUME (in gal.)	FLOW RATE (in gpm)	INTAKE
1/12/94	09:00	0		SETTING MASTERFLEX #			Flow really starts
1/12/94	09 07	7	28.33 sec	3	250ml	0.53 L/min	@ 09:05 LINE at 8.7'
	09:18	18	25.29 sec	3	250ml	0.59 L/m	Line at 8.7' 0 to 1 30% Product (30% Product
	09:26	26	N/A	3			DTW has risen 0.06'
	"		N/A	3			DT Product dropped 0.08'
	09:33	33	25.38s	3	250ml	0.59 L/m	10% Product
	09:59	59	29.49s	3	250ml	0.51 L/m	
	10:30	90	46.62s	3	250ml		Product 0.03
	10:44	~~144~~ 104	46.56s	3	250ml		Pumping mostly H_2O
	10:45	105	37.90s	4	250ml		
	10:51	111	38.78s	7	250ml	0.39 L/m	
	10:57	117	34.61s	8	250ml	0.43 L/m	
	11:17	137	13.77s	9	250ml	1.09 L/m	
	11:20	140	17.47s	7	250	0.86 L/m	
	11:21	141	21.13s	5	250	0.71 L/m	
	11:23	143	22.57s	4	250		
	11:24	144	25.63s	3	250		
	11:25	145	N/A	3	250		set pump intake to 11.5 feet & continued
	12:42		95.27s	3	250		to run pump discharging (now w/ product)
	12:43						
	12:45		157.63s		250	0.098 L/m	Restart
1/13/94	01:00		146.38		250	0.102 L/min	

MASTERFLEX

Time Drawdown Plots


Semi-Logarithmic
t (min)
1.0
10.0
100.0
0.1
0.2
0.3
GPT-6-1 Time-drawdown
Phase II 3.0 gpm
Δ(h₀-h) = 0.11 / log cycle
T = (2.3 Q) / [4πΔ(h₀-h)]
= (2.3 * 585.2) / (4π * 0.11)
= 973.7 ft²/day
K = T / B
= 973.7 / 30
= 32.5 ft/day
= 0.011 cm/sec



GPT-6-4 Time-drawdown
Phase II 3.0 gpm

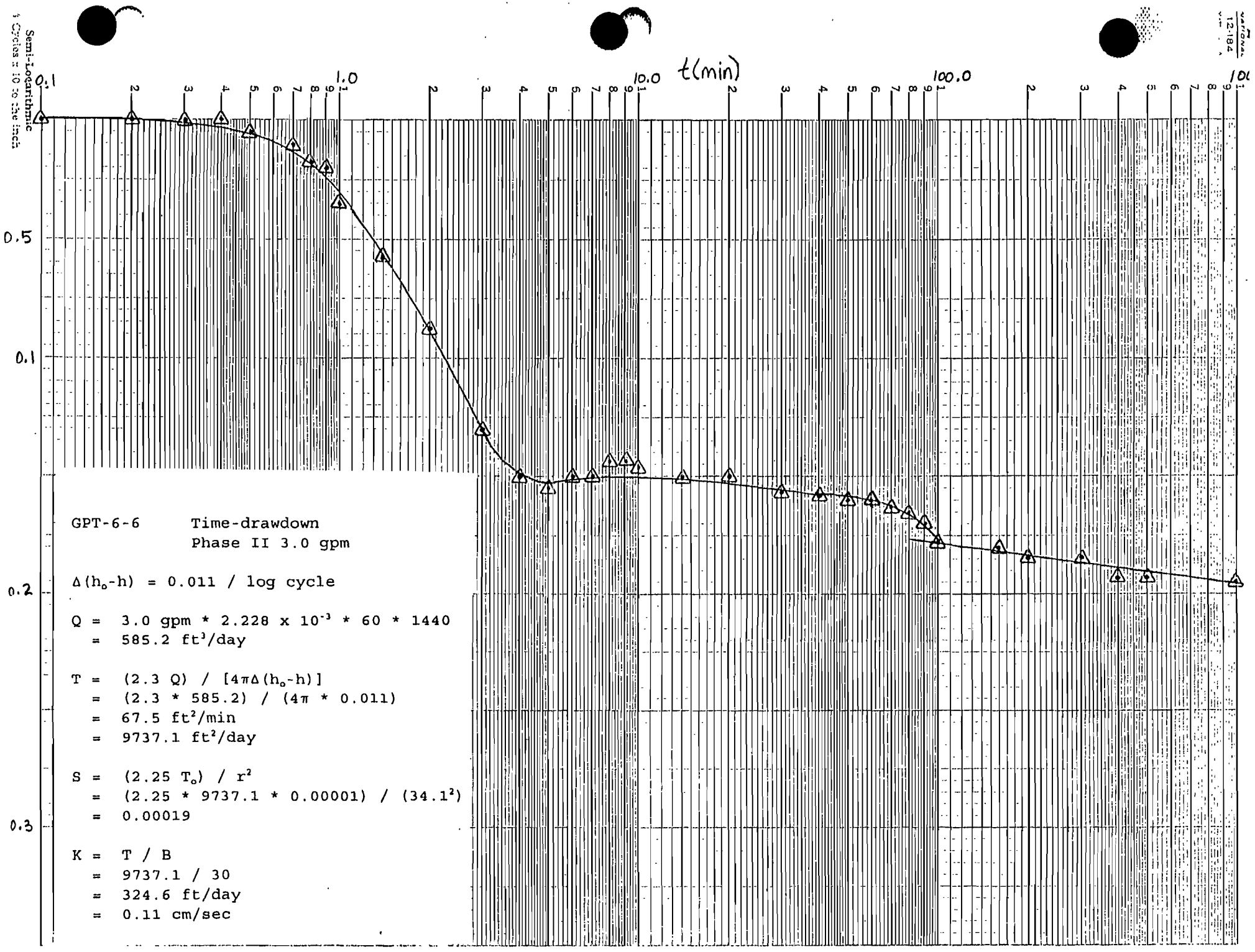
$\Delta(h_o-h) = 0.05$ / log cycle

$T = (2.3\ Q) / [4\pi\Delta(h_o-h)]$

$= (2.3 * 585.2) / (4\pi * 0.05)$
$= 2142.2\ ft^2/day$

$S = (2.25\ T_o) / r^2$
$= (2.25 * 2142.2 * 1.6) / (75.7^2)$
$= 1.3$

$K = T / B$
$= 2142.2 / 30$
$= 71.4$ ft/day
$= 0.025$ cm/sec



GPT-6-6 Time-drawdown
Phase II 3.0 gpm

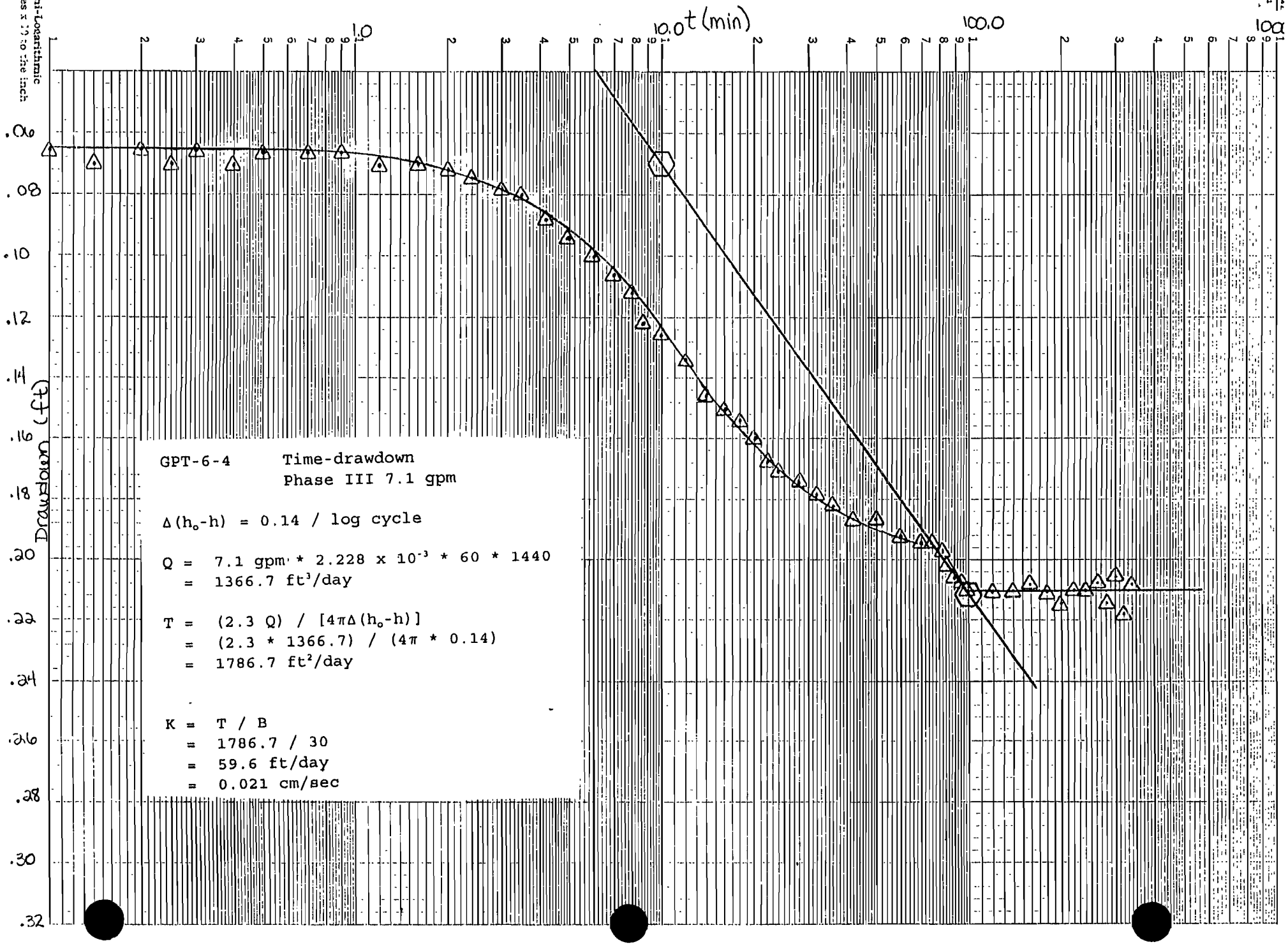
$\Delta(h_o-h) = 0.011$ / log cycle

$Q = 3.0 \text{ gpm} * 2.228 \times 10^{-3} * 60 * 1440$
$= 585.2 \text{ ft}^3/\text{day}$

$T = (2.3\ Q) / [4\pi\Delta(h_o-h)]$
$= (2.3 * 585.2) / (4\pi * 0.011)$
$= 67.5 \text{ ft}^2/\text{min}$
$= 9737.1 \text{ ft}^2/\text{day}$

$S = (2.25\ T_o) / r^2$
$= (2.25 * 9737.1 * 0.00001) / (34.1^2)$
$= 0.00019$

$K = T / B$
$= 9737.1 / 30$
$= 324.6 \text{ ft/day}$
$= 0.11 \text{ cm/sec}$



GPT-6-4 Time-drawdown
Phase III 7.1 gpm

$\Delta(h_o-h) = 0.14$ / log cycle

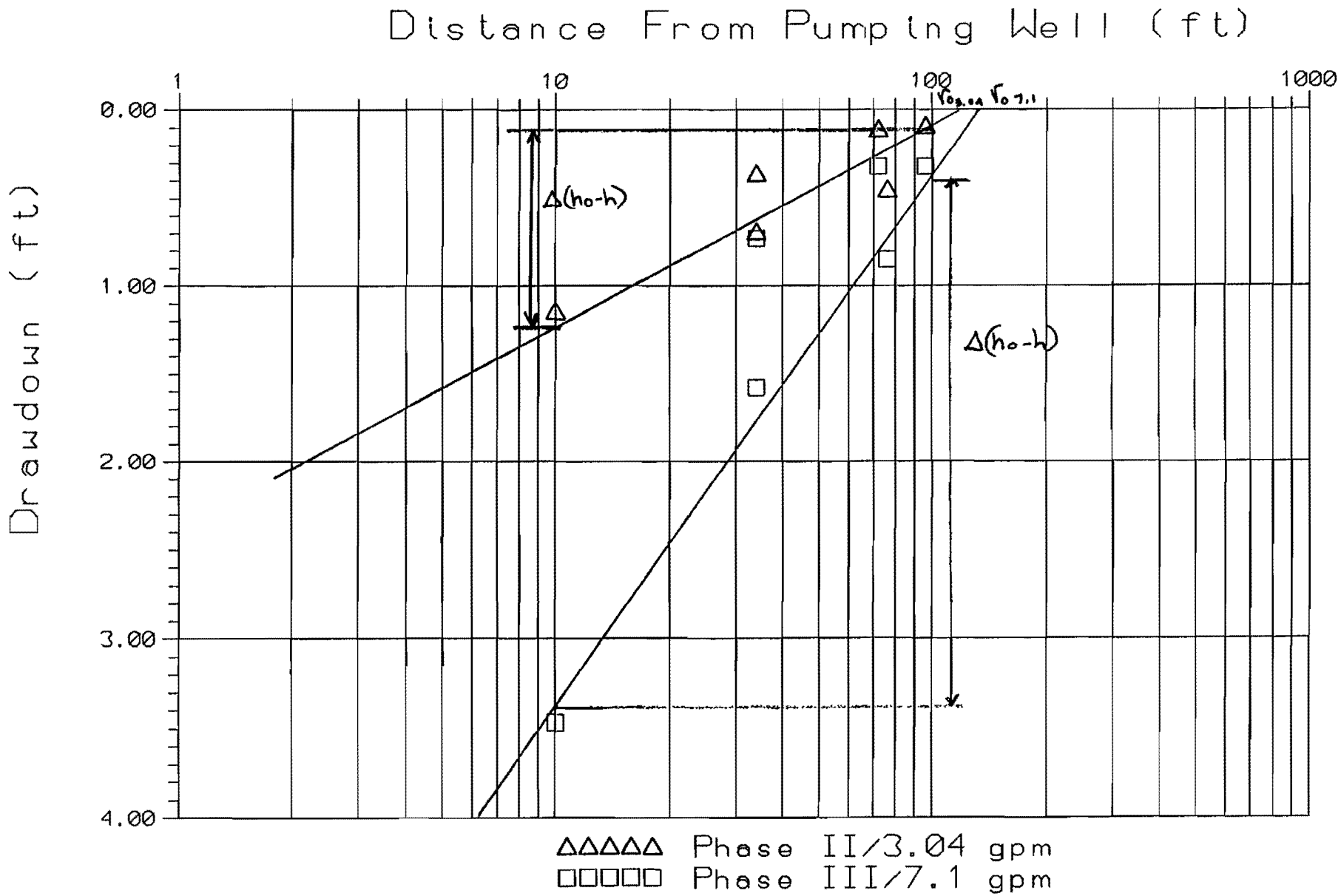
$Q = 7.1 \text{ gpm} * 2.228 \times 10^{-3} * 60 * 1440$
$= 1366.7 \text{ ft}^3/\text{day}$

$T = (2.3\ Q) / [4\pi\Delta(h_o-h)]$
$= (2.3 * 1366.7) / (4\pi * 0.14)$
$= 1786.7 \text{ ft}^2/\text{day}$

$K = T / B$
$= 1786.7 / 30$
$= 59.6 \text{ ft/day}$
$= 0.021 \text{ cm/sec}$

Distance Drawdown Plots

JACOB STRAIGHT-LINE SOLUTION (DISTANCE-DRAWDOWN METHOD)



APPENDIX D

STEPPED PUMPING TEST DATA

APPENDIX D

About this Appendix

This appendix contains the direct output form the data logger following the pumping test. The data are in two sections because the output was eight channels, but only six could be printed on a single page. Pages D-2 through D-18 contain the first six channels, while channels 7 and 8 are shown on pages D-19 through D-34.

Definition of Acronyms

Setups: Input #	-	refer to the transducer number (1 through 8).
Mode TOC	-	references measurements from top of casing
I.D.	-	well identification
Reference	-	input of depth to water from top of casing, in feet
SG	-	specific gravity of fluid of interest. Groundwater in this case.
Linearity, scale factor, offset	-	correction factors specific to each transducer
Delay MSEC	-	the delay in milliseconds (mSEC) before the transducer begins to take readings

INPUT NUMBER	WELL NUMBER
INPUT 1	GPT-6-RW
INPUT 2	GPT-6-1
INPUT 3	GPT-6-6
INPUT 4	GPT-6-7
INPUT 5	GPT-6-3
INPUT 6	GPT-6-4
INPUT 7	GPT-6-5
INPUT 8	BAROMETER

SE2000
Environmental Logger
01/13 10:04

Unit# 546 Test 0 and Test 1

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
Type	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC	TOC	TOC
I.D.	GPT-6-RW	6-1	6-6	6-7	6-3	6-4
Reference	8.310	7.590	6.160	11.150	4.280	8.510
SG	1.000	1.000	1.000	1.000	1.000	1.000
Linearity	0.117	0.046	0.042	-0.006	0.024	0.042
Scale factor	19.999	9.988	10.033	30.017	10.032	10.025
Offset	-0.004	0.023	0.010	-0.049	0.022	-0.005
Delay mSEC	50.000	50.000	50.000	50.000	50.000	50.000

Step 0 01/11 18:15:01

Elapsed Time	Input 1	Input 2	Input 3	Input 4	Input 5	Input 6
0	23.715	7.586	6.16	11.15	4.28	8.51
15	23.715	7.59	6.163	11.15	4.28	8.516
30	23.715	7.59	6.163	11.15	4.28	8.516
45	23.715	7.583	6.16	11.15	4.276	8.51
60	23.715	7.586	6.163	11.15	4.28	8.513
75	23.715	7.583	6.16	11.15	4.276	8.506
90	23.715	7.58	6.16	11.15	4.276	8.506
105	23.715	7.58	6.156	11.15	4.273	8.503
120	23.715	7.58	6.16	11.15	4.273	8.503
135	23.715	7.577	6.156	11.15	4.27	8.5
150	23.715	7.58	6.163	11.15	4.273	8.506
165	23.715	7.58	6.163	11.15	4.273	8.51
180	23.715	7.577	6.16	11.15	4.273	8.503
195	23.715	7.577	6.163	11.15	4.273	8.506
210	23.715	7.577	6.163	11.15	4.273	8.506
225	23.715	7.577	6.16	11.15	4.27	8.503
240	23.715	7.571	6.156	11.15	4.267	8.494
255	23.715	7.567	6.153	11.15	4.264	8.491
270	23.715	7.567	6.15	11.15	4.26	8.487
285	23.715	7.567	6.153	11.15	4.264	8.491
300	23.715	7.567	6.156	11.15	4.264	8.494
315	23.715	7.567	6.156	11.15	4.264	8.494
330	23.715	7.564	6.153	11.15	4.26	8.491
345	23.715	7.558	6.147	11.15	4.257	8.481
360	23.715	7.558	6.147	11.14	4.257	8.481
375	23.715	7.561	6.15	11.15	4.257	8.484
390	23.715	7.561	6.15	11.15	4.257	8.487

405	23.715	7.558	6.15	11.15	4.257	8.484
420	23.715	7.561	6.15	11.15	4.257	8.484
435	23.715	7.561	6.15	11.15	4.257	8.484
450	23.715	7.558	6.15	11.15	4.257	8.484
465	23.715	7.558	6.15	11.14	4.257	8.484
480	23.715	7.555	6.147	11.15	4.254	8.478
495	23.715	7.558	6.15	11.15	4.254	8.484
510	23.715	7.552	6.147	11.15	4.254	8.478
525	23.715	7.558	6.153	11.14	4.257	8.484
540	23.715	7.555	6.15	11.15	4.254	8.484
555	23.715	7.555	6.15	11.15	4.254	8.484
570	23.715	7.555	6.147	11.15	4.254	8.481
585	23.715	7.555	6.15	11.15	4.257	8.484
600	23.715	7.555	6.15	11.14	4.254	8.484
615	23.715	7.552	6.15	11.15	4.254	8.481
630	23.715	7.548	6.144	11.14	4.251	8.478
645	23.715	7.552	6.147	11.15	4.254	8.481
660	23.715	7.548	6.144	11.14	4.248	8.475
675	23.715	7.548	6.144	11.14	4.248	8.472
690	23.715	7.552	6.15	11.14	4.254	8.481
705	23.715	7.548	6.147	11.14	4.251	8.478
720	23.715	7.552	6.147	11.14	4.254	8.481
735	23.715	7.555	6.15	11.14	4.257	8.484
750	23.715	7.552	6.15	11.14	4.254	8.484
765	23.715	7.548	6.147	11.14	4.251	8.478
780	23.715	7.548	6.15	11.15	4.254	8.481
795	23.715	7.555	6.153	11.14	4.257	8.487
810	8.316	7.555	6.15	11.14	4.257	8.487
825	8.31	7.552	6.15	11.14	4.254	8.484
840	8.316	7.555	6.153	11.14	4.257	8.487
855	8.316	7.555	6.153	11.14	4.257	8.487
870	8.303	7.548	6.144	11.14	4.254	8.478
885	8.296	7.544	6.146	11.13	4.254	8.474
885.0083	8.296	7.548	6.143	11.13	4.254	8.474
885.0166	8.296	7.548	6.146	11.13	4.254	8.474
885.025	8.296	7.548	6.146	11.13	4.254	8.474
885.0333	8.296	7.548	6.146	11.13	4.25	8.477
885.0416	8.296	7.548	6.146	11.13	4.254	8.474
885.05	8.296	7.544	6.146	11.13	4.254	8.474
885.0583	8.303	7.548	6.146	11.13	4.254	8.477
885.0666	8.296	7.548	6.146	11.13	4.254	8.474
885.075	8.296	7.548	6.146	11.13	4.254	8.477
885.0833	8.296	7.548	6.146	11.13	4.254	8.474
885.0916	8.296	7.548	6.146	11.13	4.254	8.477
885.1	8.296	7.548	6.146	11.13	4.25	8.474
885.1083	8.303	7.548	6.15	11.13	4.254	8.477
885.1166	8.296	7.548	6.146	11.13	4.254	8.474
885.125	8.303	7.548	6.146	11.13	4.254	8.474
885.1333	8.296	7.548	6.146	11.13	4.25	8.474
885.1416	8.303	7.548	6.146	11.13	4.254	8.474
885.15	8.303	7.548	6.146	11.13	4.254	8.474

885.1583	8.296	7.548	6.146	11.13	4.254	8.474
885.1666	8.296	7.548	6.146	11.13	4.254	8.477
885.175	8.296	7.548	6.146	11.13	4.254	8.477
885.1833	8.296	7.548	6.146	11.13	4.254	8.477
885.1916	8.303	7.548	6.146	11.13	4.254	8.474
885.2	8.296	7.548	6.146	11.13	4.254	8.474
885.2083	8.303	7.548	6.146	11.13	4.254	8.474
885.2166	8.296	7.548	6.146	11.13	4.254	8.474
885.225	8.303	7.548	6.146	11.13	4.257	8.474
885.2333	8.296	7.551	6.146	11.13	4.254	8.474
885.2416	8.296	7.548	6.146	11.13	4.254	8.474
885.25	8.296	7.548	6.146	11.13	4.254	8.477
885.2583	8.296	7.548	6.146	11.13	4.254	8.477
885.2666	8.303	7.548	6.146	11.13	4.254	8.474
885.275	8.296	7.548	6.146	11.13	4.254	8.474
885.2833	8.303	7.548	6.146	11.13	4.254	8.474
885.2916	8.296	7.548	6.146	11.13	4.254	8.474
885.3	8.303	7.548	6.146	11.13	4.257	8.474
885.3083	8.303	7.548	6.146	11.13	4.254	8.477
885.3166	8.303	7.548	6.146	11.13	4.254	8.477
885.325	8.303	7.548	6.15	11.13	4.254	8.474
885.3333	8.303	7.548	6.146	11.13	4.254	8.477
885.35	8.303	7.548	6.146	11.13	4.254	8.474
885.3666	8.303	7.544	6.146	11.13	4.254	8.474
885.3833	8.303	7.548	6.146	11.13	4.254	8.477
885.4	8.303	7.548	6.146	11.13	4.254	8.477
885.4166	8.303	7.548	6.146	11.13	4.254	8.477
885.4333	8.309	7.551	6.146	11.13	4.254	8.477
885.45	8.309	7.548	6.15	11.13	4.254	8.474
885.4666	8.303	7.548	6.15	11.13	4.254	8.477
885.4833	8.309	7.551	6.15	11.13	4.257	8.477
885.5	8.315	7.551	6.146	11.13	4.254	8.477
885.5166	8.309	7.548	6.15	11.13	4.254	8.477
885.5333	8.309	7.548	6.146	11.13	4.254	8.477
885.55	8.309	7.551	6.146	11.13	4.254	8.477
885.5666	8.309	7.548	6.146	11.13	4.254	8.477
885.5833	8.309	7.548	6.15	11.13	4.254	8.477
885.6	8.309	7.548	6.146	11.13	4.254	8.474
885.6166	8.309	7.548	6.146	11.13	4.254	8.477
885.6333	8.309	7.551	6.146	11.13	4.254	8.477
885.65	8.309	7.548	6.146	11.13	4.254	8.477
885.6666	8.315	7.551	6.146	11.13	4.254	8.477
885.6833	8.315	7.551	6.146	11.14	4.254	8.477
885.7	8.309	7.551	6.15	11.14	4.254	8.477
885.7166	8.309	7.551	6.146	11.13	4.254	8.477
885.7333	8.309	7.548	6.146	11.13	4.254	8.474
885.75	8.309	7.551	6.146	11.13	4.254	8.474
885.7666	8.309	7.548	6.146	11.13	4.254	8.474
885.7833	8.309	7.551	6.146	11.13	4.254	8.477
885.8	8.309	7.551	6.146	11.13	4.254	8.474
885.8166	8.309	7.548	6.146	11.13	4.254	8.474

885.8333	8.309	7.548	6.146	11.13	4.254	8.477
885.85	8.309	7.548	6.146	11.13	4.254	8.474
885.8666	8.309	7.548	6.146	11.13	4.254	8.477
885.8833	8.309	7.548	6.15	11.13	4.254	8.474
885.9	8.309	7.548	6.146	11.13	4.254	8.474
885.9166	8.309	7.548	6.146	11.13	4.254	8.474
885.9333	8.309	7.548	6.146	11.13	4.254	8.474
885.95	8.309	7.551	6.146	11.13	4.257	8.474
885.9666	8.309	7.551	6.146	11.13	4.254	8.474
885.9833	8.309	7.548	6.146	11.13	4.254	8.474
886	8.309	7.551	6.146	11.13	4.257	8.474
886.2	8.309	7.548	6.146	11.13	4.257	8.474
886.4	8.309	7.548	6.146	11.13	4.254	8.474
886.6	8.309	7.548	6.146	11.13	4.254	8.474
886.8	8.309	7.551	6.146	11.13	4.254	8.474
887	8.309	7.548	6.146	11.13	4.254	8.477
887.2	8.309	7.548	6.146	11.13	4.254	8.474
887.4	8.309	7.551	6.146	11.13	4.257	8.477
887.6	8.309	7.548	6.146	11.13	4.254	8.474
887.8	8.309	7.548	6.15	11.13	4.254	8.477
888	8.309	7.548	6.146	11.13	4.254	8.474
888.2	8.309	7.551	6.15	11.13	4.254	8.477
888.4	8.309	7.548	6.15	11.13	4.254	8.474
888.6	8.309	7.551	6.146	11.13	4.254	8.474
888.8	8.309	7.551	6.146	11.13	4.25	8.474
889	8.309	7.548	6.146	11.13	4.254	8.474
889.2	8.303	7.548	6.146	11.13	4.254	8.474
889.4	8.309	7.548	6.146	11.13	4.254	8.474
889.6	8.309	7.548	6.146	11.13	4.254	8.474
889.8	8.303	7.548	6.146	11.13	4.254	8.474
890	8.315	7.551	6.146	11.13	4.254	8.477
890.2	8.328	7.551	6.146	11.13	4.254	8.474
890.4	8.334	7.551	6.146	11.13	4.254	8.474
890.6	8.334	7.554	6.143	11.13	4.254	8.474
890.8	8.34	7.554	6.146	11.121	4.25	8.474
891	8.34	7.557	6.143	11.13	4.25	8.474
891.2	8.347	7.554	6.143	11.13	4.25	8.477
891.4	8.347	7.557	6.146	11.13	4.254	8.477
891.6	8.353	7.557	6.146	11.13	4.254	8.477
891.8	8.353	7.557	6.15	11.13	4.254	8.477
892	8.359	7.56	6.146	11.13	4.254	8.477
892.2	8.353	7.56	6.146	11.13	4.254	8.477
892.4	8.359	7.56	6.15	11.13	4.257	8.477
892.6	8.359	7.56	6.15	11.13	4.257	8.481
892.8	8.359	7.56	6.15	11.13	4.257	8.481
893	8.366	7.563	6.153	11.13	4.257	8.481
893.2	8.366	7.56	6.15	11.13	4.257	8.481
893.4	8.366	7.563	6.153	11.13	4.257	8.481
893.6	8.366	7.563	6.153	11.13	4.26	8.481
893.8	8.366	7.56	6.153	11.13	4.257	8.481
894	8.366	7.563	6.153	11.13	4.257	8.481

894.2	8.366	7.563	6.153	11.13	4.26	8.481
894.4	8.366	7.563	6.153	11.13	4.26	8.481
894.6	8.366	7.56	6.153	11.13	4.26	8.481
894.8	8.372	7.563	6.153	11.13	4.257	8.477
895	8.378	7.566	6.159	11.13	4.26	8.487
897	8.378	7.566	6.156	11.14	4.26	8.481
899	8.372	7.566	6.156	11.13	4.26	8.481
901	8.378	7.566	6.156	11.13	4.257	8.484
903	8.378	7.566	6.156	11.14	4.257	8.487
905	8.378	7.566	6.159	11.14	4.257	8.487
907	8.378	7.563	6.156	11.14	4.257	8.484
909	8.372	7.563	6.156	11.14	4.257	8.484
911	8.372	7.557	6.156	11.14	4.257	8.484
913	8.372	7.563	6.216	11.14	4.257	8.481
915	8.372	7.563	6.162	11.13	4.254	8.481
917	8.372	7.563	6.153	11.13	4.254	8.481
919	8.378	7.563	6.156	11.14	4.257	8.427
921	8.378	7.563	6.156	11.14	4.257	8.487
923	8.378	7.563	6.153	11.14	4.257	8.484
925	8.372	7.563	6.153	11.13	4.254	8.481
927	8.372	7.563	6.153	11.14	4.257	8.481
929	8.372	7.56	6.153	11.14	4.254	8.481
931	8.372	7.56	6.153	11.14	4.254	8.481
933	8.372	7.56	6.15	11.14	4.254	8.477
935	8.372	7.56	6.153	11.14	4.254	8.477
937	8.372	7.56	6.153	11.14	4.254	8.477
939	8.372	7.56	6.153	11.14	4.254	8.477
941	8.372	7.563	6.153	11.14	4.257	8.481
943	8.372	7.563	6.153	11.14	4.254	8.481
945	8.372	7.563	6.156	11.14	4.257	8.484
947	8.378	7.563	6.156	11.14	4.257	8.484
949	8.372	7.563	6.156	11.14	4.254	8.481
951	8.372	7.563	6.153	11.14	4.254	8.484
953	8.372	7.563	6.156	11.14	4.254	8.484
955	8.372	7.566	6.156	11.14	4.254	8.484
957	8.372	7.563	6.153	11.14	4.257	8.484
959	8.372	7.563	6.153	11.14	4.254	8.481
961	8.366	7.56	6.153	11.14	4.254	8.481
963	8.366	7.56	6.146	11.14	4.254	8.474
965	8.366	7.56	6.15	11.14	4.25	8.477
967	8.366	7.56	6.153	11.14	4.254	8.477
969	8.366	7.56	6.153	11.14	4.254	8.477
971	8.359	7.56	6.15	11.14	4.254	8.477
973	8.366	7.557	6.15	11.14	4.25	8.474
975	8.347	7.557	6.153	11.14	4.254	8.477
977	8.34	7.554	6.15	11.14	4.25	8.474
979	8.34	7.554	6.146	11.14	4.25	8.471
981	8.34	7.551	6.146	11.14	4.25	8.471
983	8.34	7.554	6.146	11.14	4.247	8.471
985	8.802	7.63	6.14	11.14	4.257	8.471
1005	8.391	7.56	6.14	11.13	4.25	8.468

(3) 6-6 6-A

1025	8.821	7.56	6.13	11.13	4.244	8.458
1025.008	8.891	7.56	6.13	11.13	4.244	8.458
1025.017	8.954	7.563	6.13	11.13	4.244	8.458
1025.025	9.011	7.566	6.13	11.13	4.244	8.458
1025.033	9.074	7.57	6.127	11.13	4.244	8.458
1025.042	9.131	7.573	6.127	11.13	4.244	8.458
1025.05	9.194	7.576	6.127	11.13	4.244	8.458
1025.058	9.259	7.579	6.13	11.13	4.244	8.458
1025.067	9.321	7.585	6.127	11.13	4.244	8.458
1025.075	9.384	7.589	6.13	11.13	4.244	8.458
1025.083	9.428	7.595	6.13	11.13	4.244	8.458
1025.092	9.492	7.598	6.127	11.13	4.244	8.458
1025.1	9.536	7.604	6.13	11.13	4.244	8.458
1025.108	9.599	7.611	6.13	11.13	4.244	8.458
1025.117	9.65	7.614	6.13	11.13	4.244	8.458
1025.125	9.7	7.62	6.13	11.13	4.244	8.458
1025.133	9.745	7.623	6.13	11.13	4.247	8.458
1025.142	9.77	7.63	6.13	11.13	4.244	8.458
1025.15	9.833	7.636	6.13	11.13	4.244	8.458
1025.158	9.884	7.642	6.13	11.13	4.244	8.458
1025.167	9.915	7.646	6.13	11.13	4.244	8.458
1025.175	9.96	7.652	6.13	11.13	4.244	8.458
1025.183	9.985	7.655	6.13	11.13	4.247	8.458
1025.192	10.023	7.665	6.13	11.13	4.247	8.458
1025.2	10.054	7.668	6.13	11.13	4.247	8.458
1025.208	10.092	7.674	6.13	11.13	4.247	8.458
1025.217	10.124	7.68	6.13	11.13	4.247	8.458
1025.225	10.182	7.684	6.13	11.13	4.247	8.458
1025.233	10.194	7.69	6.13	11.13	4.247	8.458
1025.242	10.219	7.693	6.13	11.13	4.247	8.462
1025.25	10.25	7.698	6.13	11.13	4.247	8.458
1025.258	10.282	7.706	6.13	11.13	4.247	8.462
1025.267	10.314	7.709	6.13	11.13	4.247	8.459
1025.275	10.345	7.715	6.13	11.13	4.25	8.462
1025.283	10.371	7.722	6.13	11.13	4.25	8.458
1025.292	10.402	7.725	6.13	11.13	4.25	8.462
1025.3	10.434	7.731	6.13	11.13	4.25	8.458
1025.308	10.459	7.734	6.13	11.13	4.25	8.462
1025.317	10.484	7.741	6.13	11.13	4.25	8.462
1025.325	10.516	7.744	6.13	11.13	4.25	8.458
1025.333	10.573	7.753	6.13	11.13	4.25	8.458
1025.35	10.624	7.763	6.13	11.13	4.254	8.462
1025.367	10.674	7.775	6.134	11.13	4.254	8.462
1025.383	10.725	7.782	6.13	11.13	4.254	8.462
1025.4	10.769	7.791	6.13	11.13	4.254	8.458
1025.417	10.813	7.801	6.13	11.13	4.254	8.462
1025.433	10.851	7.807	6.134	11.13	4.257	8.462
1025.45	10.889	7.817	6.134	11.13	4.257	8.462
1025.467	10.927	7.826	6.134	11.13	4.257	8.462
1025.483	10.965	7.832	6.134	11.13	4.257	8.462
1025.5	11.003	7.842	6.134	11.13	4.26	8.462

1025.517	11.041	7.848	6.134	11.13	4.26	8.462
1025.533	11.072	7.859	6.134	11.13	4.26	8.462
1025.55	11.098	7.864	6.134	11.13	4.26	8.462
1025.567	11.136	7.87	6.137	11.13	4.26	8.462
1025.583	11.142	7.88	6.137	11.13	4.283	8.462
1025.6	11.161	7.886	6.137	11.13	4.263	8.462
1025.617	11.186	7.892	6.137	11.13	4.263	8.462
1025.633	11.199	7.899	6.137	11.13	4.263	8.462
1025.65	11.218	7.905	6.137	11.13	4.266	8.462
1025.667	11.237	7.911	6.137	11.13	4.266	8.462
1025.683	11.237	7.915	6.14	11.13	4.266	8.462
1025.7	11.268	7.921	6.14	11.13	4.266	8.462
1025.717	11.287	7.924	6.14	11.13	4.269	8.462
1025.733	11.294	7.93	6.143	11.13	4.269	8.462
1025.75	11.313	7.937	6.14	11.13	4.273	8.462
1025.767	11.319	7.943	6.143	11.13	4.269	8.462
1025.783	11.351	7.949	6.143	11.13	4.273	8.462
1025.8	11.363	7.953	6.146	11.13	4.273	8.462
1025.817	11.376	7.956	6.143	11.13	4.276	8.462
1025.833	11.388	7.962	6.146	11.13	4.276	8.462
1025.85	11.395	7.968	6.146	11.13	4.276	8.462
1025.867	11.42	7.968	6.15	11.13	4.276	8.462
1025.883	11.42	7.975	6.146	11.13	4.276	8.462
1025.9	11.445	7.978	6.15	11.13	4.279	8.462
1025.917	11.458	7.981	6.15	11.13	4.279	8.462
1025.933	11.471	7.987	6.15	11.13	4.279	8.462
1025.95	11.483	7.991	6.153	11.13	4.279	8.465
1025.967	11.496	7.994	6.153	11.13	4.279	8.462
1025.983	11.509	7.997	6.153	11.13	4.282	8.465
1026	11.667	8.048	6.165	11.13	4.288	8.468
1026.2	11.66	8.079	6.179	11.13	4.298	8.468
1026.4	11.578	8.092	6.188	11.13	4.304	8.471
1026.6	11.49	8.098	6.2	11.13	4.311	8.471
1026.8	11.452	8.101	6.21	11.13	4.317	8.477
1027	11.433	8.108	6.219	11.13	4.323	8.477
1027.2	11.426	8.111	6.229	11.13	4.327	8.481
1027.4	11.332	8.114	6.238	11.13	4.33	4.484
1027.6	11.136	8.104	6.248	11.13	4.336	8.487
1027.8	10.94	8.085	6.254	11.13	4.339	8.493
1028	10.655	8.06	6.26	11.13	4.339	8.496
1028.2	10.484	8.032	6.267	11.13	4.339	8.499
1028.4	10.371	8.01	6.273	11.13	4.339	8.499
1028.6	10.288	7.991	6.276	11.13	4.339	8.503
1028.8	10.225	7.978	6.28	11.121	4.336	8.506
1029	10.181	7.965	6.28	11.13	4.336	8.509
1029.2	10.149	7.959	6.283	11.13	4.336	8.509
1029.4	10.124	7.953	6.283	11.13	4.336	8.509
1029.6	10.042	7.943	6.283	11.13	4.336	8.509
1029.8	9.96	7.93	6.283	11.13	4.333	8.512
1030	9.915	7.918	6.283	11.13	4.33	8.515
1030.2	9.871	7.911	6.283	11.13	4.33	8.515

1030.4	9.846	7.902	6.283	11.13	4.33	8.518
1030.6	9.821	7.899	6.283	11.13	4.333	8.518
1030.8	9.808	7.892	6.28	11.13	4.33	8.518
1031	9.789	7.889	6.28	11.13	4.33	8.522
1031.2	9.789	7.883	6.28	11.13	4.33	8.522
1031.4	9.776	7.88	6.28	11.13	4.33	8.522
1031.6	9.77	0.88	6.28	11.13	4.33	8.522
1031.8	9.764	7.877	6.28	11.13	4.33	8.525
1032	9.764	7.873	6.28	11.14	4.33	8.525
1032.2	9.757	7.873	6.276	11.13	4.327	8.525
1032.4	9.751	7.87	6.276	11.13	4.327	8.528
1032.6	9.745	7.87	6.276	11.13	4.327	8.525
1032.8	9.751	7.87	6.278	11.13	4.327	8.528
1033	9.745	7.867	6.273	11.13	4.327	8.528
1033.2	9.745	7.867	6.276	11.13	4.327	8.528
1033.4	9.732	7.867	6.273	11.13	4.327	8.525
1033.6	9.738	7.867	6.273	11.13	4.327	8.525
1033.8	9.745	7.864	6.273	11.13	4.327	8.525
1034	9.738	7.864	6.273	11.13	4.327	8.528
1034.2	9.738	7.864	6.273	11.13	4.327	8.528
1034.4	9.732	7.864	6.273	11.13	4.327	8.528
1034.6	9.738	7.864	6.27	11.13	4.327	8.528
1034.8	9.738	7.864	6.273	11.14	4.33	8.528
1035	9.738	7.864	6.276	11.14	4.33	8.528
1037	9.738	7.864	6.276	11.14	4.33	8.531
1039	9.745	7.864	6.28	11.14	4.327	8.534
1041	9.745	7.864	6.28	11.14	4.327	8.534
1043	9.738	7.864	6.276	11.14	4.327	8.534
1045	9.745	7.864	6.28	11.14	4.323	8.534
1047	9.751	7.864	6.251	11.14	4.323	8.534
1049	9.757	7.867	6.283	11.14	4.327	8.531
1051	9.757	7.87	6.283	11.14	4.327	8.541
1053	9.757	7.87	6.286	11.14	4.33	8.534
1055	9.764	7.87	6.286	11.14	4.327	8.534
1057	9.764	7.87	6.286	11.14	4.33	8.534
1059	9.764	7.87	6.286	11.14	4.327	8.534
1061	9.757	7.848	6.289	11.14	4.327	8.534
1063	9.764	7.858	6.286	11.14	4.33	8.534
1065	9.757	7.858	6.289	11.14	4.327	8.534
1067	9.751	7.861	6.289	11.14	4.33	8.534
1069	9.751	7.861	6.289	11.14	4.327	8.534
1071	9.751	7.861	6.292	11.14	4.327	8.534
1073	9.751	7.861	6.292	11.14	4.327	8.534
1075	9.745	7.861	6.289	11.14	4.327	8.534
1077	9.738	7.858	6.292	11.14	4.327	8.534
1079	9.738	7.858	6.289	11.14	4.327	8.531
1081	9.738	7.858	6.289	11.14	4.327	8.534
1083	9.732	7.858	6.289	11.14	4.323	8.531
1085	9.726	7.858	6.289	11.14	4.327	8.531
1087	9.726	7.854	6.286	11.13	4.323	8.531
1089	9.719	7.858	6.289	11.14	4.323	8.531

1091	9.757	7.861	6.292	11.14	4.327	8.534
1093	9.757	7.861	6.292	11.13	4.327	8.534
1095	9.757	7.861	6.292	11.14	4.327	8.534
1097	9.757	7.861	6.292	11.13	4.323	8.534
1099	9.757	7.861	6.292	11.14	4.327	8.534
1101	9.757	7.861	6.292	11.14	4.327	8.534
1103	9.751	7.864	6.295	11.13	4.327	8.534
1105	9.757	7.864	6.295	11.13	4.33	8.534
1107	9.751	7.864	6.295	11.13	4.327	8.537
1109	9.745	7.864	6.295	11.13	4.33	8.537
1111	9.745	7.867	6.299	11.13	4.33	8.541
1113	9.745	7.864	6.299	11.14	4.33	8.541
1115	9.745	7.867	6.302	11.14	4.33	8.541
1117	9.738	7.867	6.299	11.13	4.33	8.541
1119	9.745	7.864	6.302	11.13	4.33	8.541
1121	9.738	7.867	6.302	11.13	4.33	8.541
1123	9.764	7.864	6.299	11.14	4.327	8.541
1125	9.764	7.873	6.308	11.13	4.336	8.547
1145	9.751	7.87	6.308	11.13	4.333	8.55
1165	9.764	7.87	6.308	11.13	4.336	8.547
1185	9.757	7.873	6.311	11.13	4.336	8.55
1205	9.757	7.883	6.318	11.13	4.342	8.56
1225	9.764	7.877	6.314	11.13	4.333	8.553
1245	9.77	7.88	6.324	11.13	4.342	8.563
1265	9.751	7.896	6.318	11.13	4.342	8.553
1285	9.764	7.899	6.314	11.13	4.339	8.56
1305	9.776	7.899	6.311	11.13	4.339	8.556
1325	9.776	7.899	6.314	11.13	4.339	8.556
1345	9.783	7.908	6.321	11.13	4.349	8.569
1365	9.783	7.905	6.324	11.13	4.349	8.569
1385	9.783	7.902	6.318	11.121	4.342	8.563
1405	9.783	7.905	6.324	11.121	4.346	8.569
1425	9.783	7.905	6.321	11.121	4.346	8.566
1445	9.783	7.908	6.324	11.121	4.349	8.569
1465	9.776	7.905	6.321	11.121	4.346	8.569
1485	9.802	7.911	6.327	11.121	4.352	8.575
1485.008	9.808	7.908	6.327	11.121	4.352	8.575
1485.017	9.827	7.908	6.327	11.121	4.352	8.575
1485.025	9.839	7.911	6.327	11.121	4.352	8.575
1485.033	9.858	7.911	6.327	11.121	4.352	8.575
1485.042	9.871	7.911	6.33	11.121	4.352	8.575
1485.05	9.884	7.911	6.327	11.121	4.352	8.575
1485.058	9.903	7.911	6.327	11.121	4.352	8.575
1485.067	9.909	7.915	6.327	11.121	4.352	8.579
1485.075	9.928	7.915	6.327	11.121	4.352	8.575
1485.083	9.941	7.915	6.327	11.121	4.352	8.575
1485.092	9.947	7.915	6.327	11.121	4.352	8.575
1485.1	9.966	7.918	6.327	11.121	4.352	8.575
1485.108	9.979	7.918	6.327	11.121	4.352	8.575
1485.117	9.985	7.918	6.327	11.121	4.352	8.575
1485.125	9.998	7.918	6.33	11.121	4.352	8.575

1485.133	10.01	7.921	6.327	11.121	4.352	8.579
1485.142	10.017	7.918	6.33	11.121	4.355	8.579
1485.15	10.036	7.921	6.327	11.121	4.352	8.575
1485.158	10.042	7.924	6.327	11.121	4.355	8.575
1485.167	10.048	7.924	6.33	11.121	4.355	8.575
1485.175	10.061	7.924	6.327	11.121	4.352	8.575
1485.183	10.073	7.924	6.327	11.121	4.352	8.575
1485.192	10.08	7.927	6.327	11.121	4.352	8.575
1485.2	10.092	7.927	6.327	11.121	4.355	8.575
1485.208	10.105	7.93	6.327	11.121	4.352	8.579
1485.217	10.105	7.93	6.327	11.121	4.352	8.575
1485.225	10.118	7.934	6.327	11.121	4.352	8.579
1485.233	10.13	7.934	6.327	11.121	4.355	8.575
1485.242	10.137	7.934	6.327	11.121	4.355	8.575
1485.25	10.143	7.937	6.327	11.121	4.352	8.579
1485.258	10.162	7.937	6.327	11.121	4.352	8.575
1485.267	10.162	7.937	6.327	11.121	4.355	8.579
1485.275	10.168	7.94	6.33	11.121	4.352	8.575
1485.283	10.181	7.94	6.327	11.121	4.355	8.579
1485.292	10.181	7.943	6.327	11.121	4.352	8.579
1485.3	10.194	7.943	6.327	11.121	4.355	8.575
1485.308	10.2	7.943	6.327	11.121	4.352	8.579
1485.317	10.206	7.943	6.327	11.121	4.355	8.579
1485.325	10.219	7.946	6.327	11.121	4.352	8.575
1485.333	10.225	7.946	6.327	11.121	4.355	8.575
1485.35	10.238	7.949	6.327	11.121	4.355	8.579
1485.367	10.244	7.953	6.33	11.121	4.355	8.579
1485.383	10.263	7.953	6.327	11.121	4.355	8.579
1485.4	10.282	7.953	6.327	11.121	4.355	8.579
1485.417	10.288	7.956	6.327	11.121	4.355	8.575
1485.433	10.295	7.959	6.327	11.121	4.355	8.575
1485.45	10.314	7.962	6.327	11.121	4.355	8.575
1485.467	10.32	7.962	6.327	11.121	4.355	8.575
1485.483	10.326	7.965	6.33	11.121	4.355	8.575
1485.5	10.345	7.968	6.33	11.121	4.355	8.575
1485.517	10.352	7.968	6.327	11.121	4.355	8.575
1485.533	10.358	7.972	6.327	11.121	4.355	8.575
1485.55	10.371	7.972	6.327	11.121	4.355	8.575
1485.567	10.383	7.975	6.33	11.121	4.355	8.575
1485.583	10.39	7.975	6.327	11.121	4.355	8.575
1485.6	10.396	7.978	6.33	11.121	4.355	8.575
1485.617	10.402	7.981	6.33	11.121	4.355	8.575
1485.633	10.409	7.981	6.33	11.121	4.358	8.575
1485.65	10.421	7.984	6.33	11.121	4.355	8.575
1485.667	10.428	7.987	6.33	11.121	4.358	8.575
1485.683	10.434	7.987	6.33	11.121	4.355	8.575
1485.7	10.44	7.987	6.33	11.121	4.358	8.575
1485.717	10.447	7.991	6.33	11.121	4.358	8.579
1485.733	10.453	7.991	6.33	11.121	4.358	8.579
1485.75	10.459	7.994	6.33	11.121	4.355	8.575
1485.767	10.472	7.994	6.33	11.121	4.358	8.575

1485.783	10.465	7.997	6.333	11.121	4.358	8.575
1485.8	10.478	7.997	6.33	11.121	4.358	8.575
1485.817	10.484	8	6.33	11.121	4.358	8.575
1485.833	10.484	8	6.33	11.121	4.358	8.575
1485.85	10.497	8.003	6.33	11.121	4.358	8.575
1485.867	10.503	8.003	6.333	11.121	4.361	8.575
1485.883	10.51	8.003	6.333	11.121	4.358	8.575
1485.9	10.522	8.006	6.33	11.121	4.361	8.575
1485.917	10.541	8.006	6.333	11.121	4.361	8.575
1485.933	10.56	8.01	6.333	11.121	4.361	8.575
1485.95	10.573	8.01	6.333	11.121	4.361	8.575
1485.967	10.592	8.013	6.33	11.121	4.361	8.575
1485.983	10.611	8.016	6.33	11.121	4.361	8.575
1486	10.624	8.016	6.333	11.121	4.361	8.579
1486.2	10.794	8.041	6.337	11.121	4.361	8.579
1486.4	10.889	8.067	6.34	11.121	4.365	8.579
1486.6	10.952	8.085	6.343	11.121	4.368	8.579
1486.8	11.003	8.098	6.346	11.121	4.371	8.582
1487	11.034	8.111	6.352	11.121	4.374	8.582
1487.2	11.06	8.12	6.356	11.121	4.377	8.582
1487.4	11.085	8.13	6.359	11.121	4.38	8.585
1487.6	11.148	8.139	6.365	11.121	4.384	8.585
1487.8	11.23	8.152	6.368	11.121	4.387	8.588
1488	11.287	8.165	6.375	11.121	4.387	8.588
1488.2	11.319	8.177	6.378	11.121	4.39	8.588
1488.4	11.363	8.187	6.384	11.121	4.393	8.591
1488.6	11.388	8.196	6.387	11.121	4.396	8.591
1488.8	11.414	8.203	6.39	11.121	4.396	8.591
1489	11.426	8.212	6.397	11.121	4.4	8.591
1489.2	11.439	8.215	6.4	11.121	4.403	8.598
1489.4	11.458	8.222	6.403	11.121	4.403	8.598
1489.6	11.464	8.228	6.406	11.121	4.406	8.598
1489.8	11.471	8.231	6.413	11.121	4.409	8.601
1490	11.483	8.234	6.416	11.121	4.409	8.604
1490.2	11.49	8.241	6.419	11.121	4.412	8.604
1490.4	11.496	8.244	6.422	11.121	4.415	8.604
1490.6	11.502	8.244	6.425	11.121	4.415	8.607
1490.8	11.502	8.25	6.429	11.121	4.419	8.61
1491	11.547	8.256	6.432	11.121	4.419	8.61
1491.2	11.584	8.263	6.435	11.121	4.422	8.61
1491.4	11.616	8.272	6.438	11.121	4.422	8.613
1491.6	11.629	8.285	6.441	11.121	4.425	8.617
1491.8	11.648	8.291	6.444	11.121	4.425	8.617
1492	11.654	8.298	6.448	11.121	4.428	8.617
1492.2	11.66	8.304	6.451	11.121	4.428	8.62
1492.4	11.673	8.307	6.454	11.121	4.431	8.623
1492.6	11.673	8.31	6.457	11.121	4.431	8.623
1492.8	11.686	8.31	6.457	11.121	4.434	8.623
1493	11.686	8.313	6.46	11.121	4.434	8.623
1493.2	11.686	8.316	6.463	11.121	4.434	8.626
1493.4	11.698	8.32	6.463	11.121	4.438	8.629

1493.6	11.698	8.32	6.467	11.121	4.438	8.632
1493.8	11.698	8.323	6.47	11.121	4.441	8.632
1494	11.705	8.326	6.47	11.121	4.441	8.632
1494.2	11.705	8.326	6.473	11.121	4.441	8.632
1494.4	11.705	8.329	6.473	11.121	4.444	8.632
1494.6	11.711	8.329	6.476	11.121	4.444	8.632
1494.8	11.705	8.332	6.476	11.121	4.444	8.636
1495	11.717	8.332	6.479	11.13	4.447	8.636
1497	11.736	8.345	6.495	11.13	4.453	8.645
1499	11.749	8.351	6.508	11.13	4.453	8.655
1501	11.755	8.358	6.517	11.13	4.46	8.661
1503	11.761	8.361	6.52	11.13	4.46	8.664
1505	11.768	8.364	6.53	11.13	4.463	8.67
1507	11.774	8.37	6.536	11.13	4.466	8.677
1509	11.78	8.373	6.539	11.13	4.469	8.68
1511	11.78	8.373	6.539	11.13	4.469	8.68
1513	11.78	8.373	6.543	11.13	4.469	8.683
1515	11.78	8.377	6.546	11.13	4.469	8.686
1517	11.787	8.377	6.549	11.13	4.472	8.689
1519	11.787	8.38	6.552	11.13	4.472	8.689
1521	11.793	8.38	6.555	11.13	4.472	8.693
1523	11.793	8.38	6.555	11.13	4.476	8.693
1525	11.793	8.38	6.555	11.13	4.476	8.693
1527	11.793	8.383	6.555	11.13	4.476	8.696
1529	11.799	8.383	6.559	11.13	4.476	8.696
1531	11.799	8.383	6.559	11.13	4.476	8.696
1533	11.793	8.383	6.559	11.121	4.479	8.696
1535	11.793	8.383	6.562	11.13	4.476	8.696
1537	11.799	8.386	6.562	11.13	4.476	8.699
1539	11.799	8.386	6.562	11.13	4.476	8.699
1541	11.793	8.386	6.565	11.13	4.479	8.699
1543	11.913	8.408	6.568	11.13	4.482	8.702
1545	11.818	8.396	6.571	11.13	4.482	8.702
1547	11.806	8.389	6.571	11.13	4.482	8.702
1549	11.806	8.389	6.571	11.13	4.479	8.705
1551	11.812	8.389	6.571	11.13	4.479	8.702
1553	11.806	8.389	6.571	11.13	4.479	8.702
1555	11.812	8.389	6.571	11.121	4.482	8.705
1557	11.812	8.389	6.574	11.13	4.482	8.705
1559	11.806	8.392	6.574	11.13	4.482	8.705
1561	11.799	8.389	6.574	11.13	4.482	8.705
1563	11.806	8.392	6.574	11.13	4.482	8.705
1565	11.806	8.392	6.574	11.13	4.482	8.705
1567	11.806	8.392	6.578	11.13	4.482	8.708
1569	11.806	8.396	6.578	11.13	4.485	8.712
1571	11.812	8.396	6.581	11.13	4.485	8.712
1573	11.818	8.396	6.581	11.13	4.485	8.712
1575	11.812	8.396	6.581	11.13	4.488	8.715
1577	11.812	8.399	6.584	11.13	4.488	8.715
1579	11.812	8.421	6.587	11.13	4.488	8.718
1581	11.818	8.377	6.587	11.13	4.488	8.718

1583	11.818	8.399	6.587	11.13	4.492	8.718
1585	11.818	8.399	6.59	11.13	4.492	8.718
1605	11.818	8.402	6.59	11.13	4.492	8.721
1625	11.837	8.402	6.593	11.13	4.492	8.721
1645	11.818	8.405	6.597	11.13	4.488	8.718
1665	11.812	8.408	6.6	11.13	4.492	8.721
1685	11.812	8.411	6.606	11.13	4.495	8.724
1705	11.818	8.408	6.603	11.121	4.492	8.721
1725	11.818	8.411	6.606	11.13	4.495	8.721
1745	11.812	8.408	6.603	11.121	4.492	8.718
1765	11.825	8.411	6.606	11.121	4.495	8.724
1785	11.806	8.405	6.6	11.121	4.488	8.715
1805	11.818	8.408	6.609	11.111	4.485	8.727
1825	11.806	8.402	6.6	11.111	4.476	8.718
1825.008	8.701	7.772	6.419	11.102	4.361	8.667
1825.017	8.701	7.772	6.419	11.111	4.361	8.667
1825.025	8.701	7.772	6.419	11.111	4.361	8.667
1825.033	8.701	7.772	6.419	11.111	4.361	8.667
1825.042	8.701	7.772	6.419	11.111	4.361	8.667
1825.05	8.701	7.775	6.419	11.102	4.361	8.667
1825.058	8.701	7.772	6.419	11.111	4.361	8.667
1825.067	8.701	7.769	6.416	11.102	4.365	8.667
1825.075	8.695	7.772	6.419	11.102	4.361	8.667
1825.083	8.695	7.772	6.416	11.102	4.361	8.667
1825.092	8.701	7.772	6.416	11.111	4.358	8.667
1825.1	8.701	7.769	6.416	11.102	4.361	8.664
1825.108	8.695	7.769	6.416	11.111	4.361	8.667
1825.117	8.701	7.769	6.416	11.111	4.361	8.664
1825.125	8.695	7.772	6.416	11.102	4.361	8.667
1825.133	8.695	7.772	6.416	11.111	4.361	8.667
1825.142	8.695	7.769	6.413	11.111	4.365	8.667
1825.15	8.695	7.769	6.413	11.111	4.361	8.664
1825.158	8.695	7.769	6.416	11.102	4.361	8.664
1825.167	8.695	7.769	6.416	11.102	4.361	8.667
1825.175	8.695	7.769	6.413	11.102	4.358	8.664
1825.183	8.695	7.766	6.413	11.111	4.358	8.664
1825.192	8.695	7.769	6.416	11.111	4.361	8.664
1825.2	8.695	7.766	6.413	11.102	4.361	8.664
1825.208	8.695	7.769	6.413	11.111	4.358	8.664
1825.217	8.695	7.766	6.413	11.111	4.361	8.664
1825.225	8.695	7.766	6.413	11.111	4.358	8.664
1825.233	8.695	7.766	6.413	11.102	4.358	8.664
1825.242	8.695	7.766	6.413	11.102	4.358	8.664
1825.25	8.688	7.766	6.413	11.102	4.361	8.664
1825.258	8.688	7.766	6.409	11.111	4.358	8.664
1825.267	8.695	7.766	6.413	11.111	4.358	8.664
1825.275	8.688	7.766	6.413	11.111	4.358	8.664
1825.283	8.695	7.763	6.413	11.111	4.358	8.664
1825.292	8.688	7.763	6.409	11.111	4.358	8.664
1825.3	8.688	7.766	6.413	11.111	4.358	8.664
1825.308	8.688	7.766	6.413	11.102	4.358	8.664

1825.317	8.695	7.763	6.409	11.102	4.358	8.664
1825.325	8.688	7.763	6.409	11.111	4.358	8.664
1825.333	8.688	7.763	6.409	11.111	4.358	8.664
1825.35	8.688	7.763	6.409	11.111	4.358	8.664
1825.367	8.688	7.763	6.406	11.111	4.358	8.664
1825.383	8.688	7.76	6.406	11.102	4.358	8.661
1825.4	8.688	7.76	6.406	11.111	4.355	8.661
1825.417	8.688	7.76	6.406	11.111	4.355	8.661
1825.433	8.688	7.76	6.406	11.102	4.358	8.661
1825.45	8.688	7.76	6.406	11.111	4.355	8.661
1825.467	8.631	7.76	6.403	11.111	4.355	8.661
1825.483	8.631	7.756	6.403	11.102	4.355	8.661
1825.5	8.631	7.756	6.403	11.111	4.358	8.661
1825.517	8.631	7.756	6.403	11.111	4.355	8.661
1825.533	8.631	7.756	6.403	11.102	4.355	8.661
1825.55	8.638	7.756	6.403	11.102	4.355	8.661
1825.567	8.638	7.756	6.403	11.111	4.355	8.661
1825.583	8.631	7.756	6.4	11.111	4.355	8.658
1825.6	8.638	7.756	6.4	11.102	4.352	8.661
1825.617	8.638	7.756	6.4	11.111	4.352	8.661
1825.633	8.638	7.753	6.4	11.102	4.352	8.661
1825.65	8.638	7.753	6.4	11.111	4.352	8.658
1825.667	8.638	7.753	6.4	11.102	4.352	8.661
1825.683	8.638	7.753	6.4	11.111	4.352	8.658
1825.7	8.638	7.753	6.397	11.102	4.352	8.658
1825.717	8.638	7.753	6.397	11.111	4.352	8.658
1825.733	8.638	7.75	6.397	11.111	4.352	8.658
1825.75	8.638	7.753	6.397	11.111	4.352	8.658
1825.767	8.638	7.75	6.397	11.102	4.352	8.658
1825.783	8.638	7.75	6.397	11.111	4.352	8.658
1825.8	8.638	7.75	6.394	11.111	4.352	8.658
1825.817	8.638	7.75	6.394	11.111	4.349	8.655
1825.833	8.638	7.75	6.394	11.111	4.352	8.658
1825.85	8.638	7.75	6.394	11.102	4.349	8.655
1825.867	8.638	7.747	6.394	11.102	4.349	8.655
1825.883	8.638	7.75	6.39	11.102	4.349	8.655
1825.9	8.631	7.747	6.394	11.102	4.352	8.655
1825.917	8.638	7.747	6.39	11.102	4.349	8.655
1825.933	8.638	7.744	6.39	11.111	4.349	8.655
1825.95	8.638	7.747	6.39	11.102	4.349	8.655
1825.967	8.631	7.747	6.39	11.111	4.349	8.658
1825.983	8.631	7.744	6.39	11.111	4.349	8.655
1826	8.638	7.747	6.39	11.111	4.346	8.655
1826.2	8.631	7.737	6.384	11.102	4.346	8.651
1826.4	8.625	7.734	6.378	11.102	4.342	8.648
1826.6	8.619	7.731	6.371	11.102	4.339	8.645
1826.8	8.612	7.725	6.368	11.102	4.339	8.642
1827	8.606	7.722	6.362	11.102	4.339	8.642
1827.2	8.6	7.715	6.359	11.102	4.333	8.639
1827.4	8.556	7.712	6.356	11.102	4.333	8.636
1827.6	8.556	7.709	6.352	11.102	4.333	8.636

1827.8	8.556	7.706	6.346	11.102	4.33	8.632
1828	8.549	7.703	6.343	11.102	4.33	8.629
1828.2	8.549	7.699	6.337	11.102	4.327	8.629
1828.4	8.543	7.696	6.337	11.102	4.323	8.626
1828.6	8.543	7.693	6.333	11.102	4.323	8.623
1828.8	8.537	7.69	6.33	11.102	4.323	8.623
1829	8.53	7.69	6.327	11.102	4.32	8.62
1829.2	8.53	7.687	6.324	11.111	4.32	8.62
1829.4	8.524	7.684	6.321	11.102	4.317	8.617
1829.6	8.524	7.68	6.318	11.102	4.317	8.613
1829.8	8.518	7.677	6.314	11.102	4.317	8.613
1830	8.511	7.674	6.311	11.102	4.314	8.61
1830.2	8.511	7.674	6.308	11.102	4.314	8.61
1830.4	8.505	7.671	6.305	11.102	4.314	8.607
1830.6	8.499	7.668	6.305	11.102	4.311	8.607
1830.8	8.448	7.668	6.302	11.102	4.311	8.607
1831	8.461	7.668	6.299	11.102	4.311	8.604
1831.2	8.467	7.665	6.295	11.102	4.307	8.604
1831.4	8.467	7.665	6.295	11.102	4.307	8.601
1831.6	8.467	7.661	6.292	11.102	4.307	8.601
1831.8	8.467	7.658	6.289	11.102	4.307	8.598
1832	8.461	7.658	6.289	11.102	4.304	8.598
1832.2	8.461	7.658	6.286	11.102	4.304	8.594
1832.4	8.461	7.655	6.286	11.102	4.304	8.594
1832.6	8.454	7.655	6.283	11.102	4.304	8.591
1832.8	8.461	7.652	6.28	11.102	4.301	8.591
1833	8.454	7.652	6.28	11.102	4.301	8.591
1833.2	8.454	7.649	6.276	11.102	4.301	8.588
1833.4	8.454	7.649	6.276	11.102	4.298	8.588
1833.6	8.448	7.649	6.273	11.102	4.298	8.588
1833.8	8.448	7.649	6.273	11.102	4.298	8.585
1834	8.454	7.649	6.27	11.102	4.298	8.585
1834.2	8.448	7.646	6.27	11.102	4.298	8.585
1834.4	8.448	7.646	6.267	11.102	4.295	8.582
1834.6	8.448	7.642	6.267	11.102	4.295	8.582
1834.8	8.448	7.642	6.267	11.102	4.295	8.582
1835	8.442	7.642	6.264	11.102	4.295	8.579
1837	8.435	7.633	6.251	11.111	4.288	8.572
1839	8.391	7.623	6.238	11.111	4.282	8.56
1841	8.404	7.617	6.229	11.111	4.279	8.553
1843	8.391	7.611	6.219	11.111	4.273	8.547
1845	8.391	7.608	6.213	11.111	4.269	8.541
1847	8.385	7.601	6.207	11.111	4.266	8.531
1849	8.385	7.601	6.203	11.102	4.263	8.528
1851	8.378	7.598	6.2	11.111	4.263	8.525
1853	8.385	7.598	6.194	11.102	4.263	8.525
1855	8.378	7.595	6.191	11.102	4.26	8.518
1857	8.378	7.592	6.188	11.111	4.26	8.515
1859	8.378	7.592	6.184	11.111	4.257	8.512
1861	8.372	7.589	6.181	11.111	4.257	8.509
1863	8.372	7.585	6.178	11.111	4.254	8.509

1865	8.372	7.585	6.178	11.102	4.254	8.506
1867	8.372	7.582	6.175	11.111	4.25	8.506
1869	8.372	7.582	6.172	11.102	4.25	8.503
1871	8.366	7.579	6.169	11.111	4.247	8.499
1873	8.366	7.579	6.165	11.111	4.25	8.499
1875	8.366	7.579	6.165	11.102	4.247	8.499
1877	8.372	7.579	6.165	11.102	4.25	8.503
1879	8.372	7.579	6.162	11.111	4.247	8.496
1881	8.359	7.573	6.159	11.111	4.244	8.493
1883	8.347	7.57	6.153	11.102	4.238	8.487
1885	8.353	7.566	6.15	11.102	4.238	8.484
1887	8.347	7.563	6.146	11.102	4.234	8.481
1889	8.347	7.563	6.146	11.102	4.234	8.481
1891	8.347	7.563	6.143	11.111	4.234	8.477
1893	8.347	7.563	6.143	11.102	4.234	8.477
1895	8.347	7.56	6.14	11.111	4.234	8.477
1897	8.34	7.557	6.137	11.102	4.228	8.471
1899	8.34	7.554	6.134	11.102	4.225	8.468
1901	8.34	7.554	6.134	11.102	4.225	8.468
1903	8.34	7.557	6.134	11.102	4.228	8.468
1905	8.334	7.554	6.13	11.102	4.225	8.465
1907	8.334	7.551	6.127	11.102	4.222	8.462
1909	8.334	7.551	6.127	11.102	4.222	8.462
1911	8.334	7.551	6.127	11.102	4.222	8.462
1913	8.334	7.551	6.127	11.102	4.222	8.462
1915	8.334	7.551	6.124	11.102	4.222	8.458
1917	8.334	7.551	6.124	11.102	4.222	8.462
1919	8.334	7.551	6.124	11.102	4.225	8.462
1921	8.334	7.548	6.124	11.102	4.222	8.462
1923	8.334	7.551	6.127	11.111	4.225	8.462
1925	8.328	7.544	6.118	11.102	4.219	8.455
1945	8.328	7.548	6.121	11.111	4.222	8.462
1965	8.321	7.535	6.108	11.102	4.212	8.446
1985	8.303	7.525	6.096	11.102	4.203	8.43
2005	8.29	7.525	6.099	11.102	4.206	8.433
2025	8.296	7.529	6.099	11.102	4.206	8.439
2045	8.303	7.525	6.099	11.102	4.206	8.436
2065	8.277	7.51	6.083	11.102	4.19	8.417
2085	8.284	7.516	6.089	11.102	4.196	8.42
2105	8.271	7.503	6.073	11.102	4.184	8.408
2125	8.265	7.503	6.073	11.102	4.184	8.405
2145	8.271	7.5	6.073	11.102	4.184	8.405
2165	8.284	7.506	6.08	11.102	4.19	8.417
2185	8.277	7.5	6.08	11.111	4.184	8.411
2205	8.284	7.503	6.083	11.111	4.19	8.414
2225	8.277	7.497	6.077	11.111	4.184	8.408
2245	8.277	7.503	6.083	11.102	4.19	8.417
2265	8.277	7.5	6.08	11.111	4.187	8.414
2285	8.277	7.497	6.077	11.111	4.187	8.411
2305	8.277	7.5	6.08	11.102	4.187	8.411
2325	8.277	7.503	6.083	11.111	4.187	8.417

2345	8.265	7.5	6.077	11.121	4.19	8.414
2365	8.271	7.503	6.083	11.111	4.193	8.417
2385	8.252	7.497	6.077	11.111	4.187	8.411

SE2000
Environmental Logger
01/13 10:18

Unit# 546 Test 0

Setups:	INPUT 7	INPUT 8
Type	Level (F)	Function
Mode	TOC	
I.D.	6-5	BARO
Reference	8.380	
SG	1.000	
Linearity	0.011	0.044
Scale factor	29.860	7.961
Offset	-0.038	8.013
Delay mSEC	50.000	50.000

Step 0 01/11 18:15:01

Elapsed Time	INPUT 7	INPUT 8
0.0000	8.389	14.815
15.0000	8.389	14.820
30.0000	8.389	14.823
45.0000	8.389	14.821
60.0000	8.389	14.825
75.0000	8.380	14.824
90.0000	8.380	14.824
105.000	8.380	14.822
120.000	8.380	14.824
135.000	8.380	14.823
150.000	8.380	14.828
165.000	8.380	14.830
180.000	8.380	14.830
195.000	8.380	14.831
210.000	8.380	14.833
225.000	8.380	14.834
240.000	8.370	14.830
255.000	8.370	14.826
270.000	8.361	14.823
285.000	8.370	14.824
300.000	8.370	14.826
315.000	8.370	14.825
330.000	8.361	14.823
345.000	8.361	14.818
360.000	8.361	14.817
375.000	8.361	14.818
390.000	8.361	14.819
405.000	8.361	14.818
420.000	8.361	14.819
435.000	8.361	14.819

450.000	8.361	14.818
465.000	8.361	14.818
480.000	8.351	14.814
495.000	8.351	14.815
510.000	8.351	14.812
525.000	8.361	14.818
540.000	8.361	14.817
555.000	8.351	14.818
570.000	8.351	14.815
585.000	8.361	14.817
600.000	8.361	14.817
615.000	8.351	14.817
630.000	8.351	14.814
645.000	8.351	14.817
660.000	8.351	14.812
675.000	8.342	14.810
690.000	8.351	14.814
705.000	8.351	14.813
720.000	8.351	14.814
735.000	8.351	14.819
750.000	8.351	14.820
765.000	8.351	14.818
780.000	8.351	14.820
795.000	8.351	14.824
810.000	8.351	14.826
825.000	8.351	14.828
840.000	8.351	14.831
855.000	8.361	14.832
870.000	8.342	14.828
0.0000	8.351	14.828
0.0083	8.341	14.828
0.0166	8.351	14.828
0.0250	8.351	14.828
0.0333	8.351	14.826
0.0416	8.341	14.828
0.0500	8.341	14.828
0.0583	8.341	14.828
0.0666	8.351	14.828
0.0750	8.351	14.828
0.0833	8.341	14.828
0.0916	8.341	14.828
0.1000	8.351	14.828
0.1083	8.341	14.828
0.1166	8.351	14.828
0.1250	8.341	14.826
0.1333	8.351	14.826
0.1416	8.351	14.826
0.1500	8.351	14.828
0.1583	8.351	14.828
0.1666	8.341	14.826
0.1750	8.341	14.828
0.1833	8.341	14.828
0.1916	8.341	14.828
0.2000	8.341	14.828

0.2083	8.351	14.828
0.2166	8.351	14.828
0.2250	8.351	14.828
0.2333	8.351	14.828
0.2416	8.351	14.828
0.2500	8.351	14.826
0.2583	8.341	14.828
0.2666	8.351	14.826
0.2750	8.351	14.828
0.2833	8.351	14.828
0.2916	8.351	14.826
0.3000	8.351	14.826
0.3083	8.341	14.828
0.3166	8.351	14.826
0.3250	8.351	14.828
0.3333	8.341	14.828
0.3500	8.351	14.828
0.3666	8.351	14.826
0.3833	8.351	14.828
0.4000	8.351	14.828
0.4166	8.351	14.828
0.4333	8.351	14.828
0.4500	8.351	14.828
0.4666	8.351	14.828
0.4833	8.351	14.828
0.5000	8.351	14.828
0.5166	8.351	14.828
0.5333	8.351	14.828
0.5500	8.351	14.828
0.5666	8.351	14.828
0.5833	8.351	14.828
0.6000	8.351	14.828
0.6166	8.351	14.828
0.6333	8.341	14.828
0.6500	8.351	14.828
0.6666	8.351	14.828
0.6833	8.351	14.828
0.7000	8.341	14.828
0.7166	8.341	14.828
0.7333	8.351	14.828
0.7500	8.351	14.828
0.7666	8.351	14.828
0.7833	8.351	14.828
0.8000	8.351	14.828
0.8166	8.351	14.828
0.8333	8.351	14.828
0.8500	8.351	14.828
0.8666	8.341	14.828
0.8833	8.341	14.828
0.9000	8.351	14.828
0.9166	8.341	14.828
0.9333	8.351	14.828
0.9500	8.351	14.828
0.9666	8.351	14.828

0.9833	8.351	14.828
1.0000	8.351	14.828
1.2000	8.351	14.828
1.4000	8.351	14.828
1.6000	8.351	14.828
1.8000	8.341	14.829
2.0000	8.351	14.828
2.2000	8.351	14.828
2.4000	8.351	14.828
2.6000	8.341	14.829
2.8000	8.351	14.828
3.0000	8.351	14.828
3.2000	8.341	14.829
3.4000	8.351	14.829
3.6000	8.351	14.829
3.8000	8.341	14.829
4.0000	8.351	14.829
4.2000	8.351	14.829
4.4000	8.351	14.828
4.6000	8.351	14.829
4.8000	8.341	14.829
5.0000	8.351	14.829
5.2000	8.351	14.829
5.4000	8.341	14.829
5.6000	8.351	14.829
5.8000	8.341	14.829
6.0000	8.351	14.829
6.2000	8.351	14.829
6.4000	8.351	14.830
6.6000	8.351	14.830
6.8000	8.351	14.830
7.0000	8.351	14.830
7.2000	8.351	14.830
7.4000	8.351	14.830
7.6000	8.351	14.830
7.8000	8.351	14.831
8.0000	8.351	14.830
8.2000	8.351	14.830
8.4000	8.351	14.831
8.6000	8.351	14.831
8.8000	8.351	14.831
9.0000	8.351	14.831
9.2000	8.351	14.831
9.4000	8.351	14.831
9.6000	8.351	14.831
9.8000	8.351	14.830
10.0000	8.351	14.831
12.0000	8.360	14.832
14.0000	8.360	14.831
16.0000	8.351	14.832
18.0000	8.360	14.833
20.0000	8.360	14.832
22.0000	8.360	14.832
24.0000	8.360	14.831

26.0000	8.360	14.831
28.0000	8.360	14.831
30.0000	8.360	14.831
32.0000	8.360	14.831
34.0000	8.360	14.831
36.0000	8.360	14.831
38.0000	8.360	14.831
40.0000	8.360	14.831
42.0000	8.360	14.831
44.0000	8.351	14.831
46.0000	8.360	14.830
48.0000	8.360	14.830
50.0000	8.351	14.829
52.0000	8.351	14.829
54.0000	8.360	14.829
56.0000	8.351	14.829
58.0000	8.360	14.830
60.0000	8.360	14.831
62.0000	8.360	14.832
64.0000	8.360	14.832
66.0000	8.360	14.832
68.0000	8.360	14.833
70.0000	8.360	14.833
72.0000	8.360	14.833
74.0000	8.360	14.832
76.0000	8.360	14.832
78.0000	8.360	14.832
80.0000	8.351	14.830
82.0000	8.360	14.830
84.0000	8.360	14.831
86.0000	8.360	14.831
88.0000	8.360	14.830
90.0000	8.351	14.830
92.0000	8.351	14.830
94.0000	8.351	14.829
96.0000	8.351	14.828
98.0000	8.351	14.826
100.000	8.351	14.828
120.000	8.351	14.828
140.000	8.351	14.823
0.0000	8.341	14.819
0.0083	8.341	14.819
0.0166	8.341	14.818
0.0250	8.341	14.819
0.0333	8.341	14.818
0.0416	8.341	14.818
0.0500	8.341	14.818
0.0583	8.341	14.818
0.0666	8.341	14.818
0.0750	8.341	14.818
0.0833	8.341	14.818
0.0916	8.341	14.818
0.1000	8.341	14.818
0.1083	8.341	14.818

0.1166	8.341	14.818
0.1250	8.341	14.818
0.1333	8.341	14.818
0.1416	8.341	14.818
0.1500	8.341	14.818
0.1583	8.341	14.817
0.1666	8.341	14.818
0.1750	8.341	14.818
0.1833	8.341	14.818
0.1916	8.341	14.817
0.2000	8.341	14.818
0.2083	8.341	14.818
0.2166	8.341	14.818
0.2250	8.341	14.818
0.2333	8.341	14.818
0.2416	8.341	14.818
0.2500	8.341	14.818
0.2583	8.341	14.817
0.2666	8.341	14.818
0.2750	8.341	14.818
0.2833	8.341	14.818
0.2916	8.341	14.818
0.3000	8.341	14.818
0.3083	8.341	14.818
0.3166	8.341	14.818
0.3250	8.341	14.818
0.3333	8.341	14.817
0.3500	8.341	14.818
0.3666	8.341	14.818
0.3833	8.341	14.818
0.4000	8.351	14.818
0.4166	8.341	14.818
0.4333	8.341	14.818
0.4500	8.351	14.818
0.4666	8.351	14.818
0.4833	8.351	14.817
0.5000	8.351	14.818
0.5166	8.351	14.818
0.5333	8.351	14.818
0.5500	8.351	14.818
0.5666	8.351	14.818
0.5833	8.351	14.818
0.6000	8.351	14.818
0.6166	8.351	14.818
0.6333	8.360	14.818
0.6500	8.360	14.818
0.6666	8.360	14.817
0.6833	8.360	14.818
0.7000	8.360	14.818
0.7166	8.360	14.817
0.7333	8.360	14.818
0.7500	8.360	14.817
0.7666	8.360	14.818
0.7833	8.360	14.817

0.8000	8.360	14.817
0.8166	8.360	14.818
0.8333	8.360	14.818
0.8500	8.360	14.818
0.8666	8.360	14.818
0.8833	8.369	14.818
0.9000	8.369	14.817
0.9166	8.369	14.817
0.9333	8.369	14.817
0.9500	8.369	14.817
0.9666	8.369	14.817
0.9833	8.369	14.818
1.0000	8.369	14.817
1.2000	8.388	14.818
1.4000	8.398	14.818
1.6000	8.407	14.818
1.8000	8.407	14.818
2.0000	8.426	14.818
2.2000	8.426	14.818
2.4000	8.426	14.818
2.6000	8.435	14.819
2.8000	8.445	14.819
3.0000	8.445	14.819
3.2000	8.454	14.819
3.4000	8.454	14.819
3.6000	8.454	14.818
3.8000	8.454	14.818
4.0000	8.454	14.819
4.2000	8.454	14.819
4.4000	8.454	14.819
4.6000	8.454	14.819
4.8000	8.445	14.819
5.0000	8.445	14.819
5.2000	8.445	14.819
5.4000	8.445	14.819
5.6000	8.445	14.819
5.8000	8.445	14.819
6.0000	8.445	14.819
6.2000	8.445	14.819
6.4000	8.445	14.819
6.6000	8.445	14.819
6.8000	8.445	14.819
7.0000	8.445	14.819
7.2000	8.445	14.819
7.4000	8.445	14.820
7.6000	8.445	14.819
7.8000	8.445	14.819
8.0000	8.445	14.819
8.2000	8.445	14.820
8.4000	8.445	14.819
8.6000	8.435	14.819
8.8000	8.435	14.819
9.0000	8.435	14.819
9.2000	8.435	14.819

9.4000	8.435	14.819
9.6000	8.435	14.818
9.8000	8.435	14.818
10.0000	8.435	14.819
12.0000	8.435	14.818
14.0000	8.435	14.818
16.0000	8.435	14.818
18.0000	8.445	14.818
20.0000	8.435	14.815
22.0000	8.435	14.814
24.0000	8.445	14.814
26.0000	8.445	14.815
28.0000	8.445	14.815
30.0000	8.435	14.814
32.0000	8.445	14.813
34.0000	8.445	14.812
36.0000	8.445	14.810
38.0000	8.445	14.810
40.0000	8.445	14.809
42.0000	8.445	14.809
44.0000	8.445	14.808
46.0000	8.445	14.807
48.0000	8.445	14.807
50.0000	8.445	14.807
52.0000	8.445	14.804
54.0000	8.445	14.803
56.0000	8.445	14.802
58.0000	8.445	14.801
60.0000	8.445	14.800
62.0000	8.445	14.798
64.0000	8.445	14.797
66.0000	8.435	14.798
68.0000	8.445	14.797
70.0000	8.445	14.796
72.0000	8.445	14.796
74.0000	8.445	14.795
76.0000	8.445	14.795
78.0000	8.445	14.795
80.0000	8.445	14.795
82.0000	8.445	14.793
84.0000	8.445	14.793
86.0000	8.445	14.793
88.0000	8.445	14.793
90.0000	8.445	14.793
92.0000	8.454	14.793
94.0000	8.445	14.792
96.0000	8.445	14.792
98.0000	8.445	14.792
100.000	8.445	14.792
120.000	8.454	14.791
140.000	8.454	14.789
160.000	8.454	14.784
180.000	8.454	14.780
200.000	8.464	14.785

220.000	8.454	14.778
240.000	8.464	14.782
260.000	8.454	14.777
280.000	8.464	14.779
300.000	8.454	14.775
320.000	8.464	14.774
340.000	8.464	14.779
360.000	8.464	14.781
380.000	8.464	14.776
400.000	8.464	14.778
420.000	8.464	14.777
440.000	8.464	14.778
460.000	8.464	14.777
0.0000	8.473	14.781
0.0083	8.464	14.781
0.0166	8.464	14.781
0.0250	8.464	14.781
0.0333	8.464	14.781
0.0416	8.464	14.781
0.0500	8.464	14.781
0.0583	8.464	14.781
0.0666	8.464	14.781
0.0750	8.464	14.780
0.0833	8.464	14.781
0.0916	8.464	14.781
0.1000	8.464	14.781
0.1083	8.464	14.780
0.1166	8.464	14.780
0.1250	8.464	14.781
0.1333	8.464	14.781
0.1416	8.464	14.780
0.1500	8.464	14.781
0.1583	8.464	14.780
0.1666	8.464	14.781
0.1750	8.464	14.780
0.1833	8.464	14.781
0.1916	8.464	14.780
0.2000	8.464	14.780
0.2083	8.464	14.780
0.2166	8.464	14.781
0.2250	8.464	14.780
0.2333	8.464	14.780
0.2416	8.464	14.780
0.2500	8.464	14.780
0.2583	8.464	14.781
0.2666	8.464	14.780
0.2750	8.464	14.781
0.2833	8.464	14.780
0.2916	8.464	14.780
0.3000	8.464	14.780
0.3083	8.464	14.781
0.3166	8.464	14.780
0.3250	8.464	14.780
0.3333	8.464	14.780

0.3500	8.464	14.780
0.3666	8.464	14.781
0.3833	8.464	14.781
0.4000	8.464	14.781
0.4166	8.464	14.781
0.4333	8.464	14.781
0.4500	8.464	14.781
0.4666	8.464	14.781
0.4833	8.464	14.781
0.5000	8.464	14.780
0.5166	8.464	14.781
0.5333	8.473	14.780
0.5500	8.464	14.780
0.5666	8.464	14.781
0.5833	8.464	14.781
0.6000	8.473	14.781
0.6166	8.473	14.781
0.6333	8.464	14.780
0.6500	8.464	14.780
0.6666	8.473	14.781
0.6833	8.473	14.780
0.7000	8.473	14.780
0.7166	8.473	14.781
0.7333	8.473	14.780
0.7500	8.473	14.781
0.7666	8.473	14.781
0.7833	8.473	14.780
0.8000	8.473	14.781
0.8166	8.473	14.781
0.8333	8.473	14.781
0.8500	8.473	14.781
0.8666	8.473	14.781
0.8833	8.473	14.780
0.9000	8.473	14.781
0.9166	8.473	14.781
0.9333	8.473	14.781
0.9500	8.473	14.781
0.9666	8.473	14.780
0.9833	8.473	14.781
1.0000	8.473	14.781
1.2000	8.473	14.781
1.4000	8.482	14.782
1.6000	8.482	14.781
1.8000	8.492	14.782
2.0000	8.492	14.781
2.2000	8.492	14.782
2.4000	8.501	14.782
2.6000	8.501	14.782
2.8000	8.501	14.782
3.0000	8.501	14.782
3.2000	8.511	14.782
3.4000	8.511	14.782
3.6000	8.520	14.782
3.8000	8.520	14.784

4.0000	8.520	14.784
4.2000	8.529	14.784
4.4000	8.529	14.784
4.6000	8.529	14.784
4.8000	8.529	14.784
5.0000	8.529	14.784
5.2000	8.539	14.784
5.4000	8.539	14.784
5.6000	8.539	14.785
5.8000	8.539	14.785
6.0000	8.548	14.785
6.2000	8.548	14.785
6.4000	8.548	14.785
6.6000	8.548	14.786
6.8000	8.548	14.786
7.0000	8.558	14.786
7.2000	8.558	14.786
7.4000	8.558	14.786
7.6000	8.558	14.786
7.8000	8.558	14.786
8.0000	8.558	14.786
8.2000	8.567	14.786
8.4000	8.567	14.786
8.6000	8.567	14.786
8.8000	8.567	14.786
9.0000	8.567	14.787
9.2000	8.567	14.787
9.4000	8.567	14.786
9.6000	8.567	14.786
9.8000	8.567	14.786
10.0000	8.577	14.786
12.0000	8.586	14.786
14.0000	8.595	14.787
16.0000	8.595	14.787
18.0000	8.595	14.786
20.0000	8.605	14.787
22.0000	8.605	14.788
24.0000	8.605	14.788
26.0000	8.605	14.787
28.0000	8.605	14.786
30.0000	8.614	14.787
32.0000	8.614	14.787
34.0000	8.614	14.787
36.0000	8.614	14.787
38.0000	8.614	14.787
40.0000	8.614	14.786
42.0000	8.614	14.785
44.0000	8.614	14.785
46.0000	8.614	14.785
48.0000	8.614	14.782
50.0000	8.614	14.784
52.0000	8.614	14.784
54.0000	8.614	14.782
56.0000	8.614	14.782

58.0000	8.624	14.784
60.0000	8.624	14.784
62.0000	8.624	14.784
64.0000	8.624	14.782
66.0000	8.624	14.781
68.0000	8.614	14.781
70.0000	8.624	14.781
72.0000	8.624	14.781
74.0000	8.624	14.781
76.0000	8.624	14.780
78.0000	8.624	14.780
80.0000	8.624	14.780
82.0000	8.624	14.780
84.0000	8.624	14.781
86.0000	8.624	14.782
88.0000	8.624	14.781
90.0000	8.633	14.782
92.0000	8.633	14.784
94.0000	8.633	14.785
96.0000	8.633	14.785
98.0000	8.633	14.785
100.000	8.633	14.785
120.000	8.633	14.784
140.000	8.633	14.780
160.000	8.633	14.775
180.000	8.633	14.774
200.000	8.633	14.773
220.000	8.633	14.766
240.000	8.633	14.764
260.000	8.633	14.758
280.000	8.633	14.758
300.000	8.624	14.747
320.000	8.633	14.762
340.000	8.624	14.789
0.0000	8.492	14.801
0.0083	8.492	14.800
0.0166	8.492	14.800
0.0250	8.492	14.800
0.0333	8.501	14.800
0.0416	8.492	14.801
0.0500	8.492	14.801
0.0583	8.492	14.798
0.0666	8.492	14.802
0.0750	8.492	14.802
0.0833	8.492	14.799
0.0916	8.492	14.802
0.1000	8.492	14.800
0.1083	8.492	14.803
0.1166	8.492	14.800
0.1250	8.492	14.799
0.1333	8.492	14.800
0.1416	8.492	14.800
0.1500	8.492	14.797
0.1583	8.492	14.806

0.1666	8.492	14.800
0.1750	8.492	14.802
0.1833	8.492	14.799
0.1916	8.492	14.803
0.2000	8.492	14.799
0.2083	8.492	14.801
0.2166	8.492	14.799
0.2250	8.492	14.801
0.2333	8.492	14.799
0.2416	8.492	14.801
0.2500	8.492	14.803
0.2583	8.492	14.799
0.2666	8.492	14.798
0.2750	8.492	14.801
0.2833	8.492	14.800
0.2916	8.492	14.801
0.3000	8.492	14.802
0.3083	8.492	14.800
0.3166	8.492	14.796
0.3250	8.492	14.802
0.3333	8.492	14.801
0.3500	8.492	14.800
0.3666	8.492	14.803
0.3833	8.492	14.800
0.4000	8.492	14.801
0.4166	8.492	14.796
0.4333	8.492	14.801
0.4500	8.492	14.801
0.4666	8.482	14.806
0.4833	8.492	14.802
0.5000	8.482	14.801
0.5166	8.492	14.800
0.5333	8.492	14.801
0.5500	8.482	14.800
0.5666	8.482	14.802
0.5833	8.482	14.800
0.6000	8.482	14.800
0.6166	8.482	14.801
0.6333	8.482	14.801
0.6500	8.482	14.800
0.6666	8.482	14.799
0.6833	8.482	14.799
0.7000	8.482	14.804
0.7166	8.482	14.804
0.7333	8.482	14.800
0.7500	8.482	14.798
0.7666	8.482	14.801
0.7833	8.482	14.802
0.8000	8.482	14.800
0.8166	8.482	14.800
0.8333	8.482	14.804
0.8500	8.482	14.804
0.8666	8.482	14.797
0.8833	8.482	14.803

0.9000	8.482	14.804
0.9166	8.482	14.801
0.9333	8.482	14.800
0.9500	8.482	14.807
0.9666	8.482	14.802
0.9833	8.473	14.801
1.0000	8.482	14.807
1.2000	8.473	14.800
1.4000	8.473	14.802
1.6000	8.473	14.801
1.8000	8.464	14.802
2.0000	8.464	14.804
2.2000	8.464	14.797
2.4000	8.454	14.802
2.6000	8.454	14.806
2.8000	8.454	14.804
3.0000	8.454	14.801
3.2000	8.454	14.801
3.4000	8.445	14.799
3.6000	8.445	14.802
3.8000	8.445	14.803
4.0000	8.445	14.804
4.2000	8.445	14.803
4.4000	8.445	14.804
4.6000	8.435	14.804
4.8000	8.435	14.804
5.0000	8.435	14.804
5.2000	8.435	14.804
5.4000	8.435	14.806
5.6000	8.435	14.806
5.8000	8.435	14.806
6.0000	8.426	14.806
6.2000	8.426	14.804
6.4000	8.426	14.806
6.6000	8.426	14.806
6.8000	8.426	14.806
7.0000	8.426	14.807
7.2000	8.426	14.807
7.4000	8.416	14.806
7.6000	8.416	14.807
7.8000	8.416	14.807
8.0000	8.416	14.806
8.2000	8.416	14.807
8.4000	8.416	14.807
8.6000	8.416	14.807
8.8000	8.416	14.808
9.0000	8.416	14.807
9.2000	8.416	14.807
9.4000	8.407	14.808
9.6000	8.416	14.808
9.8000	8.416	14.808
10.0000	8.416	14.808
12.0000	8.407	14.809
14.0000	8.398	14.807

16.0000	8.398	14.808
18.0000	8.388	14.807
20.0000	8.388	14.807
22.0000	8.379	14.807
24.0000	8.379	14.807
26.0000	8.379	14.809
28.0000	8.379	14.810
30.0000	8.379	14.810
32.0000	8.369	14.809
34.0000	8.369	14.810
36.0000	8.369	14.810
38.0000	8.369	14.810
40.0000	8.360	14.811
42.0000	8.360	14.811
44.0000	8.360	14.811
46.0000	8.360	14.811
48.0000	8.360	14.812
50.0000	8.360	14.813
52.0000	8.360	14.815
54.0000	8.360	14.814
56.0000	8.351	14.811
58.0000	8.351	14.810
60.0000	8.351	14.809
62.0000	8.341	14.808
64.0000	8.341	14.809
66.0000	8.341	14.809
68.0000	8.341	14.809
70.0000	8.341	14.808
72.0000	8.341	14.806
74.0000	8.332	14.804
76.0000	8.341	14.806
78.0000	8.341	14.807
80.0000	8.341	14.804
82.0000	8.332	14.802
84.0000	8.332	14.802
86.0000	8.332	14.803
88.0000	8.332	14.803
90.0000	8.332	14.803
92.0000	8.332	14.804
94.0000	8.332	14.806
96.0000	8.332	14.806
98.0000	8.332	14.807
100.000	8.322	14.801
120.000	8.332	14.811
140.000	8.322	14.808
160.000	8.303	14.798
180.000	8.313	14.799
200.000	8.313	14.803
220.000	8.313	14.808
240.000	8.294	14.797
260.000	8.303	14.799
280.000	8.285	14.791
300.000	8.285	14.788
320.000	8.285	14.787

340.000	8.294	14.792
360.000	8.285	14.792
380.000	8.294	14.797
400.000	8.285	14.793
420.000	8.294	14.800
440.000	8.285	14.801
460.000	8.285	14.803
480.000	8.285	14.806
500.000	8.294	14.811
520.000	8.294	14.810
540.000	8.294	14.815
560.000	8.294	14.815

APPENDIX E

APPENDIX E

ANALYTICAL DATA

Data Validation Definitions

CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
PQL	Practical Quantitation Limit
J	Indicates an estimated concentration.
U	Indicates compound was analyzed but not detected.
UJ	Quantitation limit is an estimated value.
R	Indicated data are unusable because quality control criteria were not met.

Validated Tables for Soil Samples

PROJECT: NCBC GULFPORT, MISSISSIPPI

VOLATILE SOIL ANALYSES (ug/kg)

Validation Table

	SAMPLE LOCATION:	SBG6503	SBG6503 DL	SBG6503D	SBG6503D DL	SBG6508	SBG6508 DL	SBG6520
	LAB NUMBER:	65541	65555	65558	65564	65545	65559	65560
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93
	DATA ANALYZED:	12/20/93	12/21/93	12/21/93	12/21/93	12/20/93	12/21/93	12/21/93
	DILUTION FACTOR:	1.0	5.0	1.0	5.0	1.0	1.0	1.0
ANALYTE	CRQL							
Chloromethane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Bromomethane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Vinyl Chloride	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Chloroethane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Methylene Chloride	10	11 U	25 R	20 U	49 R	11 UJ	1400 R	31 U
Acetone	10	68 U	76 R	190 U	150 R	11 UJ	1400 R	66 U
Carbon Disulfide	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
1,1-Dichloroethene	10	1 J	54 R	11 U	54 R	17 J	1400 R	12 U
1,1-Dichloroethane	10	3 J	54 R	11 U	54 R	38 J	1400 R	12 U
1,2-Dichloroethene (total)	10	7 J	54 R	11 U	54 R	23 J	1400 R	12 U
Chloroform	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
1,2-Dichloroethane	10	4 J	10 R	11 U	54 R	70 J	1400 R	12 U
2-Butanone	10	10 J	54 R	11 U	54 R	11 UJ	1400 R	12 U
1,1,1-Trichloroethane	10	11 U	54 R	11 U	54 R	27 J	1400 R	12 U
Carbon Tetrachloride	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Bromodichloromethane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
1,2-Dichloropropane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
cis-1,3-Dichloropropene	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Trichloroethene	10	3 J	6 R	3 J	54 R	39 J	1400 R	12 U
Dibromochloromethane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
1,1,2-Trichloroethane	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Benzene	10	20	21 R	12 J	10 R	170 J	290 R	4 J
trans-1,3-Dichloropropene	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
Bromoform	10	11 U	54 R	11 U	54 R	11 UJ	1400 R	12 U
4-Methyl-2-Pentanone	10	11 U	54 R	11 UJ	54 R	11 UJ	1400 R	12 U
2-Hexanone	10	11 U	54 R	11 UJ	54 R	11 UJ	1400 R	12 U
Tetrachloroethene	10	63	31 R	51 J	43 R	980 J	980 J	10 J
1,1,2,2-Tetrachloroethane	10	11 U	54 R	11 UJ	54 R	11 UJ	1400 R	12 U
Toluene	10	160	160	140 J	89 R	5200 J	5200 J	73
Chlorobenzene	10	11 U	54 R	11 UJ	54 R	11 UJ	1400 R	12 U
Ethylbenzene	10	170	89 R	110 J	67 R	2700 J	2700 J	34
Styrene	10	11 U	54 R	11 UJ	54 R	11 UJ	1400 R	12 U
Xylene (total)	10	590	590	400	400	19000 J	19000 J	240

PROJECT: NCBC GULFPORT, MISSISSIPPI — VOLATILE SOIL ANALYSES (ug/kg) — Validation Table

	SAMPLE LOCATION:	SBG6708	SBG6720	SBG6745
	LAB NUMBER:	65547	65548	65549
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93
	DATE ANALYZED:	12/20/93	12/20/93	12/20/93
	DILUTION FACTOR:	1.0	1.0	1.0
ANALYTE	CRQL			
Chloromethane	10	12 U	12 U	12 U
Bromomethane	10	12 U	12 U	12 U
Vinyl Chloride	10	12 U	12 U	12 U
Chloroethane	10	12 U	12 U	12 U
Methylene Chloride	10	14 U	15 U	12 U
Acetone	10	58 U	29 U	33 U
Carbon Disulfide	10	12 U	2 J	12 U
1,1-Dichloroethene	10	12 U	12 U	12 U
1,1-Dichloroethane	10	12 U	12 U	12 U
1,2-Dichloroethene (total)	10	9 J	12 U	12 U
Chloroform	10	12 U	12 U	12 U
1,2-Dichloroethane	10	8 J	12 U	12 U
2-Butanone	10	12 U	12 U	12 U
1,1,1-Trichloroethane	10	12 U	12 U	12 U
Carbon Tetrachloride	10	12 U	12 U	12 U
Bromodichloromethane	10	12 U	12 U	12 U
1,2-Dichloropropane	10	12 U	12 U	12 U
cis-1,3-Dichloropropene	10	12 U	12 U	12 U
Trichloroethene	10	12 U	12 U	12 U
Dibromochloromethane	10	12 U	12 U	12 U
1,1,2-Trichloroethane	10	12 U	12 U	12 U
Benzene	10	2 J	12 U	12 U
trans-1,3-Dichloropropene	10	12 U	12 U	12 U
Bromoform	10	12 U	12 U	12 U
4-METHYL-2-PENTANONE	10	12 U	12 U	12 U
2-Hexanone	10	12 U	12 U	12 U
Tetrachloroethene	10	3 J	12 U	12 U
1,1,2,2-Tetrachloroethane	10	12 U	12 U	12 U
Toluene	10	11 J	2 J	1 J
Chlorobenzene	10	12 U	12 U	12 U
Ethylbenzene	10	4 J	12 U	12 U
Styrene	10	12 U	12 U	12 U
Xylene (total)	10	26	12 U	12 U

PROJECT: NCBC GULFPORT, MISSISSIPPI

SEMIVOLATILE SOIL ANALYSES (ug/kg)

Validation Table

	SAMPLE LOCATION:	SBG6503	SBG6503D	SBG6508	SBG6520	SBG6708	SBG6720	SBG6745
	LAB NUMBER:	90287	90287005	90287006	90287007	92087008	90287009	90288003
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93	12/11/93
	DATE ANALYZED:	01/03/94	01/04/94	01/04/94	01/04/94	01/04/94	01/04/94	01/12/94
	DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ANALYTE	CRQL							
Phenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
bis (2-Chloroethyl) Ether	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2- Chlorophenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
1,3- Dichlorobenzene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
1,4- Dichlorobenzene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
1,2- Dichlorobenzene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2- Methylphenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,2'-oxybis(1-Chloropropane)	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
4-Methylphenol	330	250 J	350 J	3700 U	400 U	380 U	380 U	380 U
N-Nitroso-Di-n-Propylamine	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Hexachloroethane	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Nitrobenzene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Isophorone	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2-Nitrophenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,4-Dimethylphenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
bis (2-Chloroethoxy) Methane	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,4-Dichlorophenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
1,2,4-Trichlorobenzene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Naphthalene	330	300 J	310 J	4800	330 J	390	380 U	380 U
4-Chloroaniline	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Hexachlorobutadiene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
4-Chloro-3-Methylphenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2-Methylnaphthalene	330	260 J	370 U	28,000	2300	880	380 U	55 J
Hexachlorocyclopentadiene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,4,6-Trichlorophenol	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,4,5-Trichlorophenol	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
2-Chloronaphthalene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2-Nitroaniline	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
Dimethylphthalate	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Acenaphthylene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,6-Dinitrotoluene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
3-Nitroaniline	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
Acenaphthene	330	370 U	370 U	720 J	400 U	63 J	380 U	380 U
2,4-Dinitrophenol	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
4-Nitrophenol	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
Dibenzofuran	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
2,4-Dinitrotoluene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Diethylphthalate	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
4-Chlorophenyl-phenylether	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Fluorene	330	370 U	370 U	4400	410	200 J	380 U	380 U
4-Nitroaniline	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U

PROJECT: NCBC GULFPORT, MISSISSIPPI

SEMIVOLATILE SOIL ANALYSES (ug/kg)

Validation Table

	SAMPLE LOCATION:	SBG6503	SBG6503D	SBG6508	SBG6520	SBG6708	SBG6720	SBG6745
	LAB NUMBER:	90287	90287005	90287006	90287007	92087008	90287009	90288003
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93	12/10/93	12/11/93
	DATE ANALYZED:	01/03/94	01/04/94	01/04/94	01/04/94	01/04/94	01/04/94	01/12/94
	DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0	1.0
ANALYTE	CRQL							
4,6-Dinitro-2-Methylphenol	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
N-Nitrosodiphenylamine	330	370 U	370 U	8900 U	980 U	930 U	930 U	380 U
4-Bromophenyl-phenylether	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Hexachlorobenzene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Pentachlorophenol	800	890 U	890 U	8900 U	980 U	930 U	930 U	930 U
Phenanthrene	330	370 U	370 U	2100 J	260 J	380 U	380 U	52 J
Anthracene	330	370 U	370 U	7600	830	450	380 U	380 U
Carbazole	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Di-n-Butylphthalate	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Fluoranthene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Pyrene	330	370 UJ	370 U	1400 J	400 U	380 U	380 U	380 U
Butylbenzylphthalate	330	370 UJ	370 U	3700 U	400 U	380 U	380 U	380 U
3,3'-Dichlorobenzidine	330	370 UJ	370 U	3700 U	400 U	380 U	380 U	380 U
Benzo (a) Anthracene	330	370 UJ	370 U	3700 U	400 U	380 U	380 U	380 U
Chrysene	330	370 UJ	370 U	3700 U	400 U	380 U	380 U	380 U
bis (2-Ethylhexyl) Phthalate	330	370 UJ	370 U	3700 U	400 U	59 J	380 U	380 U
Di-n-Octyl Phthalate	330	370 UJ	370 U	3700 U	400 U	380 U	380 U	380 U
Benzo (b) Fluoranthene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Benzo (k) Fluoranthene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Benzo (a) Pyrene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Indeno (1,2,3-cd) Pyrene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Dibenz (a,h) Anthracene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U
Benzo (g,h,i) Perylene	330	370 U	370 U	3700 U	400 U	380 U	380 U	380 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — HERBICIDES SOIL ANALYSES (ug/kg) — Validation Table

	SAMPLE LOCATION:	SBG6503	SBG6503D	SBG6508
	LAB NUMBER:	GN-90287004	GN-90287005	GN-90287006
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93
ANALYTE	PQL			
MCPA	50,000	280,000 U	280,000 U	55,000 U
Dalapon	1160	6,700 U	6,600 U	1,300 U
MCPP	40,000	220,000 U	220,000 U	44,000 U
Dicamba	54	300 U	300 U	60 U
2,4-D	240	1,300 U	1,300 U	270 U
Dichlorprop (2,4-DP)	130	730 U	720 U	140 U
2,4,5-TP (Silvex)	40	190 U	190 U	38 U
2,4,5-T	34	230 U	220 U	44 U
2,4-DB	182	1,000 U	1000 U	200 U
Dinoseb	14	79 U	77 U	16 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — TPH SOIL ANALYSES (mg/kg) — Validation Table

	SAMPLE LOCATION:	SBG6503	SBG6503D	SBG6508	SBG6708
	LAB NUMBER:	90287004	90287005	90287006	90287008
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93	12/10/93
ANALYTE					
TPH		88000	16000	15300	101

PROJECT: NCBC GULFPORT, MISSISSIPPI — TOTAL ORGANIC CARBON SOIL ANALYSES (mg/kg) — Validation Table

	SAMPLE LOCATION:	SBG6720	SBG6720D
	LAB NUMBER:	GN-90287009	GN-90287010
	DATE SAMPLED:	12/10/93	12/10/93
ANALYTE			
TOC		1960	2030

PROJECT: NCBC GULFPORT, MISSISSIPPI PESTICIDE/PCB SOIL ANALYSES (ug/kg) Validation Table

ANALYTE	SAMPLE LOCATION: / LAB NUMBER: / DATE SAMPLED: / CRQL	SBG6503 / 90287004 / 12/10/93	SBG6503D / 90287005 / 12/10/93	SBG6508 / 90287006 / 12/10/93
alpha-BHC	1.7	9.6 UJ	9.4 UJ	9.4 UJ
beta-BHC	1.7	9.6 UJ	9.4 UJ	9.4 UJ
delta-BHC	1.7	9.6 UJ	9.4 UJ	9.4 UJ
gamma-BHC (Lindane)	1.7	9.6 UJ	9.4 UJ	9.4 UJ
Heptachlor	1.7	9.6 UJ	9.4 UJ	9.4 UJ
Aldrin	1.7	9.6 UJ	9.4 UJ	9.4 UJ
Heptachlor epoxide	1.7	9.6 UJ	9.4 UJ	9.4 UJ
Endosulfan I	1.7	9.6 UJ	9.4 UJ	9.4 UJ
Dieldrin	3.3	19 UJ	18 UJ	18 UJ
4,4'- DDE	3.3	19 UJ	18 UJ	18 UJ
Endrin	3.3	19 UJ	18 UJ	18 UJ
Endosulfan II	3.3	19 UJ	18 UJ	18 UJ
4,4'- DDD	3.3	19 UJ	18 UJ	18 UJ
Endosulfan Sulfate	3.3	19 UJ	18 UJ	18 UJ
4,4'- DDT	3.3	19 UJ	18 UJ	18 UJ
Methoxychlor	17	96 UJ	94 UJ	94 UJ
Endrin Ketone	3.3	19 UJ	18 UJ	18 UJ
Endrin aldehyde	1.7	19 UJ	18 UJ	18 UJ
alpha-Chlordane	1.7	9.6 UJ	9.4 UJ	9.4 UJ
gamma-Chlordane	1.7	9.6 UJ	9.4 UJ	9.4 UJ
Toxaphene	170	960 UJ	940 UJ	940 UJ
Aroclor-1016	33	190 UJ	180 UJ	180 UJ
Aroclor-1221	67	380 UJ	370 UJ	370 UJ
Aroclor-1232	33	190 UJ	180 UJ	180 UJ
Aroclor-1242	33	190 UJ	180 UJ	180 UJ
Aroclor-1248	33	190 UJ	180 UJ	180 UJ
Aroclor-1254	33	190 UJ	180 UJ	180 UJ
Aroclor-1260	33	190 UJ	180 UJ	180 UJ

PROJECT: NCBC GULFPORT, MISSISSIPPI

DIOXIN SOIL ANALYSES (pg/g)

Validation Table

SAMPLE LOCATION:	SBG6503	SBG6503D	SBG6508
LAB NUMBER:	GN-90287-004	90287005	90287006
DATE SAMPLED:	12/10/93	12/10/93	12/10/93
ANALYTE			
2,3,7,8-Tetrachlorodibenzodioxin	14.2 U	16.6 U	15.7 U
2,3,7,8-Tetrachlorodibenzofuran	22.6 U	16.7 U	14.6 U
1,2,3,7,8-Pentachlorodibenzodioxin	34.0 U	42.6 U	31.5 U
1,2,3,7,8-Pentachlorodibenzofuran	30.8 U	47.5 UJ	14.1 U
2,3,4,7,8-Pentachlorodibenzofuran	31.5 U	19.8 U	16.2 U
1,2,3,4,7,8-Hexachlorodibenzodioxin	19.7 U	18.0 U	25.1 U
1,2,3,6,7,8-Hexachlorodibenzodioxin	21.8 U	21.6 U	18.9 U
1,2,3,7,8,9-Hexachlorodibenzodioxin	22.6 U	45.7 U	19.0 U
1,2,3,4,7,8-Hexachlorodibenzofuran	22.5 U	25.9 U	12.9 U
1,2,3,6,7,8-Hexachlorodibenzofuran	21.5 U	21.4 U	13.1 U
2,3,4,6,7,8-Hexachlorodibenzofuran	36.0 U	21.3 U	17.1 U
1,2,3,7,8,9-Hexachlorodibenzofuran	48.0 U	34.8 U	43.5 U
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	37.9 U	51.9 U	27.7 U
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	30.6 U	23.0 U	25.4 U
1,2,3,4,7,8,9-Heptachlorodibenzodioxin	41.1 U	33.4 U	29.4 U
Octachlorodibenzodioxin	130	110 U	152 J
Octachlorodibenzofuran	49.2 U	101 U	65.8 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — INORGANIC SOIL ANALYSES (mg/kg) — Validation/Summary Table

	SAMPLE LOCATION:	SBG6503	SBG6503D	SBG6508
	SAMPLING DEPTH:	3-5 FT	3-5 FT	8-10 FT
	LAB NUMBER:	90287004	90287005	90287006
	DATE SAMPLED:	12/10/93	12/10/93	12/10/93
ANALYTE	CRDL			
Aluminum	40	5840	8610	1460
Antimony	12	4.6 U	4.6 U	4.9 U
Arsenic	2	0.48 J	1.5 J	0.39 UJ
Barium	40	32.0 J	29.4 J	2.2 U
Beryllium	1	0.04 UJ	0.04 UJ	0.05 UJ
Cadmium	1	0.71 U	0.71 U	0.76 U
Calcium	1000	541 UJ	324 UJ	112 UJ
Chromium	2	8.4	7.2	3.9
Cobalt	10	0.91 U	1.2 J	0.98 U
Copper	5	3.4 U	3.0 U	3.6 U
Iron	20	1660	3040	127
Lead	1.0	62.1	90.2	6.7
Magnesium	1000	182 U	307 U	6.9 U
Manganese	3	10.7 U	10.8 U	1.0 U
Mercury	0.1	0.07	0.03 U	0.04 U
Nickel	8	3.8 J	5.2 J	2.2 UJ
Potassium	1000	137 U	272 J	147 U
Selenium	1	0.69 J	0.80 J	5.1
Silver	2	0.60 U	0.60 U	0.65 U
Sodium	1000	9.7 U	15.1 U	7.3 U
Thallium	2	0.20 U	0.19 U	0.21 U
Vanadium	10	4.5 J	10.5 J	3.9 J
Zinc	4	6.9 U	17.7	0.37 U
Cyanide	1	0.19 U	0.19 U	0.20 U

Validated Tables
for Groundwater Samples

PROJECT: NCBC GULFPORT, MISSISSIPPI

VOLATILE AQUEOUS ANALYSES (ug/l)

Validation Table

	SAMPLE LOCATION:	GWG62	GWG63	GWG64	GWG64 DL	GWG64D	GWG64D DL	GWG65
	LAB NUMBER:	95484	95463	95459	95481	95460	95482	95462
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93
	DATA ANALYZED:	12/20/93	12/18/93	12/18/93	12/20/93	12/18/93	12/20/93	12/18/93
	DILUTION FACTOR:	1.0	1.0	1.0	100.0	1.0	100.0	1.0
ANALYTE	CRQL							
Chloromethane	10	10 U	2 J	12 J	1000 R	10 U	1000 R	10 U
Bromomethane	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Vinyl Chloride	10	10 U	10 U	21 J	1000 R	35 J	1000 R	10 U
Chloroethane	10	10 U	10 U	230 J	1000 R	310 J	210 R	10 U
Methylene Chloride	10	10 U	10 U	51 J	470 R	95 J	540 R	10 U
Acetone	10	20 U	17 U	150 U	660 R	140 U	660 R	20 U
Carbon Disulfide	10	10 U	10 U	3 J	1000 R	4 J	1000 R	10 U
1,1-Dichloroethene	10	10 U	9 J	1800	1800	3100	3100	10 U
1,1-Dichloroethane	10	10 U	10	2700	2700	4900	4900	10 U
1,2-Dichloroethene (total)	10	10 U	11	89 J	1000 R	63 J	1000 R	10 U
Chloroform	10	10 U	10 U	14 J	1000 R	20 J	1000 R	10 U
1,2-Dichloroethane	10	10 U	9 J	890 J	890 R	1200	1200	10 U
2-Butanone	10	10 U	10 U	59 J	1000 R	80 J	1000 R	10 U
1,1,1-Trichloroethane	10	10 U	10 U	3400	3400	5900	5900	10 U
Carbon Tetrachloride	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Bromodichloromethane	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
1,2-Dichloropropane	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
cis-1,3-Dichloropropene	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Trichloroethene	10	10 U	3 J	6 J	1000 R	6 J	1000 R	10 U
Dibromochloromethane	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
1,1,2-Trichloroethane	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Benzene	10	10 U	12	71 J	1000 R	83 J	100 R	3 J
trans-1,3-Dichloropropene	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Bromoform	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
4-Methyl-2-Pentanone	10	10 U	10 U	74 J	1000 R	100 J	1000 R	10 U
2-Haxanone	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Tetrachloroethene	10	10 U	1 J	32 J	1000 R	12 J	1000 R	2 J
1,1,2,2-Tetrachloroethane	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Toluene	10	10 U	10	340 J	250 R	260 J	260 R	13
Chlorobenzene	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Ethylbenzene	10	10 U	4 J	77 J	1000 R	36 J	1000 R	4 J
Styrene	10	10 U	10 U	10 U	1000 R	10 U	1000 R	10 U
Xylene (total)	10	10 U	13	490 J	240 R	230 J	180 R	25

PROJECT: NCBC GULFPORT, MISSISSIPPI

VOLATILE AQUEOUS ANALYSES (ug/l)

Validation Table

	SAMPLE LOCATION:	GWG66	GWG66 RE	GWG67
	LAB NUMBER:	95461	65563	95464
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93
	DATE ANALYZED:	12/18/93	12/21/93	12/18/93
	DILUTION FACTOR:	1.0	1.0	1.0
ANALYTE	CRQL			
Chloromethane	10	10 U	10 R	7 J
Bromomethane	10	10 U	10 R	10 U
Vinyl Chloride	10	10 U	10 R	10 U
Chloroethane	10	10 U	10 R	10 U
Methylene Chloride	10	10 U	4 R	10 U
Acetone	10	78 U	100 R	13 U
Carbon Disulfide	10	10 U	10 R	10 U
1,1-Dichloroethene	10	10 U	10 R	10 U
1,1-Dichloroethane	10	3 J	3 R	10 U
1,2-Dichloroethene (total)	10	170	240 R	10 U
Chloroform	10	10 U	10 R	10 U
1,2-Dichloroethane	10	23	30 R	10 U
2-Butanone	10	19	20 R	10 U
1,1,1-Trichloroethane	10	10 U	10 R	10 U
Carbon Tetrachloride	10	10 U	10 R	10 U
Bromodichloromethane	10	10 U	10 R	10 U
1,2-Dichloropropane	10	10 U	10 R	10 U
cis-1,3-Dichloropropene	10	10 U	10 R	10 U
Trichloroethene	10	90	86 R	10 U
Dibromochloromethane	10	10 U	10 R	10 U
1,1,2-Trichloroethane	10	10 U	10 R	10 U
Benzene	10	21	23 R	10 U
trans-1,3-Dichloropropene	10	10 U	10 R	10 U
Bromoform	10	10 U	10 R	10 U
2-Hexanone	10	10 U	10 R	10 U
4-Methyl-2-Pentanone	10	10 U	10 R	10 U
Tetrachloroethene	10	2 J	5 R	10 U
1,1,2,2-Tetrachloroethane	10	10 U	10 R	10 U
Toluene	10	43	37 R	20
Chlorobenzene	10	10 U	10 R	10 U
Ethylbenzene	10	28	18 R	12
Styrene	10	10 U	10 R	10 U
Xylene (total)	10	190	130 R	73

PROJECT: NCBC GULFPORT, MISSISSIPPI

SEMIVOLATILE AQUEOUS ANALYSES (ug/l)

Validation Table

	SAMPLE LOCATION:	GWG62	GWG63	GWG64	GWG64D	GWG65	GWG66	GWG67
	LAB NUMBER:	90290009	90290007	90290003	90290004	90290006	90290005	90290008
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93
	DATE ANALYZED:	01/10/94	01/10/94	01/08/94	01/09/94	01/10/94	01/10/94	01/10/94
	DILUTION FACTOR:	1.0	1.0	20.0	20.0	1.0	10.0	1.0
ANALYTE	CRQL							
Phenol	10	10 U	10 U	48 J	47 J	10 U	100 U	10 U
bis (2-Chloroethyl) Ether	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2- Chlorophenol	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
1,3- Dichlorobenzene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
1,4- Dichlorobenzene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
1,2- Dichlorobenzene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2- Methylphenol	10	10 U	2 J	380 J	370	10 U	19 J	10 U
2,2'-oxybis(1-Chloropropane)	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
4-Methylphenol	10	10 U	10 U	970 J	1100	3 J	36 J	10 U
N-Nitroso-Di-n-Propylamine	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Hexachloroethane	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Nitrobenzene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Isophorone	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2-Nitrophenol	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2,4-Dimethylphenol	10	10 U	10 U	51 J	56 J	10 U	100 U	10 U
bis (2-Chloroethoxy) Methane	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2,4-Dichlorophenol	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
1,2,4-Trichlorobenzene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Naphthalene	10	10 U	16	230 J	210	16	250	16
4-Chloroaniline	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Hexachlorobutadiene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
4-Chloro-3-Methylphenol	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2-Methylnaphthalene	10	10 U	13	770 J	700	48	250	31
Hexachlorocyclopentadiene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2,4,6-Trichlorophenol	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2,4,5-Trichlorophenol	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
2-Chloronaphthalene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2-Nitroaniline	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
Dimethylphthalate	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Acenaphthylene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2,6-Dinitrotoluene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
3-Nitroaniline	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
Acenaphthene	10	10 U	10 U	48 J	39 J	3 J	11 J	1 J
2,4-Dinitrophenol	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
4-Nitrophenol	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
Dibenzofuran	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
2,4-Dinitrotoluene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Diethylphthalate	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
4-Chlorophenyl-phenylether	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Fluorene	10	10 U	10 U	200 R	200 U	8 J	23 J	2 J
4-Nitroaniline	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
4,6-Dinitro-2-Methylphenol	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
N-Nitrosodiphenylamine	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — SEMIVOLATILE AQUEOUS ANALYSES (ug/l) — Validation Table

	SAMPLE LOCATION:	GWG62	GWG63	GWG64	GWG64D	GWG65	GWG66	GWG67
	LAB NUMBER:	90290009	90290007	90290003	90290004	90290006	90290005	90290008
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93
	DATE ANALYZED:	01/10/94	01/10/94	01/08/94	01/09/94	01/10/94	01/10/94	01/10/94
	DILUTION FACTOR:	1.0	1.0	20.0	20.0	1.0	10.0	1.0
ANALYTE	CRQL							
4-Bromophenyl-phenylether	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Hexachlorobenzene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Pentachlorophenol	25	25 U	25 U	500 R	500 U	25 U	250 U	25 U
Phenanthrene	10	10 U	10 U	350 J	270	15	59 J	5 J
Anthracene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Carbazole	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Di-n-Butylphthalate	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Fluoranthene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Pyrene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Butylbenzylphthalate	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
3,3'-Dichlorobenzidine	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Benzo (a) Anthracene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Chrysene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
bis (2-Ethylhexyl) Phthalate	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Di-n-Octyl Phthalate	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Benzo (b) Fluoranthene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Benzo (k) Fluoranthene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Benzo (a) Pyrene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Indeno (1,2,3-cd) Pyrene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Dibenz (a,h) Anthracene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U
Benzo (g,h,i) Perylene	10	10 U	10 U	200 R	200 U	10 U	100 U	10 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — PESTICIDE/PCB AQUEOUS ANALYSES (ug/l) — Validation Table

ANALYTE	CRQL	GWG64	GWG64D	GWG66
SAMPLE LOCATION:		GWG64	GWG64D	GWG66
LAB NUMBER:		90290003	90290004	90290005
DATE SAMPLED:		12/13/93	12/13/93	12/13/93
alpha-BHC	0.05	0.25 R	0.25 R	0.25 R
beta-BHC	0.05	0.25 R	0.25 R	0.25 R
delta-BHC	0.05	0.25 R	0.25 R	0.25 R
gamma-BHC (Lindane)	0.05	0.25 R	0.25 R	0.25 R
Heptachlor	0.05	0.25 R	0.25 R	0.25 R
Aldrin	0.05	0.25 R	0.25 R	0.25 R
Heptachlor epoxide	0.05	0.25 R	0.25 R	0.25 R
Endosulfan I	0.05	0.25 R	0.25 R	0.25 R
Dieldrin	0.10	0.50 R	0.50 R	0.50 R
4,4'- DDE	0.10	0.50 R	0.50 R	0.50 R
Endrin	0.10	0.50 R	0.50 R	0.50 R
Endosulfan II	0.10	0.50 R	0.50 R	0.50 R
4,4'- DDD	0.10	0.50 R	0.50 R	0.50 R
Endosulfan Sulfate	0.10	0.50 R	0.50 R	0.50 R
4,4'- DDT	0.10	0.50 R	0.50 R	0.50 R
Methoxychlor	0.50	2.5 R	2.5 R	2.5 R
Endrin Ketone	0.10	0.50 R	0.50 R	0.50 R
Endrin aldehyde	0.10	0.50 R	0.50 R	0.50 R
alpha-Chlordane	0.05	0.25 R	0.14 J	0.25 R
gamma-Chlordane	0.05	0.25 R	0.25 R	0.25 R
Toxaphene	5.0	25 R	25 R	25 R
Aroclor-1016	1.0	5.0 R	5.0 R	5.0 R
Aroclor-1221	2.0	10 R	10 R	10 R
Aroclor-1232	1.0	5.0 R	5.0 R	5.0 R
Aroclor-1242	1.0	5.0 R	5.0 R	5.0 R
Aroclor-1248	1.0	5.0 R	5.0 R	5.0 R
Aroclor-1254	1.0	5.0 R	5.0 R	5.0 R
Aroclor-1260	1.0	5.0 R	5.0 R	5.0 R

PROJECT: NCBC GULFPORT, MISSISSIPPI — HERBICIDE AQUEOUS ANALYSES (ug/l) — Validation Table

	SAMPLE LOCATION:	GWG64	GWG64D	GWG66
	LAB NUMBER:	90290003	90290004	90290005
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93
ANALYTE	PQL			
MCPA	2500	2500 U	2500 U	2500 R
Dalapon	58	58 U	58 U	58 R
MCPP	2000	2000 U	2000 U	2000 R
Dicamba	2.7	2.7 U	2.7 U	2.7 R
2,4-D	12	12 U	12 U	12 R
Dichlorprop (2,4-DP)	6.5	6.5 U	6.5 U	6.5 R
2,4,5-TP (Silvex)	1.7	1.7 UJ	1.7 UJ	1.7 R
2,4,5-T	2.0	2.0 U	2.0 U	2.0 R
2,4-DB	9.1	9.1 U	9.1 U	9.1 R
Dinoseb	0.7	0.70 U	0.70 U	0.70 R

PROJECT: NCBC GULFPORT, MISSISSIPPI — TPH AQUEOUS ANALYSES (mg/l) — Validation Table

	SAMPLE LOCATION:	GWG62	GWG63	GWG64	GWG64D	GWG66
	LAB NUMBER:	90290009	90290007	90290003	90290004	90290005
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93	12/13/93	12/13/93
ANALYTE						
TPH		0.88	0.10	295	250	72.5

PROJECT: NCBC GULFPORT, MISSISSIPPI — TOTAL ORGANIC CARBON AQUEOUS ANALYSES (mg/l) — Validation Table

	SAMPLE LOCATION:	GWG64	GWG64D	GWG66
	LAB NUMBER:	GN-90290003	GN-90290004	GN-90290005
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93
ANALYTE				
TOC		270	302	264

PROJECT: NCBC GULFPORT, MISSISSIPPI

DIOXIN AQUEOUS ANALYSES (pg/l)

Validation Table

SAMPLE LOCATION:	GWG64	GWG64D	GWG66
LAB NUMBER:	GN-90290-003	GN-90290-004	GN-90290-005
DATE SAMPLED:	12/13/93	12/13/93	12/13/93
ANALYTE			
2,3,7,8-Tetrachlorodibenzodioxin	300 U	376 U	227 U
2,3,7,8-Tetrachlorodibenzofuran	562 U	313 U	184 U
1,2,3,7,8-Pentachlorodibenzodioxin	527 U	962 U	368 U
1,2,3,7,8-Pentachlorodibenzofuran	513 U	286 U	239 U
2,3,4,7,8-Pentachlorodibenzofuran	349 U	586 U	297 U
1,2,3,4,7,8-Hexachlorodibenzodioxin	372 U	769 U	297 U
1,2,3,6,7,8-Hexachlorodibenzodioxin	286 U	426 U	251 U
1,2,3,7,8,9-Hexachlorodibenzodioxin	708 U	443 U	518 U
1,2,3,4,7,8-Hexachlorodibenzofuran	413 U	559 U	235 U
1,2,3,6,7,8-Hexachlorodibenzofuran	389 U	574 U	206 U
2,3,4,6,7,8-Hexachlorodibenzofuran	480 U	686 U	275 U
1,2,3,7,8,9-Hexachlorodibenzofuran	1070 U	702 U	357 U
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	717 U	1280 U	939 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran	88.3 U	705 U	580 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran	127 U	771 U	516 U
Octachlorodibenzodioxin	8630	6450	15,000
Octachlorodibenzofuran	586 U	1460 U	201 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — INORGANIC AQUEOUS ANALYSES (ug/l) — Validation Table

	SAMPLE LOCATION:	GWG64	GWG64D	GWG66
	LAB NUMBER:	90290003	90290004	90290005
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93
ANALYTE	CRDL			
Aluminum	200	194000	127000	80200
Antimony	60	20.7 U	20.7 U	20.7 U
Arsenic	10	20.2 J	16.1 J	23.9 J
Barium	200	771	639	187 J
Beryllium	5	0.73 J	0.29 J	1.7 J
Cadmium	5	5.4	3.4 J	3.2 U
Calcium	5000	145000	143000	54400
Chromium	10	238	159	92.6
Cobalt	50	18.5 J	14.2 J	18.0 J
Copper	25	79.8	53.4	25.2
Iron	100	34100	31500	28200
Lead	3	533	178	48.6
Magnesium	5000	11200	10800	3370 J
Manganese	15	903	877	219
Mercury	0.2	1.4	0.68	0.26
Nickel	40	46.5	44.3	34.2 J
Potassium	5000	5900	6130	1620 J
Selenium	5	36.0 J	3.5 J	4.9 J
Silver	10	2.7 U	2.7 U	2.7 U
Sodium	5000	8480 U	8610 U	6260 U
Thallium	10	0.88 UJ	0.88 UJ	0.88 UJ
Vanadium	50	53.8	41.9 J	108
Zinc	20	247	159	73.8
Cyanide	10	3.8 J	2.7 J	1.7 U

Validated Tables for Quality Assurance and Quality Control Samples

PROJECT: NCBC GULFPORT, MISSISSIPPI — VOLATILE AQUEOUS ANALYSES (ug/l) — Validation Table

	SAMPLE LOCATION:	DBG601	ERG601	ERG602	ERG603	PBG604
	LAB NUMBER:	65561	95479	95480	95458	95452
	DATE SAMPLED:	12/10/93	12/10/93	12/11/93	12/13/93	12/10/93
	DATA ANALYZED:	12/21/93	12/20/93	12/20/93	12/18/93	12/18/93
	DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0
ANALYTE	CRQL					
Chloromethane	10	10 U	10 U	10 U	10 U	10 U
Bromomethane	10	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	10	10 U	10 U	10 U	10 U	10 U
Chloroethane	10	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	10	10 U	10 U	10 U	10 U	10 U
Acetone	10	42 J	10 U	15 U	10 U	10 U
Carbon Disulfide	10	10 U	3 J	10 U	10 U	10 U
1,1-Dichloroethene	10	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	10	10 U	10 U	10 U	10 U	10 U
Chloroform	10	10 U	1 J	10 U	10 U	10 U
1,2-Dichloroethane	10	10 U	10 U	10 U	10 U	10 U
2-Butanone	10	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	10	10 U	10 U	10 U	10 U	10 U
Carbon Tetrachloride	10	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10	10 U	10 U	10 U	10 U	1 J
1,2-Dichloropropane	10	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10	10 U	10 U	10 U	10 U	10 U
Trichloroethene	10	10 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10	10 U	10 U	10 U	10 U	1 J
1,1,2-Trichloroethane	10	10 U	10 U	10 U	10 U	10 U
Benzene	10	10 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10	10 U	10 U	10 U	10 U	10 U
Bromoform	10	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10	10 U	10 U	10 U	10 U	10 U
Toluene	10	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	10	10 U	3 J	10 U	10 U	10 U
Ethylbenzene	10	10 U	10 U	10 U	10 U	10 U
Styrene	10	10 U	10 U	10 U	10 U	10 U
Xylene (total)	10	3 J	10 U	10 U	10 U	10 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — VOLATILE AQUEOUS ANALYSES (ug/l) — Validation Table

	SAMPLE LOCATION:	TRPBLK	TBG602	TBG603
	LAB NUMBER:	95454	95455	95457
	DATE SAMPLED:	12/10/93	12/11/93	12/13/93
	DATE ANALYZED:	12/18/93	12/18/93	12/18/93
	DILUTION FACTOR:	1.0	1.0	1.0
ANALYTE	CRQL			
Chloromethane	10	10 U	10 U	10 U
Bromomethane	10	10 U	10 U	10 U
Vinyl Chloride	10	10 U	10 U	10 U
Chloroethane	10	10 U	10 U	10 U
Methylene Chloride	10	10 U	10 U	10 U
Acetone	10	10 U	10 U	10 U
Carbon Disulfide	10	10 U	10 U	10 U
1,1-Dichloroethene	10	10 U	10 U	10 U
1,1-Dichloroethane	10	10 U	10 U	10 U
1,2-Dichloroethene (total)	10	10 U	10 U	10 U
Chloroform	10	10 U	10 U	10 U
1,2-Dichloroethane	10	10 U	10 U	10 U
2-Butanone	10	10 U	10 U	10 U
1,1,1-Trichloroethane	10	10 U	10 U	10 U
Carbon Tetrachloride	10	10 U	10 U	10 U
Bromodichloromethane	10	10 U	10 U	10 U
1,2-Dichloropropane	10	10 U	10 U	10 U
cis-1,3-Dichloropropene	10	10 U	10 U	10 U
Trichloroethene	10	10 U	10 U	10 U
Dibromochloromethane	10	10 U	10 U	10 U
1,1,2-Trichloroethane	10	10 U	10 U	10 U
Benzene	10	10 U	10 U	10 U
trans-1,3-Dichloropropene	10	10 U	10 U	10 U
Bromoform	10	10 U	10 U	10 U
2-Hexanone	10	10 U	10 U	10 U
4-Methyl-2-Pentanone	10	10 U	10 U	10 U
Tetrachloroethene	10	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10	10 U	10 U	10 U
Toluene	10	10 U	10 U	10 U
Chlorobenzene	10	10 U	10 U	10 U
Ethylbenzene	10	10 U	10 U	10 U
Styrene	10	10 U	10 U	10 U
Xylene (total)	10	10 U	10 U	10 U

PROJECT: NCBC GULFPORT, MISSISSIPPI

SEMIVOLATILE AQUEOUS ANALYSES (ug/l)

							Validation Table
	SAMPLE LOCATION:	DBG601	ERG601	ERG602	ERG603	PBG601	PBG601RE
	LAB NUMBER:	90287001	90287003	90288002-EBK	90290002-EBK	90287002	90287002RE
	DATE SAMPLED:	12/10/93	12/10/93	12/11/93	12/13/93	12/10/93	12/10/93
	DATE ANALYZED:	01/03/94	01/03/94	01/03/94	01/08/94	01/03/94	01/03/94
	DILUTION FACTOR:	1.0	1.0	1.0	1.0	1.0	1.0
ANALYTE	CRQL						
Phenol	10	10 U	10 U	10 U	10 U	10 R	10 R
bis (2-Chloroethyl) Ether	10	10 U	10 U	10 U	10 U	10 R	10 R
2- Chlorophenol	10	10 U	10 U	10 U	10 U	10 R	10 R
1,3- Dichlorobenzene	10	10 U	10 U	10 U	10 U	10 U	10 R
1,4- Dichlorobenzene	10	10 U	10 U	10 U	10 U	10 U	10 R
1,2- Dichlorobenzene	10	10 U	10 U	10 U	10 U	10 U	10 R
2- Methylphenol	10	10 U	10 U	10 U	10 U	10 R	10 R
2,2'-oxybis(1-Chloropropane)	10	10 U	10 U	10 U	10 U	10 U	10 R
4-Methylphenol	10	10 U	10 U	10 U	10 U	10 R	10 R
N-Nitroso-Di-n-Propylamine	10	10 U	10 U	10 U	10 U	10 R	10 R
Hexachloroethane	10	10 U	10 U	10 U	10 U	10 U	10 R
Nitrobenzene	10	10 U	10 U	10 U	10 U	10 U	10 R
Isophorone	10	10 U	10 U	10 U	10 U	10 U	10 R
2-Nitrophenol	10	10 U	10 U	10 U	10 U	10 R	10 R
2,4-Dimethylphenol	10	10 U	10 U	10 U	10 U	10 R	10 R
bis (2-Chloroethoxy) Methane	10	10 U	10 U	10 U	10 U	10 R	10 R
2,4-Dichlorophenol	10	10 U	10 U	10 U	10 U	10 R	10 R
1,2,4-Trichlorobenzene	10	10 U	10 U	10 U	10 U	10 U	10 R
Naphthalene	10	10 U	10 U	10 U	10 U	10 U	10 R
4-Chloroaniline	10	10 U	10 U	10 U	10 U	10 U	10 R
Hexachlorobutadiene	10	10 U	10 U	10 U	10 U	10 U	10 R
4-Chloro-3-Methylphenol	10	10 U	10 U	10 U	10 U	10 R	10 R
2-Methylnaphthalene	10	10 U	10 U	10 U	10 U	10 U	10 R
Hexachlorocyclopentadiene	10	10 U	10 U	10 U	10 U	10 U	10 R
2,4,6-Trichlorophenol	10	10 U	10 U	10 U	10 U	10 R	10 R
2,4,5-Trichlorophenol	25	25 U	25 U	25 U	25 U	25 R	25 R
2-Chloronaphthalene	10	10 U	10 U	10 U	10 U	10 U	10 R
2-Nitroaniline	25	25 U	25 U	25 U	25 U	25 U	25 R
Dimethylphthalate	10	10 U	10 U	10 U	10 U	10 U	10 R
Acenaphthylene	10	10 U	10 U	10 U	10 U	10 U	10 R
2,6-Dinitrotoluene	10	10 U	10 U	10 U	10 U	10 U	10 R
3-Nitroaniline	25	25 U	25 U	25 U	25 U	25 U	25 R
Acenaphthene	10	10 U	10 U	10 U	10 U	10 U	10 R
2,4-Dinitrophenol	25	25 U	25 U	25 U	25 U	25 R	25 R
4-Nitrophenol	25	25 U	25 U	25 U	25 U	25 R	25 R
Dibenzofuran	10	10 U	10 U	10 U	10 U	10 U	10 R
2,4-Dinitrotoluene	10	10 U	10 U	10 U	10 U	10 U	10 R
Diethylphthalate	10	10 U	10 U	10 U	10 U	10 U	10 R
4-Chlorophenyl-phenylether	10	10 U	10 U	10 U	10 U	10 R	10 R
Fluorene	10	10 U	10 U	10 U	10 U	10 U	10 R
4-Nitroaniline	25	25 U	25 U	25 U	25 U	25 U	25 R
4,6-Dinitro-2-Methylphenol	25	25 U	25 U	25 U	25 U	25 R	25 R
N-Nitrosodiphenylamine	10	10 U	10 U	10 U	10 U	10 R	10 R

PROJECT: NCBC GULFPORT, MISSISSIPPI

SEMIVOLATILE AQUEOUS ANALYSES (ug/l)

Validation Table

	SAMPLE LOCATION:	DBG601	ERG601	ERG602	GWG64D	PBG601	PBG601RE
	LAB NUMBER:	90287001	90287003	90288002-EBK	90290004	90287002	90287002RE
	DATE SAMPLED:	12/13/93	12/13/93	12/13/93	12/13/93	12/10/93	12/10/93
	DATE ANALYZED:	01/03/94	01/03/94	01/03/94	01/09/94	01/03/94	01/03/94
	DILUTION FACTOR:	1.0	1.0	1.0	20.0	1.0	1.0
ANALYTE	CRQL						
4-Bromophenyl-phenylether	10	10 U	10 U	10 U	10 U	10 R	10 R
Hexachlorobenzene	10	10 U	10 U	10 U	10 U	10 U	10 R
Pentachlorophenol	25	25 U	25 U	25 U	25 U	25 R	25 R
Phenanthrene	10	10 U	10 U	10 U	10 U	10 U	10 R
Anthracene	10	10 U	10 U	10 U	10 U	10 U	10 R
Carbazole	10	10 U	10 U	10 U	10 U	10 U	10 R
Di-n-Butylphthalate	10	10 U	10 U	10 U	10 U	10 U	10 R
Fluoranthene	10	10 U	10 U	10 U	10 U	10 U	10 R
Pyrene	10	10 U	10 U	10 U	10 U	10 U	10 R
Butylbenzylphthalate	10	10 U	10 U	10 U	10 U	10 U	10 R
3,3'-Dichlorobenzidine	10	10 U	10 U	10 U	10 U	10 U	10 R
Benzo (a) Anthracene	10	10 U	10 U	10 U	10 U	10 U	10 R
Chrysene	10	10 U	10 U	10 U	10 U	10 U	10 R
bis (2-Ethylhexyl) Phthalate	10	10 U	10 U	10 U	10 U	10 U	10 R
Di-n-Octyl Phthalate	10	10 U	10 U	10 U	10 U	10 U	10 R
Benzo (b) Fluoranthene	10	10 U	10 U	10 U	10 U	10 U	10 R
Benzo (k) Fluoranthene	10	10 U	10 U	10 U	10 U	10 U	10 R
Benzo (a) Pyrene	10	10 U	10 U	10 U	10 U	10 U	10 R
Indeno (1,2,3-cd) Pyrene	10	10 U	10 U	10 U	10 U	10 U	10 R
Dibenz (a,h) Anthracene	10	10 U	10 U	10 U	10 U	10 U	10 R
Benzo (g,h,i) Perylene	10	10 U	10 U	10 U	10 U	10 U	10 R

PROJECT: NCBC GULFPORT, MISSISSIPPI — PESTICIDE/PCB AQUEOUS ANALYSES (ug/l) — Validation Table

	SAMPLE LOCATION:	DBG601	ERG601	ERG603	PBG601
	LAB NUMBER:	90287001	90287003-EBK	90287002-EBK	90287002
	DATE SAMPLED:	12/10/93	12/10/93	12/13/93	12/10/93
ANALYTE	CRQL				
alpha-BHC	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
beta-BHC	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
delta-BHC	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
gamma-BHC (Lindane)	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
Heptachlor	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
Aldrin	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
Heptachlor epoxide	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
Endosulfan I	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
Dieldrin	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
4,4'- DDE	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
Endrin	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
Endosulfan II	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
4,4'- DDD	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
Endosulfan Sulfate	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
4,4'- DDT	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
Methoxychlor	0.50	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ
Endrin Ketone	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
Endrin aldehyde	0.10	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ
alpha-Chlordane	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
gamma-Chlordane	0.05	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ
Toxaphene	5.0	5.0 U	5.0 UJ	5.0 UJ	5.0 UJ
Aroclor-1016	1.0	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ
Aroclor-1221	2.0	2.0 U	2.0 UJ	2.0 UJ	2.0 UJ
Aroclor-1232	1.0	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ
Aroclor-1242	1.0	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ
Aroclor-1248	1.0	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ
Aroclor-1254	1.0	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ
Aroclor-1260	1.0	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ

PROJECT: NCBC GULFPORT, MISSISSIPPI — HERBICIDE AQUEOUS ANALYSES (ug/l) — Validation Table

ANALYTE	PQL	DBG601	ERG601	ERG603	PBG601
SAMPLE LOCATION:		DBG601	ERG601	ERG603	PBG601
LAB NUMBER:		GN-90287001	GN-90287003	GN-900290002-EBK	GN-90287002
DATE SAMPLED:		12/10/93	12/10/93	12/13/93	12/10/93
MCPA	2500	2500 U	2500 U	2500 U	2500 U
Dalapon	58	58 U	58 U	58 U	58 U
MCPP	2000	2000 U	2000 U	2000 U	2000 U
Dicamba	2.7	2.7 U	2.7 U	2.7 U	2.7 U
2,4-D	12	12 U	12 U	12 U	12 U
Dichlorprop (2,4-DP)	6.5	6.5 U	6.5 U	6.5 U	6.5 U
2,4,5-TP (Silvex)	1.7	1.7 U	1.7 U	1.7 U	1.7 U
2,4,5-T	2.0	2.0 U	2.0 U	2.0 U	2.0 U
2,4-DB	9.1	9.1 U	9.1 U	9.1 U	9.1 U
Dinoseb	0.7	0.70 U	0.70 U	0.70 U	0.70 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — TPH AQUEOUS ANALYSES (mg/l) — Validation Table

ANALYTE	DBG601	ERG601	ERG603	PBG601
SAMPLE LOCATION:	DBG601	ERG601	ERG603	PBG601
LAB NUMBER:	90287001	90287002	90290002	90287003
DATE SAMPLED:	12/10/93	12/10/93	12/13/93	12/10/93
TPH	<0.06	<0.06	<0.06	<0.06

PROJECT: NCBC GULFPORT, MISSISSIPPI — TOTAL ORGANIC CARBON AQUEOUS ANALYSES (mg/l) — Validation Table

ANALYTE	DBG601	ERG601	ERG603	PBG601
SAMPLE LOCATION:	DBG601	ERG601	ERG603	PBG601
LAB NUMBER:	GN-90287001	GN-90287002	GN-90290001	GN-90287003
DATE SAMPLED:	12/10/93	12/10/93	12/10/93	12/10/93
TOC	<1.0	<1.0	<1.0	1.1

PROJECT: NCBC GULFPORT, MISSISSIPPI

DIOXIN AQUEOUS ANALYSES (pg/l)

Validation Table

SAMPLE LOCATION:	ERG601	ERG603	PBG601	DBG601
LAB NUMBER:	GN-90287-003	GN-90290-002	GN-90287-002	GN-90287-001
DATE SAMPLED:	12/10/93	12/13/93	12/10/93	12/10/93
ANALYTE				
2,3,7,8-Tetrachlorodibenzodioxin	5.60 U	CN	4.71 U	CN
2,3,7,8-Tetrachlorodibenzofuran	6.68 U	6.05 U	3.76 U	5.33 U
1,2,3,7,8-Pentachlorodibenzodioxin	2.13 U	2.57 U	2.20 U	2.33 U
1,2,3,7,8-Pentachlorodibenzofuran	7.57 UJ	3.64 U	3.86 U	2.01 U
2,3,4,7,8-Pentachlorodibenzofuran	1.61 U	1.53 U	1.22 U	1.04 U
1,2,3,4,7,8-Hexachlorodibenzodioxin	4.14 U	2.92 U	3.95 U	2.54 U
1,2,3,6,7,8-Hexachlorodibenzodioxin	5.93 U	1.93 U	2.57 U	1.90 U
1,2,3,7,8,9-Hexachlorodibenzodioxin	6.42 U	2.09 U	2.79 U	2.06 U
1,2,3,4,7,8-Hexachlorodibenzofuran	4.36 U	1.61 U	2.03 U	1.07 U
1,2,3,6,7,8-Hexachlorodibenzofuran	3.48 U	1.95 U	2.35 U	1.12 U
2,3,4,6,7,8-Hexachlorodibenzofuran	6.81 U	1.94 U	2.84 U	1.28 U
1,2,3,7,8,9-Hexachlorodibenzofuran	5.17 U	2.54 U	2.95 U	1.79 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.39 U	2.24 U	1.85 U	1.95 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.86 U	2.50 U	1.84 U	1.63 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran	2.58 U	2.93 U	2.20 U	2.20 U
Octachlorodibenzodioxin	4.37 U	7.34	6.09 U	5.44
Octachlorodibenzofuran	3.17 U	2.78 U	2.46 U	2.08 U

PROJECT: NCBC GULFPORT, MISSISSIPPI — INORGANIC AQUEOUS ANALYSES (ug/l) — Validation Table

ANALYTE	CRDL	DBG601	ERG601	ERG603	PBG601
SAMPLE LOCATION:		DBG601	ERG601	ERG603	PBG601
LAB NUMBER:		90287001	90287003	90290002	90287002
DATE SAMPLED:		12/10/93	12/10/93	12/13/93	12/10/93
Aluminum	200	19.9 U	19.9 U	19.9 U	19.9 U
Antimony	60	20.7 U	20.7 U	20.7 U	20.7 U
Arsenic	10	1.6 U	1.6 U	1.6 UJ	1.6 U
Barium	200	0.80 U	0.80 U	5.1 U	8.1 U
Beryllium	5	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ
Cadmium	5	3.2 U	3.2 U	3.2 U	3.2 U
Calcium	5000	36.5 J	78.2 U	29.3 U	2110 J
Chromium	10	3.3 U	3.3 U	3.3 U	3.3 U
Cobalt	50	4.1 U	4.1 U	4.1 U	4.1 U
Copper	25	2.1 U	2.1 U	2.1 U	2.1 U
Iron	100	20.7 B	177 U	56.9 U	62.5 U
Lead	3	1.0 U	1.0 U	1.0 U	4.6
Magnesium	5000	29.0 U	29.0 U	29.0 U	63.0 U
Manganese	15	8.2 U	25.4 U	16.9 U	37.2
Mercury	0.2	0.15 U	0.15 U	0.15 U	0.15 U
Nickel	40	9.0 U	9.0 U	9.0 U	9.0 U
Potassium	5000	614 U	614 U	614 U	614 U
Selenium	5	2.0 UJ	2.0 U	2.0 R	2.0 U
Silver	10	2.7 U	2.7 U	2.7 U	2.7 U
Sodium	5000	23.4 U	47.4 U	55.7 U	55200
Thallium	10	0.88 U	0.88 U	0.88 UJ	0.88 U
Vanadium	50	2.5 U	2.5 U	2.5 U	2.5 U
Zinc	20	1.4 U	10.5 U	2.4 U	7.7 U
Cyanide	10	1.7 U	1.7 U	1.7 U	1.7 U

Non-Validated Analytical Results

Report of Analytical Results
INORGANICS

Date Collected: 12/13/93
Date Received: 02/23/94
Sample Matrix: Water
Sample Description:

Client Sample ID: GWG64
Lab ReferenceNum: RD-94076
Lab Sample ID: RD-94076-004

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
CATIONS					
Aluminum	83100	ug/L	22.0	03/03/94	EPA200.7/SW6010
Antimony	< 14.0	ug/L	14.0	03/03/94	EPA200.7/SW6010
Arsenic	16.8	ug/L	0.70	03/07/94	EPA206.2/SW7060
Barium	584	ug/L	1.0	03/03/94	EPA200.7/SW6010
Beryllium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Cadmium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Calcium	149000	ug/L	100	03/03/94	EPA200.7/SW6010
Chromium	88.2	ug/L	3.0	03/03/94	EPA200.7/SW6010
Cobalt	13.6	ug/L	6.0	03/03/94	EPA200.7/SW6010
Copper	30.1	ug/L	3.0	03/03/94	EPA200.7/SW6010
Iron	27600	ug/L	10.0	03/03/94	EPA200.7/SW6010
Lead	378	ug/L	8.0	03/02/94	EPA239.2/SW7421
Magnesium	11300	ug/L	100	03/03/94	EPA200.7/SW6010
Manganese	890	ug/L	1.0	03/03/94	EPA200.7/SW6010
Mercury	< 0.20	ug/L	0.20	03/08/94	EPA245.1/SW7470
Nickel	19.4	ug/L	13.0	03/03/94	EPA200.7/SW6010
Potassium	4830	ug/L	350	03/03/94	EPA200.7/SW6010
Selenium	7.7	ug/L	0.50	03/04/94	EPA270.2/SW7740
Silver	< 2.0	ug/L	2.0	03/03/94	EPA200.7/SW6010
Sodium	8740	ug/L	100	03/03/94	EPA200.7/SW6010
Thallium	< 0.60	ug/L	0.60	03/02/94	EPA279.2/SW7841
Vanadium	28.8	ug/L	2.0	03/03/94	EPA200.7/SW6010
Zinc	142	ug/L	4.0	03/03/94	EPA200.7/SW6010

(375)

Approved By Fred Brickell 3/9/94

Quality Analytical Laboratories, Inc. (QAL)

RDJ 3/9/94

FPPA[RPT]#034
06.94.mlv

Report of Analytical Results
INORGANICS

Date Collected: 12/13/93
Date Received: 02/23/94
Sample Matrix: Water
Sample Description:

Client Sample ID: GWG62-S
Lab ReferenceNum: RD-94076
Lab Sample ID: RD-94076-003

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
CATIONS					
Soluble Aluminum	203	ug/L	22.0	03/03/94	EPA200.7/SW6010
Soluble Antimony	< 14.0	ug/L	14.0	03/03/94	EPA200.7/SW6010
Soluble Arsenic	1.0	ug/L	0.70	03/07/94	EPA206.2/SW7060
Soluble Barium	92.4	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Beryllium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Cadmium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Calcium	4790	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Chromium	< 3.0	ug/L	3.0	03/03/94	EPA200.7/SW6010
Soluble Cobalt	< 6.0	ug/L	6.0	03/03/94	EPA200.7/SW6010
Soluble Copper	< 3.0	ug/L	3.0	03/03/94	EPA200.7/SW6010
Soluble Iron	29.8	ug/L	10.0	03/03/94	EPA200.7/SW6010
Soluble Lead	0.8	ug/L	0.80	03/02/94	EPA239.2/SW7421
Soluble Magnesium	1000	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Manganese	4.7	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Mercury	< 0.20	ug/L	0.20	03/08/94	EPA245.1/SW7470
Soluble Nickel	< 13.0	ug/L	13.0	03/03/94	EPA200.7/SW6010
Soluble Potassium	< 350	ug/L	350	03/03/94	EPA200.7/SW6010
Soluble Selenium	21.7	ug/L	0.50	03/04/94	EPA270.2/SW7740
Soluble Silver	< 2.0	ug/L	2.0	03/03/94	EPA200.7/SW6010
Soluble Sodium	2660	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Thallium	< 0.60	ug/L	0.60	03/02/94	EPA279.2/SW7841
Soluble Vanadium	< 2.0	ug/L	2.0	03/03/94	EPA200.7/SW6010
Soluble Zinc	62.3	ug/L	4.0	03/03/94	EPA200.7/SW6010

(375)

Fred Brickel 3/9/94
Approved By

Quality Analytical Laboratories, Inc. (QAL)

RDT 3/9/94

FPPA[RPT]#034
06.94.mlv

Report of Analytical Results
INORGANICS

Date Collected: 12/13/93
Date Received: 02/23/94
Sample Matrix: Water
Sample Description:

Client Sample ID: GWG63-S
Lab ReferenceNum: RD-94076
Lab Sample ID: RD-94076-002

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
CATIONS					
Soluble Aluminum	125	ug/L	22.0	03/03/94	EPA200.7/SW6010
Soluble Antimony	< 14.0	ug/L	14.0	03/03/94	EPA200.7/SW6010
Soluble Arsenic	< 0.70	ug/L	0.70	03/07/94	EPA206.2/SW7060
Soluble Barium	93.3	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Beryllium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Cadmium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Calcium	5530	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Chromium	< 3.0	ug/L	3.0	03/03/94	EPA200.7/SW6010
Soluble Cobalt	< 6.0	ug/L	6.0	03/03/94	EPA200.7/SW6010
Soluble Copper	< 3.0	ug/L	3.0	03/03/94	EPA200.7/SW6010
Soluble Iron	38.3	ug/L	10.0	03/03/94	EPA200.7/SW6010
Soluble Lead	< 0.80	ug/L	0.80	03/02/94	EPA239.2/SW7421
Soluble Magnesium	1050	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Manganese	9.9	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Mercury	< 0.20	ug/L	0.20	03/08/94	EPA245.1/SW7470
Soluble Nickel	< 13.0	ug/L	13.0	03/03/94	EPA200.7/SW6010
Soluble Potassium	615	ug/L	350	03/03/94	EPA200.7/SW6010
Soluble Selenium	< 0.50	ug/L	0.50	03/04/94	EPA270.2/SW7740
Soluble Silver	< 2.0	ug/L	2.0	03/03/94	EPA200.7/SW6010
Soluble Sodium	3330	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Thallium	< 0.60	ug/L	0.60	03/02/94	EPA279.2/SW7841
Soluble Vanadium	< 2.0	ug/L	2.0	03/03/94	EPA200.7/SW6010
Soluble Zinc	42.0	ug/L	4.0	03/03/94	EPA200.7/SW6010

(375)

Fred Bickel 3/9/94
Approved By

Quality Analytical Laboratories, Inc. (QAL)

RJJ 3/9/94

FPPA[RPT]#034
06.94.mlv

Report of Analytical Results
INORGANICS

Date Collected: 12/13/93
Date Received: 02/23/94
Sample Matrix: Water
Sample Description:

Client Sample ID: GWG64-S
Lab ReferenceNum: RD-94076
Lab Sample ID: RD-94076-001

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
CATIONS					
Soluble Aluminum	111	ug/L	22.0	03/03/94	EPA200.7/SW6010
Soluble Antimony	< 14.0	ug/L	14.0	03/03/94	EPA200.7/SW6010
Soluble Arsenic	6.0	ug/L	0.70	03/07/94	EPA206.2/SW7060
Soluble Barium	259	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Beryllium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Cadmium	< 1.0	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Calcium	127000	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Chromium	< 3.0	ug/L	3.0	03/03/94	EPA200.7/SW6010
Soluble Cobalt	7.6	ug/L	6.0	03/03/94	EPA200.7/SW6010
Soluble Copper	< 3.0	ug/L	3.0	03/03/94	EPA200.7/SW6010
Soluble Iron	11200	ug/L	10.0	03/03/94	EPA200.7/SW6010
Soluble Lead	1.5	ug/L	0.80	03/02/94	EPA239.2/SW7421
Soluble Magnesium	10300	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Manganese	718	ug/L	1.0	03/03/94	EPA200.7/SW6010
Soluble Mercury	< 0.20	ug/L	0.20	03/08/94	EPA245.1/SW7470
Soluble Nickel	< 13.0	ug/L	13.0	03/03/94	EPA200.7/SW6010
Soluble Potassium	4690	ug/L	350	03/03/94	EPA200.7/SW6010
Soluble Selenium	1.1	ug/L	0.50	03/04/94	EPA270.2/SW7740
Soluble Silver	< 2.0	ug/L	2.0	03/03/94	EPA200.7/SW6010
Soluble Sodium	8490	ug/L	100	03/03/94	EPA200.7/SW6010
Soluble Thallium	< 0.60	ug/L	0.60	03/02/94	EPA279.2/SW7841
Soluble Vanadium	2.7	ug/L	2.0	03/03/94	EPA200.7/SW6010
Soluble Zinc	20.3	ug/L	4.0	03/03/94	EPA200.7/SW6010

(375)

Fred Bickel 3/9/94
Approved By

Quality Analytical Laboratories, Inc. (QAL)

ROJ 3/9/94

FPPA[RPT]#034
06.94.mlv

Report of Analytical Results
INORGANICS

Date Collected: 01/12/94
Date Received: 01/14/94
Sample Matrix: Water
Sample Description:

Client Sample ID: ETPRW
Lab ReferenceNum: GN-90332
Lab Sample ID: GN-90332-001

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
GENERAL					
Alkalinity as CaCO3	16	mg/L	1.0	01/25/94	EPA310.1
Color	0.0	APHA	0.0	01/17/94	EPA110.2
Hardness as CaCO3	44	mg/L	1.0	01/31/94	EPA130.2
Total Dissolved Solids	78	mg/L	1.0	01/18/94	EPA160.1
Total Suspended Solids	< 1.0	mg/L	1.0	01/17/94	EPA160.2
ANIONS					
Chloride	9.4	mg/L	1.0	01/27/94	EPA325.3
Sulfate	14	mg/L	1.0	01/28/94	EPA375.4
DEMAND AND GENERAL ORGANIC					
BOD, 5 Day	6.7	mg/L	2.0	01/14/94	EPA405.1
Chemical Oxygen Demand	32	mg/L	5.0	01/24/94	EPA410.4

(515)

Approved By

Quality Analytical Laboratories, Inc. (QAL)

000002

FPPA[RPT]#034
06.94.mlv

Report of Analytical Results
INORGANICS

Date Collected: 01/12/94
Date Received: 01/14/94
Sample Matrix: Water
Sample Description:

Client Sample ID: ETPRWD
Lab ReferenceNum: GN-90332
Lab Sample ID: GN-90332-002

CATEGORY NAME Analytical Parameter	Result	Units	Reporting Level	Date of Analysis	Analytical Method(s)
GENERAL					
Alkalinity as CaCO3	17	mg/L	1.0	01/25/94	EPA310.1
Color	0.0	APHA	0.0	01/17/94	EPA110.2
Hardness as CaCO3	37	mg/L	1.0	01/31/94	EPA130.2
Total Dissolved Solids	72	mg/L	1.0	01/18/94	EPA160.1
Total Suspended Solids	< 1.0	mg/L	1.0	01/17/94	EPA160.2
ANIONS					
Chloride	9.9	mg/L	1.0	01/27/94	EPA325.3
Sulfate	14	mg/L	1.0	01/28/94	EPA375.4
DEMAND AND GENERAL ORGANIC					
BOD, 5 Day	13	mg/L	2.0	01/14/94	EPA405.1
Chemical Oxygen Demand	36	mg/L	5.0	01/24/94	EPA410.4

(515)

Approved By

Quality Analytical Laboratories, Inc. (QAL)

000003

FPPA[RPT]#034
06.94.mlv

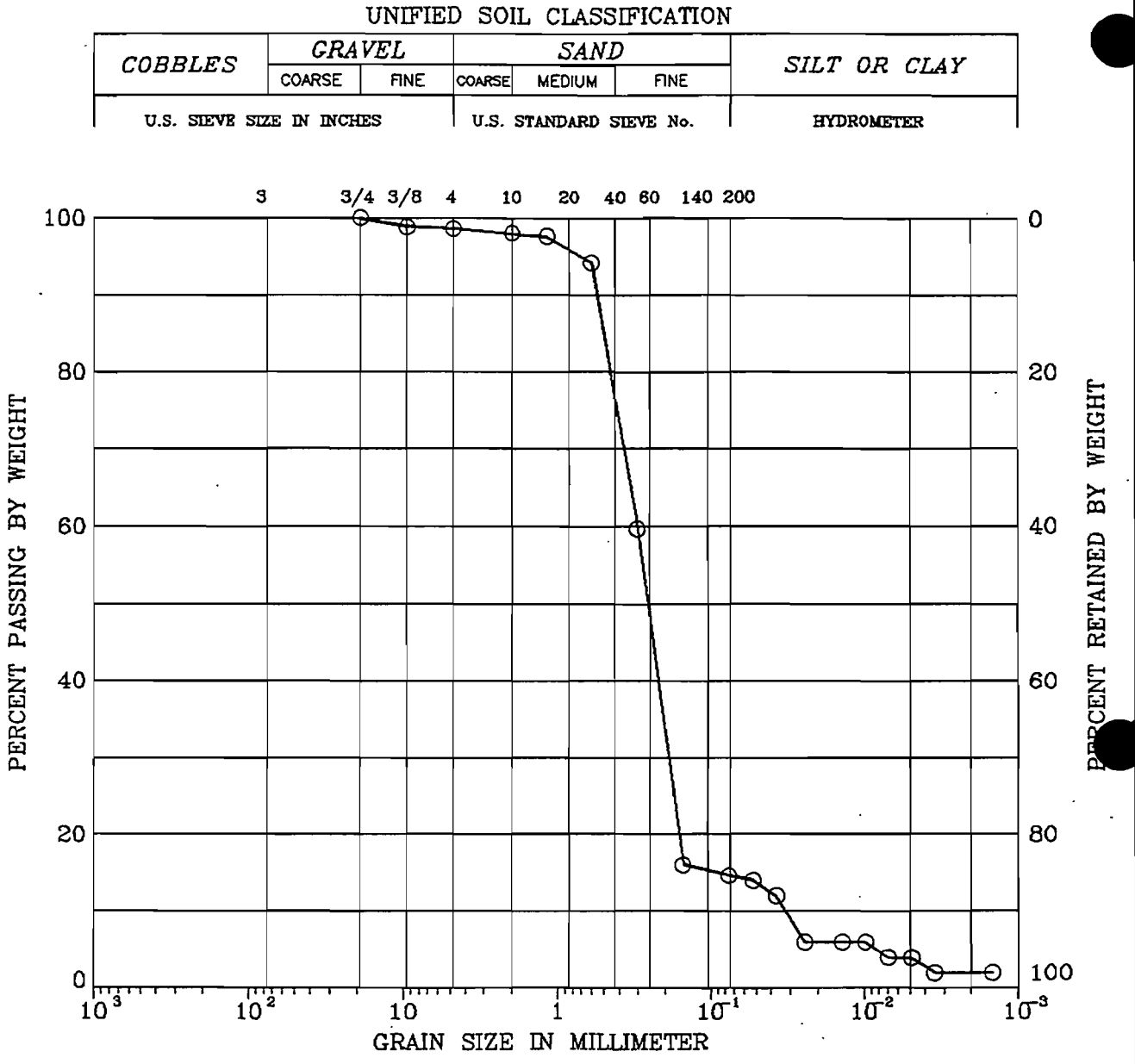
SUMMARY OF CATION EXCHANGE CAPACITY
METHOD EPA 9080

Project : NCBC Gulfport

Project # : 3-4569-0000

Date : January 3, 1994

SAMPLE ID	TOTAL CATION EXCHANGE CAPACITY meg/100g	TOTAL ORGANIC CARBON
M-18 D-8	5.7	2.23%
M-18 D-15	4.1	2.43%

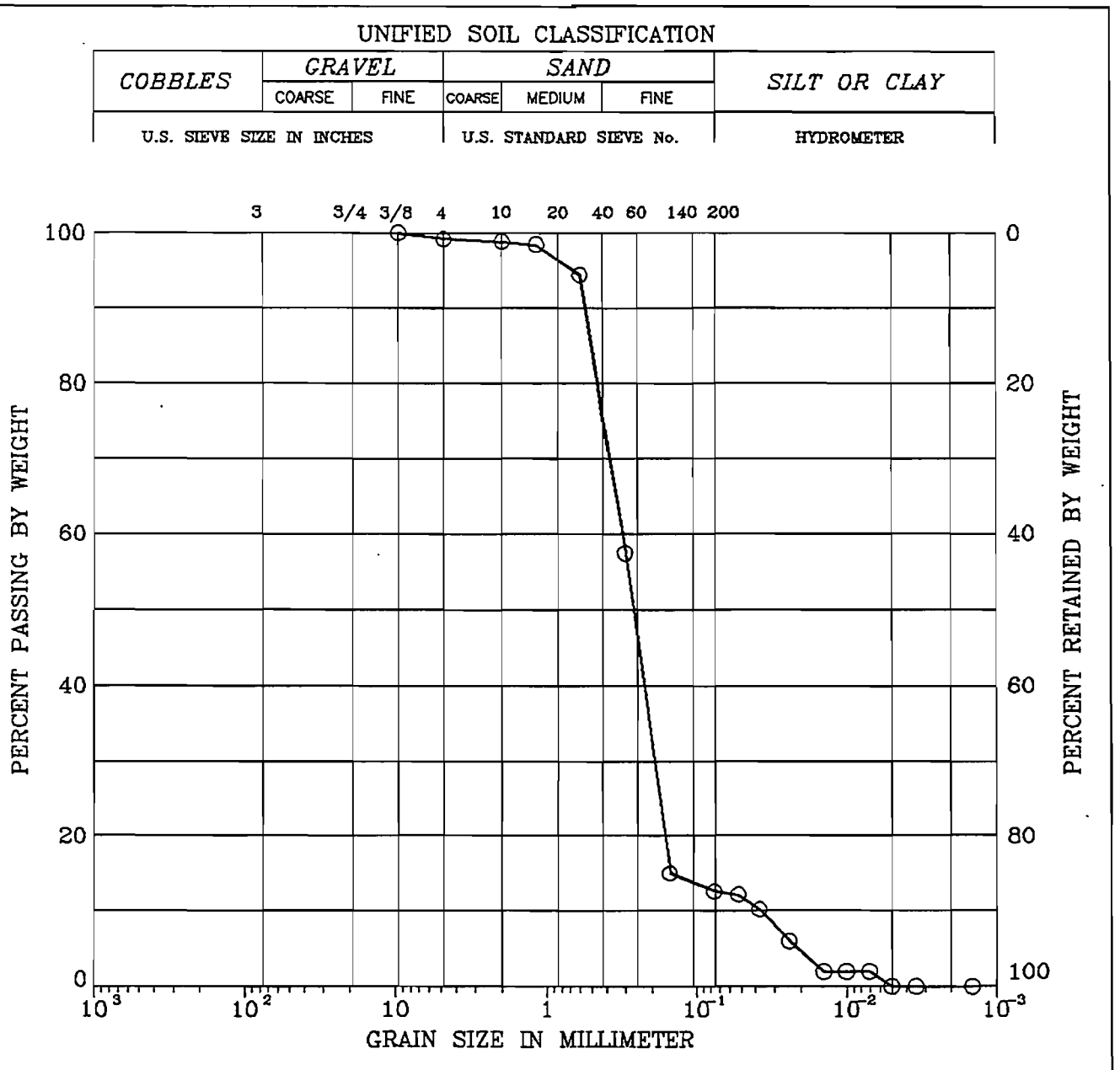


SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION	
O	M-18	15.0			SAND, silty, dark brown	USC=SM

Remark : ABB Environmental Services

Project No.3-4569	NCBC Gulfport
G.A. TECHNICAL SERVICES	GRAIN SIZE DISTRIBUTION Nov. 30, 1993

FPPA[RPT]#034
06.94.mlv



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION	
O	M-18	8.0			SAND, silty, dark brown	USC=SM

Remark : ABB Environmental Services

Project No.3-4569	NCBC Gulfport
G.A. TECHNICAL SERVICES	GRAIN SIZE DISTRIBUTION Nov. 30, 1993

GRAIN SIZE ANALYSIS
METHOD ASTM D422

PROJECT : NCBC Gulfport **PROJECT NO** : 3-4569-0000

DESCRIPTION : SAND, silty, dark brown **SAMPLE** : M-18 D15.0

Particle Size	% Passing
3/4 in (19.0 mm)	100
3/8 in (9.5 mm)	98.9
#4 (4.76 mm)	98.6
#10 (2.00 mm)	97.9
#16 (1.18 mm)	97.6
#30 (0.60 mm)	94.2
#50 (0.30 mm)	59.5
#100 (0.150 mm)	16.1
#200 (0.075 mm)	14.7
0.0527 mm	14.0
0.0375 mm	12.0
0.0241 mm	6.0
0.0139 mm	6.0
0.0098 mm	6.0
0.0070 mm	4.0
0.0049 mm	4.0
0.0034 mm	2.0
0.0014 mm	2.0

GRAIN SIZE ANALYSIS
METHOD ASTM D422

PROJECT : NCBC Gulfport **PROJECT NO** : 3-4569-0000

DESCRIPTION : SAND, silty, dark brown **SAMPLE** : M-18 D8.0

Sieve Size	% Passing
3/8 in (9.5 mm)	100.0
#4 (4.76 mm)	99.3
#10 (2.00 mm)	98.7
#16 (1.18 mm)	98.3
#30 (0.60 mm)	94.4
#50 (0.30 mm)	57.5
#100 (0.150 mm)	15.0
#200 (0.075 mm)	12.6
0.0530 mm	12.1
0.0377 mm	10.1
0.0241 mm	6.1
0.0141 mm	2.0
0.0099 mm	2.0
0.0070 mm	2.0
0.0050 mm	0.0
0.0035 mm	0.0
0.0014 mm	0.0

PCDD/PCDF DATA
(Analytical Results of Field Samples)

93-12-006-01 (GPT-HP-18/GN-90241)
{no chromatograms}

CANVIRO ANALYTICAL LABORATORIES LTD. - CONCENTRATION REPORT:

SAMPLE DESCRIPTION: GPT-HP-18
METHOD: 8290

SAMPLE DATE: Nov. 18-93
EXTRACTION DATE: NA

SAMPLE WEIGHT (grams) = 0.0216
ANALYSIS DATE: Dec. 9-93
ANALYSIS TIME: 18:21

GC COLUMN & MS: DB-5, 60 m, 0.25 mm ID, 0.25 um df - Kratos Concept HRMS

CANVIRO I.D. NO.: FILE: K548_0023 APPROVED BY: TC

CONGENERS	CONC. ug/g	DL ug/g	ION RATIO	RATIO LIMITS	RETENTION TIME SHIFT (SEC.)
2,3,7,8-TCDD	ND	28.0		(0.65-0.89)	
2,3,7,8-TCDF	ND	42.3		(0.65-0.89)	
1,2,3,7,8-PeCDD	ND	64.3		(1.32-1.78)	
1,2,3,7,8-PeCDF	ND	43.4		(1.32-1.78)	
2,3,4,7,8-PeCDF	ND	40.9		(1.32-1.78)	
1,2,3,4,7,8-HxCDD	ND	53.0		(1.05-1.43)	
1,2,3,7,8,9-HxCDD	ND	41.7		(1.05-1.43)	
1,2,3,6,7,8-HxCDD	ND	47.4		(1.05-1.43)	
1,2,3,4,7,8-HxCDF	ND	37.1		(1.05-1.43)	
1,2,3,6,7,8-HxCDF	ND	35.9		(1.05-1.43)	
2,3,4,6,7,8-HxCDF	ND	45.7		(1.05-1.43)	
1,2,3,7,8,9-HxCDF	ND	61.7		(1.05-1.43)	
1,2,3,4,6,7,8-HpCDD	ND	95.8		(0.88-1.20)	
1,2,3,4,6,7,8-HpCDF	ND	66.9		(0.88-1.20)	
1,2,3,4,7,8,9-HpCDF	ND	96.8		(0.88-1.20)	
OCDD	235	48.6	0.86	(0.76-1.02)	1
OCDF	ND	111		(0.76-1.02)	
TE	0.235				

INTERNAL STANDARDS	% RECOVERY	ION RATIO	RATIO LIMITS
13C-2,3,7,8-TCDD	98.3	0.88	(0.65-0.89)
13C-2,3,7,8-TCDF	72.9	0.82	(0.65-0.89)
13C-1,2,3,7,8-PeCDD	82.3	1.47	(1.32-1.78)
13C-1,2,3,7,8-PeCDF	83.0	1.51	(1.32-1.78)
13C-2,3,4,7,8-PeCDF	86.1	1.68	(1.32-1.78)
13C-1,2,3,4,7,8-HxCDD	105	1.34	(1.05-1.43)
13C-1,2,3,6,7,8-HxCDD	122	1.29	(1.05-1.43)
13C-1,2,3,4,7,8-HxCDF	104	0.59	(0.43-0.59)
13C-1,2,3,6,7,8-HxCDF	97.0	0.51	(0.43-0.59)
13C-2,3,4,6,7,8-HxCDF	104	0.45	(0.43-0.59)
13C-1,2,3,7,8,9-HxCDF	96.3	0.46	(0.43-0.59)
13C-1,2,3,4,6,7,8-HpCDD	119	1.09	(0.88-1.20)
13C-1,2,3,4,6,7,8-HpCDF	105	0.40	(0.37-0.51)
13C-1,2,3,4,7,8,9-HpCDF	108	0.50	(0.37-0.51)
13C-OCDD	153 **	0.91	(0.76-1.02)

CLEAN-UP STANDARD	% RECOVERY
37Cl4-2,3,7,8-TCDD	Not Added

CANVIRO ANALYTICAL LABORATORIES LTD. - CONCENTRATION REPORT:

SAMPLE DESCRIPTION: GPT-HP-18
METHOD: 8290

SAMPLE DATE: Nov. 18-93
EXTRACTION DATE: NA

SAMPLE WEIGHT (grams) = 0.0216
ANALYSIS DATE: Dec. 9-93
ANALYSIS TIME: 18:21

GC COLUMN & MS: DB-5, 60 m, 0.25 mm ID, 0.25 um df - Kratos Concept HRMS

CANVIRO I.D. NO.:

FILE: K548_0023

APPROVED BY: TC

TOTAL HOMOLOGUES	ug/g	DL	# PEAKS
TOTAL TCDD	ND	28.0	
TOTAL PeCDD	ND	64.3	
TOTAL HxCDD	ND	53.0	
TOTAL HpCDD	ND	95.8	
TOTAL OCDD	235	48.6	1
TOTAL PCDDs	235		
TOTAL TCDF	ND	42.3	
TOTAL PeCDF	ND	43.4	
TOTAL HxCDF	ND	37.1	
TOTAL HpCDF	ND	66.9	
TOTAL OCDF	ND	111	
TOTAL PCDFs	ND		

GENERAL NOTES:

ng/g = ppb
CN = Refer to Case Narrative
ND = Not Detected
MPC = Not all idenification criteria satisfied, Incorrect ion ratio.
The Maximum Possible Concentration is reported
TEF = International 2,3,7,8-TCDD Toxic Equivalents
Results are corrected for Internal Standard Recovery
* = Result is outside of Ratio Limit
DL = Sample specific detection limit.
NA = Not Applicable

PCDD/PCDF DATA
(Analytical Results of Field Samples)

93-09-010-01 (GPT 6-1) {No Chromatograms}

CANVIRO ANALYTICAL LABORATORIES LTD. - CONCENTRATION REPORT:

SAMPLE DESCRIPTION: GPT 6-1
METHOD: 8290

SAMPLE DATE: Aug. 24-93
EXTRACTION DATE: NA

SAMPLE WEIGHT (grams) = 0.0265
ANALYSIS DATE: Oct. 1-93
ANALYSIS TIME: 19:01

GC COLUMN & MS: DB-5, 60 m, 0.25 mm ID, 0.25 um df - Kratos Concept HRMS

CANVIRO I.D. NO.: 93009010-01 FILE: K515_0036 APPROVED BY: TC

CONGENERS	CONC. ng/g	DL ng/g	ION RATIO	RATIO LIMITS	RETENTION TIME SHIFT (SEC.)
2,3,7,8-TCDD	ND	0.18		(0.65-0.89)	
2,3,7,8-TCDF	ND	0.27		(0.65-0.89)	
1,2,3,7,8-PeCDD	ND	0.30		(1.32-1.78)	
1,2,3,7,8-PeCDF	ND	0.27		(1.32-1.78)	
2,3,4,7,8-PeCDF	ND	0.14		(1.32-1.78)	
1,2,3,4,7,8-HxCDD	ND	0.14		(1.05-1.43)	
1,2,3,7,8,9-HxCDD	ND	0.12		(1.05-1.43)	
1,2,3,6,7,8-HxCDD	ND	0.22		(1.05-1.43)	
1,2,3,4,7,8-HxCDF	ND	0.16		(1.05-1.43)	
1,2,3,6,7,8-HxCDF	ND	0.23		(1.05-1.43)	
2,3,4,6,7,8-HxCDF	ND	0.23		(1.05-1.43)	
1,2,3,7,8,9-HxCDF	ND	0.32		(1.05-1.43)	
1,2,3,4,6,7,8-HpCDD	ND	0.32		(0.88-1.20)	
1,2,3,4,6,7,8-HpCDF	ND	0.20		(0.88-1.20)	
1,2,3,4,7,8,9-HpCDF	ND	0.37		(0.88-1.20)	
OCDD	ND	0.52		(0.76-1.02)	
OCDF	ND	0.38		(0.76-1.02)	
TE	0.00				

INTERNAL STANDARDS	% RECOVERY	ION RATIO	RATIO LIMITS	
13C-2,3,7,8-TCDD	53.9	0.84	(0.65-0.89)	
13C-2,3,7,8-TCDF	39.2 **	0.88	(0.65-0.89)	
13C-1,2,3,7,8-PeCDD	51.4	1.71	(1.32-1.78)	
13C-1,2,3,7,8-PeCDF	40.4	1.56	(1.32-1.78)	
13C-2,3,4,7,8-PeCDF	48.6	1.58	(1.32-1.78)	
13C-1,2,3,4,7,8-HxCDD	81.0	1.41	(1.05-1.43)	
13C-1,2,3,6,7,8-HxCDD	47.3	1.11	(1.05-1.43)	
13C-1,2,3,4,7,8-HxCDF	69.9	0.50	(0.43-0.59)	
13C-1,2,3,6,7,8-HxCDF	45.7	0.59	(0.43-0.59)	
13C-2,3,4,6,7,8-HxCDF	57.7	0.54	(0.43-0.59)	
13C-1,2,3,7,8,9-HxCDF	67.8	0.57	(0.43-0.59)	
13C-1,2,3,4,6,7,8-HpCDD	64.7	1.16	(0.88-1.20)	
13C-1,2,3,4,6,7,8-HpCDF	66.1	0.49	(0.37-0.51)	
13C-1,2,3,4,7,8,9-HpCDF	69.9	0.34	(0.37-0.51)	*
13C-OCDD	85.7	0.81	(0.76-1.02)	

CLEAN-UP STANDARD	% RECOVERY
37Cl4-2,3,7,8-TCDD	Not Added

CANVIRO ANALYTICAL LABORATORIES LTD. - CONCENTRATION REPORT:

SAMPLE DESCRIPTION: GPT 6-1
METHOD: 8290

SAMPLE DATE: Aug. 24-93
EXTRACTION DATE: NA

SAMPLE WEIGHT (grams) = 0.0265
ANALYSIS DATE: Oct. 1-93
ANALYSIS TIME: 19:01

GC COLUMN & MS: DB-5, 60 m, 0.25 mm ID, 0.25 um df - Kratos Concept HRMS

CANVIRO I.D. NO.: 93009010-01 FILE: K515_0036 APPROVED BY: TC

TOTAL HOMOLOGUES	ng/g	DL	# PEAKS
TOTAL TCDD	ND	0.18	
TOTAL PeCDD	ND	0.30	
TOTAL HxCDD	ND	0.14	
TOTAL HpCDD	ND	0.32	
TOTAL OCDD	ND	0.52	
TOTAL PCDDs	ND		
TOTAL TCDF	ND	0.27	
TOTAL PeCDF	ND	0.27	
TOTAL HxCDF	ND	0.16	
TOTAL HpCDF	ND	0.20	
TOTAL OCDF	ND	0.38	
TOTAL PCDFs	ND		

GENERAL NOTES:
ng/g = ppb
CN = Refer to Case Narrative
ND = Not Detected
MPC = Not all idenification criteria satisfied, Incorrect ion ratio.
The Maximum Possible Concentration is reported
TEF = International 2,3,7,8-TCDD Toxic Equivalents
Results are corrected for Internal Standard Recovery
* = Result is outside of Ratio Limit
DL = Sample specific detection limit.
NA = Not Applicable

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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/08/93

JOB NUMBER: 935874 CUSTOMER: CH2M HILL QUALITY ANALYTICAL LABS ATTN: NANCY MOSURICK

CLIENT I.D.....: 0850530
DATE SAMPLED.....: 11/18/93
TIME SAMPLED.....: 14:45
WORK DESCRIPTION...: 90241-003

LABORATORY I.D...: 935874-0003
DATE RECEIVED....: 11/24/93
TIME RECEIVED....: 13:24
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Capillary Gas Chromatography	Attached		See Attached	Capilliary GC	12/07/93	SD
Simulated Distillation of Crude		*1		ASTM D-5307	12/03/93	KC
% OFF	Deg. F	0				
IBP	321	0				
5	420	0				
10	464	0				
15	494	0				
20	519	0				
25	539	0				
30	559	0				
35	582	0				
40	607	0				
45	633	0				
50	666	0				
55	710	0				
60	760	0				
65	803	0				
70	843	0				
75	885	0				
80	939	0				
85	982	0				
90	---	0				
95	---	0				
% Recovered	86.4	0	@ 1000 deg. F			
% Residue	13.6	0	@ 1000 deg. F			

P O BOX 34766
HOUSTON, TX 77234-4282
(713) 943-9776

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(713) 943-9776

CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 935874-3
Sample ID: 90241-003 0850530

CAPILLARY ANALYSIS

	Wt.%	LV.%	Mole %
2-Methylhexane	0.01	0.01	0.02
3-Methylhexane	0.01	0.01	0.02
2,2,4-Trimethylpentane	0.01	0.01	0.03
Methylcyclohexane	0.01	0.01	0.02
2,3,4-Trimethylpentane	0.01	0.01	0.01
Toluene	0.04	0.04	0.11
3-Methylheptane	0.01	0.01	0.01
n-Octane	0.02	0.02	0.04
Ethylbenzene	0.01	0.01	0.03
meta-Xylene	0.06	0.05	0.14
para-Xylene	0.01	0.01	0.03
4-Methyloctane	0.02	0.02	0.04
2-Methyloctane	0.03	0.03	0.05
3-Methyloctane	0.03	0.03	0.05
ortho-Xylene	0.04	0.03	0.09
cis-1-Ethyl-3-Methylcyclohexane	0.01	0.01	0.03
trans-1-Ethyl-4-Methylcyclohexane	0.01	0.01	0.03
n-Nonane	0.14	0.16	0.28
trans-1-Ethyl-3-Methylcyclohexane	0.02	0.02	0.04
2,2-Dimethyloctane	0.02	0.02	0.03
3,5-Dimethyloctane	0.01	0.01	0.02
Propylcyclohexane	0.06	0.06	0.12
n-Butylcyclopentane	0.01	0.01	0.01
3,3-Dimethyloctane	0.06	0.06	0.10
n-Propylbenzene	0.03	0.03	0.07
1,3-Dimethyl-2-Ethylcyclohexane	0.02	0.02	0.03
meta-Ethyltoluene	0.08	0.08	0.18
para-Ethyltoluene	0.04	0.04	0.09
1,3,5-Trimethylbenzene	0.15	0.14	0.31
5-Methylnonane	0.04	0.04	0.07
4-Methylnonane	0.07	0.08	0.13
ortho-Ethyltoluene	0.12	0.11	0.26
3-Ethyloctane	0.01	0.01	0.02
3-Methylnonane	0.10	0.11	0.18
trans-1-Methyl-4-isopropylcyclohexane	0.03	0.03	0.06

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CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 935874-3
Sample ID: 90241-003 0850530

CAPILLARY ANALYSIS

	Wt.%	LV.%	Mole %
1,2,4-Trimethylbenzene	0.20	0.19	0.43
cis-1-Methyl-3-Propylcyclohexane	0.03	0.03	0.05
iso-Butylcyclohexane	0.03	0.03	0.05
1-Ethyl-2,3-Dimethylcyclohexane	0.01	0.01	0.02
iso-Butylbenzene	0.02	0.02	0.04
n-Decane	0.49	0.54	0.88
Unidentified C-10 Compounds	0.01	0.01	0.01
1,2,3-Trimethylbenzene	0.09	0.08	0.19
Indane	0.02	0.02	0.04
1-Methyl-4-isopropylbenzene	0.01	0.01	0.02
1-Methyl-2-isopropylbenzene	0.05	0.05	0.10
1,3-Diethylbenzene	0.10	0.09	0.19
1-Methyl-3-Propylbenzene	0.11	0.11	0.22
1-Methyl-4-Propylbenzene	0.04	0.04	0.08
n-Butylbenzene	0.08	0.07	0.15
1,2-Diethylbenzene	0.01	0.01	0.01
1-Methyl-2-Propylbenzene	0.08	0.07	0.15
4-Methyldecane	0.09	0.10	0.15
1,4-Dimethyl-2-Ethylbenzene	0.18	0.16	0.34
1,3-Dimethyl-4-Ethylbenzene	0.09	0.08	0.17
3-Methyldecane	0.11	0.12	0.18
1,2-Dimethyl-4-Ethylbenzene	0.10	0.09	0.19
1,3-Dimethyl-2-Ethylbenzene	0.01	0.01	0.02
1,2-Dimethyl-3-Ethylbenzene	0.03	0.02	0.05
n-Undecane	0.75	0.82	1.23
Unidentified C-11 Compounds	0.32	0.35	0.52
1,2,4,5-Tetramethylbenzene	0.06	0.06	0.12
1,2,3,5-Tetramethylbenzene	0.11	0.10	0.22
1,2,3,4-Tetramethylbenzene	0.11	0.10	0.21
Pentylbenzene	0.03	0.02	0.04
trans-1-Methyl(4-Methylpentane)cyclopentane	0.07	0.07	0.12
n-Dodecane	0.82	0.89	1.24
Naphthalene	0.16	0.11	0.33
2-Methyl Naphthalene	0.75	0.60	1.35
1-Methyl Naphthalene	0.57	0.45	1.03

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CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 935874-3
Sample ID: 90241-003 0850530

CAPILLARY ANALYSIS

	Wt.%	LV.%	Mole %
Unidentified C12 Compounds	1.50	1.42	2.38
Tridecane	1.37	1.12	1.91
Unidentified C13 Compounds	3.12	2.54	4.44
Tetradecane	2.88	2.35	3.73
Unidentified C14 Compounds	4.08	3.32	5.28
Pentadecane	2.48	2.61	3.01
Unidentified C15 Compounds	7.02	7.37	8.51
Hexadecane	2.26	2.38	2.57
Unidentified C16 Compounds	7.24	7.62	8.22
Heptadecane	1.98	2.07	2.12
Pristane	1.84	1.91	1.76
Unidentified C17 Compounds	4.31	4.51	4.61
Octadecane	1.59	1.67	1.61
Phytane	1.33	1.40	1.21
Unidentified C18 Compounds	2.41	2.53	2.44
Nonadecane	1.54	1.62	1.48
Unidentified C19 Compounds	1.14	1.19	1.09
Eicosane	0.85	0.88	0.78
Unidentified C20 Compounds	2.29	2.36	2.08
Heneicosane	0.55	0.57	0.48
Unidentified C21 Compounds	1.56	1.61	1.35
Docosane	0.32	0.32	0.26
Unidentified C22 Compounds	0.65	0.67	0.54
Tricosane	0.16	0.17	0.13
Unidentified C23 Compounds	0.51	0.54	0.41
Tetracosane	0.11	0.11	0.08
Unidentified C24 Compounds	0.33	0.35	0.25
Pentacosane	0.09	0.10	0.07
Unidentified C25 Compounds	0.12	0.13	0.09
Hexacosane	0.07	0.07	0.05
Unidentified C26 Compounds	0.20	0.21	0.14
Heptacosane	0.02	0.02	0.01
Unidentified C27 Compounds	0.07	0.07	0.05
C28 Plus	36.94	37.33	24.01
	100.04	100.00	100.05

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CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 935874-3
Sample ID: 90241-003 0850530

CAPILLARY ANALYSIS

Specific Gravity of Total Sample=	0.8144
Specific Gravity of Hexanes Plus=	0.8144
Molecular Weight of Total Sample=	256.7612
Molecular Weight of Hexanes Plus=	256.7612

Paraffins,	LV%=	18.47
Naphthenes,	LV%=	0.29
Aromatics,	LV%=	3.12
Isoparaffins,	LV%=	3.96
Olefins,	LV%=	0.00
Unidentified,	LV%=	74.16
	Total=	100.00

Benzene, WT%	0.00
Toluene,WT%	0.04
Xylenes, WT%	0.11
BTEX, WT%	0.15
Aromatics, WT%	3.58
C9+ Aromatics, WT	3.43
Saturates, WT%	22.72

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P.O. Box 34282
Houston, TX 77034
(713) 943-9776

CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 934227
Sample I.D.: 90116-001

CAPILLARY ANALYSIS

	Wt. %	L.V. %	Mole %
Ethylbenzene	0.01	0.01	0.02
m-Xylene	0.03	0.03	0.08
p-Xylene	0.01	0.01	0.02
2-Methyloctane	0.01	0.01	0.02
o-Xylene/3-Methyloctane	0.04	0.03	0.09
n-Nonane	0.11	0.12	0.22
Unidentified C9 Compounds	0.03	0.03	0.05
n-Propylbenzene	0.03	0.02	0.05
1-Methyl-3-Ethylbenzene(METOL)	0.05	0.05	0.11
1-Methyl-4-Ethylbenzene(PETOL)	0.03	0.02	0.05
1,3,5-Trimethylbenzene	0.11	0.10	0.24
1-Methyl-2-Ethylbenzene(OETOL)	0.09	0.08	0.19
4-Methylnonane	0.06	0.06	0.10
tert-Butylbenzene/1,2,4-Trimethylbenzene	0.14	0.13	0.28
1-Methyl-2-Isopropylbenzene/sec-Butylbenzene	0.05	0.05	0.09
n-Decane	0.44	0.48	0.78
Unidentified C10 compounds	0.30	0.32	0.55
Isobutylbenzene	0.02	0.02	0.04
1,2,3-Trimethylbenzene	0.06	0.06	0.13
1-Methyl-3-Isopropylbenzene	0.01	0.01	0.01
1-Methyl-4-Isopropylbenzene	0.01	0.01	0.02
Indane (2,3-Dihydroindene)	0.02	0.02	0.04
1,3-Diethylbenzene/1-Methyl-3-n-Propylbenzene	0.17	0.16	0.32
n-Butylbenzene	0.06	0.06	0.12
1-Methyl-4-n-Propylbenzene/1,2-Diethylbenzene	0.04	0.04	0.08
1-Methyl-2-n-Propylbenzene	0.09	0.09	0.18
1,4-Dimethyl-2-Ethylbenzene	0.18	0.16	0.33
1,3-Dimethyl-4-Ethylbenzene	0.08	0.07	0.14
1,2-Dimethyl-4-Ethylbenzene	0.08	0.07	0.15
1,3-Dimethyl-2-Ethylbenzene	0.01	0.01	0.02
1,2-Dimethyl-3-Ethylbenzene	0.02	0.02	0.04
n-Undecane	0.93	0.99	1.51

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced except in its entirety, without the written approval of Core Laboratories

Western Atlas International

CORE LABORATORIES

P.O. Box 34282
Houston, TX 77034
(713) 943-9776

CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 934227
Sample I.D.: 90116-001

CAPILLARY ANALYSIS

	Wt. %	L.V. %	Mole %
Unidentified C11 compounds	0.65	0.69	1.09
1,2,4,5-Tetramethylbenzene (Durene)	0.06	0.05	0.11
1,2,3,5-Tetramethylbenzene (Isodurene)	0.11	0.10	0.21
1,2,3,4-Tetramethylbenzene (Prehnitene)	0.13	0.12	0.25
Naphthalene	0.21	0.14	0.41
n-Dodecane(C-12)	1.21	1.27	1.80
C-12 Unidentified	1.61	1.64	2.11
C-12 thru C-13 (not including *)	3.30	3.35	5.03
n-Tridecane(C-13)	1.69	1.72	2.32
C-13 thru C-14	5.44	5.53	7.65
n-Tetradecane	2.37	2.41	3.03
C-14 thru C-15	6.13	6.24	7.84
n-Pentadecane	2.48	2.53	2.96
C-15 thru C-16	6.74	6.88	8.06
n-Hexadecane	2.21	2.26	2.47
C-16 thru C-17	3.92	4.02	4.40
n-Heptadecane	2.06	2.10	2.18
Pristane	1.91	1.97	1.81
C-17 thru C-18	3.93	4.00	4.15
n-Octadecane	1.72	1.75	1.71
Phytane	1.34	1.39	1.21
C-18 thru C-19	2.14	2.19	2.14
n-Nonadecane	1.46	1.49	1.38
C-19 thru C-20	1.85	1.89	1.75
n-Eicosane	0.90	0.91	0.81
C-20 thru C-21	1.28	1.29	1.15
n-Heneicosane	0.53	0.53	0.45
C-21 thru C-22	0.33	0.33	0.28
n-Docosane	0.36	0.36	0.29
C-22 thru C-23	0.02	0.02	0.02
n-Tricosane	0.13	0.13	0.10

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Western Atlas International

CORE LABORATORIES

P.O. Box 34282
Houston, TX 77034
(713) 943-9776

CH2M Hill Quality Analytical Labs
ATTN: Nancy Mosurick

Job No: 934227
Sample I.D.: 90116-001

CAPILLARY ANALYSIS

	Wt. %	L.V. %	Mole %
C-24 Plus	37.06	36.27	22.26
2-Methylnaphthalene	0.83	0.65	1.48
1-Methylnaphthalene	0.57	0.44	1.02
	0.00	0.00	0.00
	100.00	100.00	100.00

NOTE: Sample appears to be 60% diesel with some heavier hydrocarbons present.

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/08/93

JOB NUMBER: 935874 CUSTOMER: CH2M HILL QUALITY ANALYTICAL LABS ATTN: NANCY MOSURICK

CLIENT I.D.....: 0850530
DATE SAMPLED.....: 11/18/93
TIME SAMPLED.....: 12:30
WORK DESCRIPTION...: 90241-001

LABORATORY I.D...: 935874-0001
DATE RECEIVED....: 11/24/93
TIME RECEIVED....: 13:24
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Total Petroleum Hydrocarbons	500	20	mg/l	EPA 418.1	12/08/93	

P O BOX 34766
HOUSTON, TX 77234-4282
(713) 943-9776

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/08/93

JOB NUMBER: 935874 CUSTOMER: CH2M HILL QUALITY ANALYTICAL LABS ATTN: NANCY MOSURICK

CLIENT I.D.....: 0850530
DATE SAMPLED.....: 11/18/93
TIME SAMPLED.....: 13:45
WORK DESCRIPTION...: 90241-002

LABORATORY I.D...: 935874-0002
DATE RECEIVED....: 11/24/93
TIME RECEIVED....: 13:24
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Total Petroleum Hydrocarbons	90	20	mg/l	EPA 418.1	12/08/93	

P O BOX 34766
HOUSTON, TX 77234-4282
(713) 943-9776

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Chain of Custody Records

FPPA[RPT]#034
06.94.mlv

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐
Purchase Order #:

Project Name: NCBC GULFPORT SITE 6

Company Name/CH2M HILL Office: ABB ENVIRONMENTAL SERVICES INC

Project Manager & Phone #: Mr. [ ] Ms. [X] Penny Porter Dr. [ ] 615 5311922

Report Copy to:

Requested Completion Date: Std

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

LAB TEST CODES: Core Labs (Houston)

ANALYSES REQUESTED

SHADED AREA – FOR LAB USE ONLY

Lab 1 #: GN-90116
Lab 2 #:
Quote #:
Kit Request #:
Project #:
No. of Samples: 1
Page 1 of 2
COC Rev:
Login: KB 8/30/93
LIMS Ver:
Ack Gen:

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	ANALYSES REQUESTED	REMARKS	LAB 1 ID	LAB 2 ID
8/24/93	1130		X	X		GPT6-1		Hydrocarbon / Solvent		001	

Sampled By & Title (Please sign and print name): Bill Oakley Bill Oakley	Date/Time: 8/24/93 1130	Relinquished By (Please sign and print name): Bill OAKLEY Bill Oakley	Date/Time: 8/25/93	HAZWRAP/NESSA: Y N	
Received By (Please sign and print name): Ben North B. NORTH	Date/Time: 1335 8/26/93	Relinquished By (Please sign and print name): Fred Rowell	Date/Time: 8/30/93 0830	QC Level: 1 2 3 Other: ____	
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:	COC Rec Y	ICE Y
				Ana Req Y	TEMP 4°C
				Cust Seal Y	Ph
Received By (Please sign and print name):	Date/Time:	Shipped Via: UPS BUS Fed-Ex Hand Other ____	Shipping #: 6424503061		
Work Authorized By (Please sign and print name):	Remarks:				

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client
REV 11/92 FORM 340

FPPA[RPT]#034
06.94.mlv

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #:
Purchase Order #:
Project Name: NCBC GULFPORT SITE 6
Company Name/CH2M HILL Office: ABB ENVIRONMENTAL SERVICES INC.
Project Manager & Phone #: Mr. [ ] Ms. [X] Penny Baxter Dr. [ ] 615 531 1922
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [ ] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES: To Compro

ANALYSES REQUESTED: Dioxin

SHADED AREA – FOR LAB USE ONLY
Lab 1 #: GN-90114
Lab 2 #:
Quote #:
Kit Request #:
Project #:
No. of Samples: 1
Page 2 of 2
COC Rev:
Login: KD 9/30/93
LIMS Ver:
Ack Gen:

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	REMARKS	LAB 1 ID	LAB 2 ID
8/27/93	1130		X	X		GPT6-1			001	

Sampled By & Title (Please sign and print name): Bill Oakley Bill Oakley HydroTech — Date/Time: 8/27/93 1130
Relinquished By (Please sign and print name): Bill Oakley Bill Oakley — Date/Time: 8/25/93
Received By (Please sign and print name): Ben North B. NORTH — Date/Time: 1335 8/26/93
Relinquished By (Please sign and print name): Fred Reeves — Date/Time: 8/27/93 0830
Received By (Please sign and print name): — Date/Time:
Relinquished By (Please sign and print name): — Date/Time:
Received By (Please sign and print name): — Date/Time:
Shipped Via: UPS BUS (Fed-Ex) Hand Other ____ — Shipping #: 6424503066
Work Authorized By (Please sign and print name): — Remarks:

HAZWRAP/NESSA: Y N
QC Level: 1 2 3 Other: ____
COC Rec Y ICE Y
Ana Req Y TEMP 4°C
Cust Seal Y Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client
REV 11/92 FORM 210

FPPA[RPT]#034
06.94.mlv

E-54

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #: 08.5.0.5.3.0
Purchase Order #:
Project Name: NLBC FREE-PHASE PRODUCT ASSESS.
Company Name/CH2M HILL Office: ABB-ENVIRONMENTAL SERVICES
Project Manager & Phone #: Mr. [ ] Ms. [X] Dr. [ ] PENNY BAXTER
Report Copy to: ROBERT FISHER
Requested Completion Date: STANDARD TURN AROUND
Sampling Requirements: SDWA [ ] NPDES [ ] RCRA [ ] OTHER ____
Sample Disposal: Dispose [X] Return [ ]

SHADED AREA – FOR LAB USE ONLY: Lab 1 # GN-90241; Lab 2 #; Quote #; Kit Request #; Project #; No. of Samples 3; Page 1 of 1; COC Rev; Login KD 11/26/93; LIMS Ver; Ack Gen

LAB TEST CODES: Column To Core; Dioxin to Carvin

ANALYSES REQUESTED: VOC (40 ml); 8260 VOC (CAPILLARY COLUMN) (40 ml); FREE EFF. (40 ml); • FINGERPRINT • SIM DIST. • GC/MS LIBRARY NON hydroc. SUBSTRS; • DIOXIN ANAL. (8290)

Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	VOC (40 ml)	8260 VOC (CAPILLARY COLUMN) (40 ml)	FREE EFF. (40 ml)	FINGERPRINT / SIM DIST. / GC/MS LIBRARY NON hydroc. SUBSTRS	DIOXIN ANAL. (8290)	REMARKS	LAB 1 ID	LAB 2 ID
~~11/17~~															
11/17	[illegible]		✓	✓		BS A01-TR*	2	✓					TRAVEL BLANK		
	1230	✓	✓			GPT-M18	2		2				DIAGL ANALY	001	
	1315	✓	✓			GPT-I19	2		2				DIAGL ANALY	2	
	1445	✓	✓			GPT-HP-18	4			4			FREE EFFUENT	3	

Sampled By & Title (Please sign and print name): ROBERT FISHER — Date/Time 11/16/93
Received By (Please sign and print name): BEN NORTH — Date/Time 11/17 11.19.93
Received By (Please sign and print name) — Date/Time
Received By (Please sign and print name) — Date/Time
Work Authorized By (Please sign and print name)

Relinquished By (Please sign and print name): ROBERT FISHER — Date/Time 11/16/93
Relinquished By (Please sign and print name) — Date/Time
Relinquished By (Please sign and print name) — Date/Time

HAZWRAP/NESSA: (Y) N
QC Level: (1) 2 3 Other: N
COC Rec Y; ICE Y
Ana Req Y; TEMP 4°C
Cust Seal Y; Ph ✓

Shipped Via: UPS BUS (Fed-Ex) Hand Other ____
Shipping # 8200528873

Remarks: * TRAVEL BLANKS EMPTY. WERE SHIPPED THAT WAY

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client
REV 11/92 FORM 340

FPPA[RPT]#034
06.94.mlv

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #:

Purchase Order #:

Project Name: Gulfport NCBC FPPA

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. ☐ Ms. ☐ Dr. ☐ D. Baxter 615-531-1922

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

SHADED AREA -- FOR LAB USE ONLY

Lab 1 # 902899 3939 (G) | Lab 2 #:

Quote #: | Kit Request #:

Project #:

No. of Samples: 10 | Page 1 of 1

COC Rev: | Login: 12/10/93 | LIMS Ver: | Ack Gen:

LAB TEST CODES: TO LRD; TO LRD; TO CANUPO

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	TCL CLP VOA (HCl)	TCL CLP SVOA	TCL CLP Pest/PCB	TAL Metals (HNO3)	CN- (NaOH)	TPH (H2SO4) Method (418.1)	TOC (H2SO4) Method (415.1)	Herbicides Method (8150)	Dioxins/Furans Methods 8290	REMARKS	LAB 1 ID	LAB 2 ID
12-10-93	0730		X	X		DBG605	11	3	1	1	1	1	1	1	1	1	DI Blank	001	
12-10-93	0745		X	X		PBG605	11	3	1	1	1	1	1	1	1	1	Potable Blank	2	
12-10-93	0815		X	X		ERG605	11	3	1	1	1	1	1	1	1	1	Equipment Rinsate	3	
12-10-93	1000		X		X	SBG6503	21	4	4	4	4		4		4	4	Soil Borings @ GPT-0.5 / MS/MSD	4/4MS/4MSD	
12-10-93	1015		X		X	SBG6503D	7	1	1	1	1		1	*	1	1	Duplicate Soil Borings @ GPT 0.5 @ 8'	5	
12-10-93	1100		X		X	SBG6508	7	1	1	1	1		1		1	1		6	
12-10-93	1300		X		X	SBG6520	2	1	1									7	
12-10-93	1530		X		X	SBG6708	3	1	1				1					8	
~~12-10-93~~	~~1550~~		~~X~~		~~X~~	~~SBG6720~~	~~X~~	~~1~~	~~1~~					~~4~~					
12-10-93	1550		X		X	SBG6720	5	1	1					3			MS/MSD for TOC only	9/9MS/9MSD	
12-10-93	1600		X		X	SBG6720D	1							1			Dup for TOC only	10	

Sampled By & Title: H. Fairchild (Please sign and print name: H. Fairchild) | Date/Time: 12/10/93 1630

Relinquished By: H. Fairchild (Please sign and print name: H. Fairchild) | Date/Time: 12/10/93 1700

Received By: S. Wollaco (Please sign and print name) | Date/Time: 12/11/93 1200

Relinquished By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time

Shipped Via: UPS ☐ Bus ☐ Fed-Ex ☐ Hand ☐ Other ____ | Shipping # 8200528906

Rush Authorized By (Please sign and print name)

Remarks: Metals shipped unpreserved, please preserve on reciept to lab w/ HNO3

HAZWRAP/NESSA: Y N

QC Level: 1 2 3 Other: ____

COC Rec	Y	ICE	Y
Ana Req	Y	TEMP	4°C
Cust Seal	Y	Ph	—

E-55

FPPA[RPT]#034
06.94.mlv

E-56

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐

Purchase Order #:

Project Name: Gulfport NCBC FPPA

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [X] Dr. [ ] D. Baxter

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [ ] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA – FOR LAB USE ONLY

Lab 1 #: GN-90287

Lab 2 #:

Quote #:

Kit Request #:

Project #:

No. of Samples: 11

Page 2 of 2

COC Rev | Login | LIMS Ver | Ack Gen

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	TCL CLP VOA									REMARKS	LAB 1 ID	LAB 2 ID
			X	X		TRIP BLK	3											011	

Sampled By & Title (Please sign and print name) | Date/Time

Received By (Please sign and print name): Ben Nash for S. Nalkar | Date/Time 1200 12.11.93

Received By (Please sign and print name) | Date/Time

Received By (Please sign and print name) | Date/Time

Work Authorized By (Please sign and print name)

Relinquished By (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name) | Date/Time

Relinquished By (Please sign and print name) | Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other ____ | Shipping #

Remarks

HAZWRAPNESSA: Y N

QC Level: 1 2 3 Other: ZN

COC Rec Y | ICE Y

Ana Req Y | TEMP 4C

Cust Seal Y | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client

REV 11/92 FORM 340

FPPA[RPT]#034
06.94.mlv

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #: ☐☐☐☐☐☐☐.☐☐.☐☐

Purchase Order #:

Project Name: Gulfport NCBC FPPA

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] P. Baxter 615-531-1922

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

SHADED AREA -- FOR LAB USE ONLY

Lab 1 #: GN-90288

Lab 2 #:

Quote #:

Kit Request #:

Project #:

No. of Samples: 3

Page: 1 of 1

COC Rev:

Login: 12/13

LIMS Ver:

Ack Gen:

LAB TEST CODES: To LRD; To LMG; To LRD; To Enviro

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	TCL CLP VOA HCl	TCL CLP SVOA	TCL CLP Pest / PCB	THL Metals (HNO3)	CN- (NaOH)	TPH (H2SO4)	Method 418.1	TOC (H2SO4)	Method 415.1 Herbicides	Method 8150	Dioxins / Furans Method 8290	REMARKS	LAB 1 ID	LAB 2 ID
12-11-93				X		TBG602	3	3											Trip Blank	001	
12-11-93	0830		X	X		ERG602	4	3	1										Equipment Rinsate	2	
12-11-93	0915		X		X	SBG674 5	2	1	1											3	

Sampled By & Title (Please sign and print name): H. Faircloth H. Faircloth	Date/Time: 12-11-93/0900	Relinquished By (Please sign and print name): Harlan Faircloth Harlan Faircloth	Date/Time: 12-11-93/1000
Received By (Please sign and print name): B. North B. NORTH	Date/Time: 12-13-93	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Shipped Via: UPS BUS Fed-Ex Hand Other ____	Shipping #: 8200528895
Work Authorized By (Please sign and print name):		Remarks: Metals shipped unpreserved, please preserve on reciept to pH < 2 w/ HNO3	

HAZWRAP/NESSA: Y N

QC Level: 1 2 3 Other: 3N

COC Rec: Y ICE: Y

Ana Req: Y TEMP: 4°C

Cust Seal: Y Ph: Y

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client

FPPA(RPT)#034
06.94.mlv

E-58

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #:
Purchase Order #:
Project Name: Gulfport NCBC FPPA
Company Name/CH2M HILL Office: ABB-ES /
Project Manager & Phone #: Mr. [ ] Ms. [X] Dr. [ ] P. Baxter (615-531-1922)
Report Copy to:
Requested Completion Date:
Sampling Requirements: SDWA [ ] NPDES [ ] RCRA [ ] OTHER ____
Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES: TO-CLP 12

SHADED AREA -- FOR LAB USE ONLY
Lab 1 #: GN-90290
Lab 2 #:
Quote #:
Kit Request #:
Project #:
No. of Samples: 9
Page: 1 of 1
COC Rev:
Login:
LIMS Ver:
Ack Gen:

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	TCL - CLP VOA (HCl)	TCL - CLP SVOA	TCL CLP PEST / PCB	TAL Metals * (HNO3)	CN- (NaOH)	TPH Method 418.1 (H2SO4)	TOC Method 415.1 (H2SO4)	Herbicide Method 8150	Dioxin/Furans Method 8290	REMARKS	LAB 1 ID	LAB 2 ID
12-13-93				X		TBG603	3	3									Trip Blank	001	
12-13-93	0800		X	X		ERG603	11	3	1	1	1	1	1	1	1	1	Equipment Rinse	2	
12-13-93	1115		X	X		GWG604	33	9	3	3	3	3	3	3	3	3	MS/MSD	3/3	1/1
12-13-93	1145		X	X		GWG604D	11	3	1	1	1	1	1	1	1	1	Duplicate	4	
12-13-93	1430		X	X		GWG606	11	3	1	1	1	1	1	1	1	1		5	
12-13-93	1515		X	X		GWG605	4	3	1									6	
12-13-93	1530		X	X		GWG603	5	3	1					1				7	
12-13-93	1600		X	X		GWG607	4	3	1									8	
12-13-93	1615		X	X		GWG602	5	3	1					1				9	

Sampled By & Title (Please sign and print name): H. Faircloth, H. Faircloth	Date/Time: 12-13-93 / 1630	Relinquished By (Please sign and print name): H. Faircloth, H. Faircloth	Date/Time: 12-13-93 / 1700
Received By (Please sign and print name): Ben North, B. NORTH	Date/Time: 1124 12-14-93	Relinquished By (Please sign and print name): [signature]	Date/Time: 1635 12-14-93
Received By (Please sign and print name): [signature]	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name): [signature], N. Pike	Date/Time: 12/16/93 (1002 AM)	Shipped Via: UPS [ ] BUS [ ] Fed-Ex [X] Hand [ ] Other ____	Shipping #: 8200528910
Work Authorized By (Please sign and print name):	Remarks: *Metals shipped unpreserved; please preserve on receipt w/ (HNO3)		

HAZWRAP/NESSA: (Y) N
QC Level: 1 (2) 3 Other: N
COC Rec: Y ICE: Y
Ana Req: Y TEMP: 4°C
Cust Seal: Y Ph: Y

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client

FPPA[RPT]#034
06.94.mlv

CH2M HILL
QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐
Purchase Order #:

Project Name: NCBC FPPA

Company Name/CH2M HILL Office: ABB ENV. SERV.

Project Manager & Phone #: Mr. [ ] Ms. [M] PENNY BAXTER Dr. [ ]

Report Copy to: PENNY BAXTER

Requested Completion Date: STANDARD TURN AROUND

Sampling Requirements: SDWA [ ] NPDES [ ] RCRA [ ] OTHER ____

Sample Disposal: Dispose [☑] Return [ ]

LAB TEST CODES

ANALYSES REQUESTED

SHADED AREA -- FOR LAB USE ONLY

Lab 1 # GN-90332
Lab 2 #
Quote #
Kit Request #
Project #
No. of Samples: 2
Page 1 of 1
COC Rev
Login: 1-14-94
LIMS Ver
Ack Gen

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	ALKALINITY, BOD, COLOR, TSS, TDS, SULFATE, CHLORIDE	COD, HARDNESS	REMARKS	LAB 1 ID	LAB 2 ID
1-12-94	2300		✓	✓		ETPRW	2	1	1		001	
"	2300		✓	✓		ETPRWD	2	1	1		2	

Sampled By & Title (Please sign and print name): ROBERT FISHER — Date/Time: 1-12-94

Received By (Please sign and print name): [signature] — Date/Time: 1-14-94 / 135

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): ROBERT FISHER — Date/Time: 1-13-94 1700

Relinquished By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

HAZWRAP/NESSA: (Y) N
QC Level: 1 2 (3) Other: IN
COC Rec: Y
ICE: Y
Ana Req: Y
TEMP: 4°C
Cust Seal:
Rh: ✓

Received By (Please sign and print name): — Date/Time:

Shipped Via: UPS BUS Fed-Ex Hand Other ____
Shipping #:

Work Authorized By (Please sign and print name):

Remarks: PRE-PRESERVED

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: ORIGINAL - LAB, Yellow - LAB, Pink - Client

FPPA|RPT|#U34
06.94.mlv

QAL QUALITY ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐

Purchase Order #:

Project Name: ABB / Gulport

Company Name: ABB

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ]

Report Copy to:

Requested Completion Date: 3/9/94 — 2 wk < 1.25 x 1.94

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☒

LAB TEST CODES

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type Matrix COMP	GARB	WATER	SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	dissolved metals	TOTAL metals	REMARKS	LAB 1 ID	LAB 2 ID
12/13/93	1115			X		GWG64-S	1	X		QC# 9029G-3	1	
↓				X		GWG63-S	1	X		-7	2	
				X		GWG62-S	1	X		-9	3	
12/13/93	1115			X		GWG64	1		X	-3	4	

SHADED AREA-- FOR LAB USE ONLY

Lab 1 # 94076. Lab 2 #

Quote # Kit Request #

Project #

No. of Samples Page of

COC Rev Login LIMS Ver Ack Gen

Sampled By & Title (Please sign and print name) Date/Time

Relinquished By (Please sign and print name) Date/Time

Received By (Please sign and print name) Date/Time

Relinquished By (Please sign and print name) Date/Time

Received By (Please sign and print name) Date/Time

Relinquished By (Please sign and print name) Date/Time

Received By (Please sign and print name) Nicole Rivera Date/Time 12/23/94

Shipped Via UPS BUS Fed-Ex Hand Other ____ Shipping #

Work Authorized By (Please sign and print name) Remarks 0000

HAZWRAP/NESSA: Y N

QC Level: 1 2 3 Other:

COC Rec NO ICE

Ana Req Y TEMP

Cust Seal NO Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB Yellow - LAB Pink - Client

APPENDIX F

APPENDIX F

PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

PRECISION, ACCURACY, REPRESENTATIVENESS, COMPARABILITY, AND COMPLETENESS FOR FREE PHASE PRODUCT ASSESSMENT SITE 6 - FORMER FIREFIGHTING TRAINING AREA

NAVAL CONSTRUCTION BATTALION CENTER GULFPORT, MISSISSIPPI

Prepared by:
Heartland Environmental Services, Inc.
P.O. Box 163
St. Peters, Missouri 63376

Prepared for:

ABB Environmental Services, Inc.
1400 Centerpoint Blvd., Suite 158
Knoxville, Tennessee 37922-1968

March 1994

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Comparability, and Completeness
SITE 6 - Former Firefighting Training Area

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Not included with the NEESA Level C quality control requirements.

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1.0 INTRODUCTION

Prior to evaluating the data for precision, accuracy, representativeness, comparability, and completeness (PARCC) criteria the laboratory reviewed the data package and the data also were independently reviewed and validated using the Naval Energy and Environmental and Support Activity (NEESA) guidance document 20.2-047B (1988) entitled, *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Program*. Before the laboratory released the chemical analytical results, both the sample and laboratory QC data were carefully reviewed in order to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data were reduced and spike recoveries were included in control charts, and the resulting data were reviewed to ascertain whether they were within the laboratory defined limits for accuracy and precision. The data were compiled into a NEESA Level C data package and any nonconforming data were discussed in the data package cover letter and case narrative.

The Level C data packages were then reviewed and validated by Heartland Environmental Services, Inc., Missouri (Heartland). Data validation is the technical review of a data package using criteria established in the data quality objectives, the quality assurance project plan and guidance documents prepared by the United States Environmental Protection Agency (USEPA) for the validation of organic and inorganic analytical data (USEPA 1990a and 1990b) as specified by NEESA document 20.2-047B. The data review and validation process is independent of the laboratory's checks because it is impossible to repeat the review conducted by the laboratory since the Level C QC has limited deliverables requirements.

Samples that did not meet the acceptance limit criteria were qualified with a flag; single letter abbreviations that indicate a problem with the data. Data qualifiers used by the validators when amending the data include the following.

U — Undetected. The analyte was not detected above the contract required quantitation limit (CRQL). The "U" designator also is used to qualify laboratory contaminants. The "U" designator is applied to an environmental sample when the laboratory contaminant is detected in an environmental sample at a concentration less than 5 times (10 X for common contaminants) the value of the concentration detected in any corresponding field QC blank, method blank or preparation blanks.

J — Estimated. The analyte was present, but the reported value may not be accurate or precise. The "J" designator is used to qualify an analyte that was present at a concentration between the CRQL and method detection limit (MDL) or the data "failed" some of the analytical validation criteria but did not require rejections of the data. When combined with the U designator, the quantitation limit is estimated.

R — Rejected. Data was rejected by the data validator during comparison of the NEESA Level C data package with the analytical functional guideline criteria. The "R" designator indicates a significant variance in acceptable laboratory performance. Either re-analysis or re-sampling and analysis would be necessary to determine the presence or absence of the target analyte(s).

Once the data were reviewed and validated according to the guidance presented in NEESA document 20.2-047B, the data were evaluated by Heartland using the PARCCs criteria included in the Data Quality Objectives (DQOs) of the Work Plan for Naval Construction Battalion Center (NCBC) Gulfport, Mississippi, dated October 1993. The following sections present a brief description of PARCCs criteria.

Precision. Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate laboratory analyses of samples collected from the same location/depth interval. Precision was calculated from laboratory analytical data and cannot be measured directly. Precision is expressed as the Relative Percent Difference (RPD) between analytical values for two samples divided by the average of their analytical values. Precision is calculated using the expression:

$$RPD = (D1-D2) / (\tfrac{1}{2}(D1+D2)) \times 100$$

D1 and D2 are the reported values for the duplicate sample pair. Precision was evaluated using field duplicate samples and laboratory split samples (for example, MS/MSD samples).

Precision for environmental samples and their duplicates was assessed using a maximum RPD of 20 Percent for water matrices and 35 Percent for soil matrices. Precision for MS/MSD/MD samples was assessed by using the target analyte specific RPD criteria for the spiked compounds and the sample duplicates.

Accuracy. Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy can be calculated from the analytical data and was not measured directly. Accuracy is used to identify the bias in a given measurement system (i.e. laboratory conditions, sample matrix, and sampling conditions). Accuracy is assessed by reviewing the Percent Recovery (%R) between the true value of the spike analyte and the actual analytical value. Accuracy is calculated using the equation:

$$\%R = ((A-B)/C) \times 100$$

A = Measured concentration of the spiked analyte.
B = Measured concentration of the spiked compound in the unspiked sample.
C = True concentration of the spiked analyte.

For the organic analyses, each of the samples was spiked with a surrogate compound; and for inorganic analyses, each chosen matrix spike and matrix duplicate pair was spiked with a known reference material before digestion. The recovery of the internals standards was used to assess accuracy for the Dioxin/Furan fraction. Each of these approaches provides a measure of the matrix effects on the analytical accuracy.

Representativeness. Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness was evaluated using the field and laboratory QC blank sample results. QC blank samples are equipment rinseate blanks, field blanks, trip blanks, laboratory method blanks for organic analysis and laboratory preparation blanks for inorganic analysis. Positive detection of target analytes in the QC blank samples identify contaminants that possibly were introduced to the associated environmental sample during sample collection, transport or laboratory analysis. Representativeness was also evaluated used the defined extraction and analytical holding time requirements set forth in the Work Plan for NCBC Gulfport or the analytical methodology.

Comparability. Comparability is qualitative measure designed to express the confidence with which one data set may be compared to another. Factors that affect comparability are: sample collection and handling techniques, sample matrix type, and analytical method. Comparability is limited by the

other PARCC parameters because only when precision and accuracy are known can data sets be compared with confidence.

Completeness. Completeness is defined as the percentage of measurements that are judged to be valid compared to the total number of measurements made. Valid usable data are values that were not qualified as rejected (R qualifier) during data validation. A goal of 85 percent usable data was established in the Work Plan for Site 6 FTA, NCBC, Gulfport, Mississippi. Completeness equals the total number of analytes for each matrix minus the total number of rejected analytes divided by the total number of analytes multiplied by 100.

2.0 PRECISION

The following section describes the evaluation of precision for volatile organic compounds, semivolatile organic compounds, dioxin/furans, pesticides and polychlorinated biphenyls (PCBs), herbicides, metals and cyanide, and wet chemistry parameters total petroleum hydrocarbons (TPHs), and total organic carbon (TOC). Duplicate samples are evaluated for precision only when contaminants are detected in both the environmental sample and the sample's duplicate. A ND in the RPD column of the spreadsheet indicates that a RPD calculation was not required because one result was a non-detect and the other result was less than the compound/analyte CRQL/CRDL. Environmental samples and their respective duplicates may not exhibit positive results for all compounds found at or near the contract required quantitation limit (CRQL) or detection limit (CRDL) because of low levels of contamination found at a site. Duplicates with Relative Percent Differences (RPDs) within control limits indicate adequate sampling practices and/or good analytical precision. Duplicates with RPDs outside the control limits may result from inappropriate sampling procedures, matrix interferences, or non-homogeneity of the sample matrix. In addition, poor precision can be attributed to deviation(s) from the analytical methodology or to poor reproducibility of target analyte concentrations at or near the required quantitation or detection limits (CRQLs or CRDLs). The acceptance criteria for evaluating precision of field duplicates analytical results is a RPD of 20 for water matrices and a RPD of 35 for soil matrix.

The percent of duplicate samples collected for the analytical parameters and sample matrices was greater than ten percent (10%) for soil and water matrices as specified in the Work Plan for NCBC Gulfport, Mississippi. The following Sections summarize the evaluation of analytical precision for the water matrix (ground water samples) and soil matrices for the following analytical groups:

- GC/MS volatile organic compounds (GC/MS VOCs);
- semivolatile organic compounds (SVOCs);
- dioxin/furan compounds (D/Fs);
- pesticides, PCBs, and herbicides; and
- inorganics, cyanide, TPHs and TOC.

Duplicate precision was assessed using both environmental sample and associated duplicates and matrix spike (MS)/matrix spike duplicates (MSDs) pairs for organic fractions, and matrix duplicate pairs (MD pairs) for the metals/cyanide, TPH, and TOC fractions.

Tabulation of the results of assessing duplicate precision and duplicate frequency are presented in Tables 2-1 and 2-2 for the surface water matrix, 2-3 and 2-4 for the soil matrix. The results of the evaluation of precision for MS/MSD samples is provided in Tables 2-5 through 2-12 for the water matrix and Tables 2-13 through 2-20 for soil matrix.

In addition, to assess whether instrument calibration for volatile and semivolatile analytical methods resulted in non-compliant duplicate precision, tables were made of initial and continuing calibration outliers for each sample delivery group (SDG) and are included in Appendix A. Calibration criteria was met or non-compliance did not results in data qualification for the pesticides/PCBs and herbicides fractions. Therefore, tables of calibration criteria were not prepared for those fraction. Serial dilution data is not a required deliverable of Level C quality control. Therefore, the data could not be assessed for impact due to non-compliant serial dilution results.

TABLE 2 - 1

ORGANIC FRACTIONS
WATER SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

VOLATILES

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
CH007	GWG64	WATER	6	CHLOROMETHANE	12	0	20%	200%
				VINYL CHLORIDE	21	35	20%	50%
				CHLOROETHANE	230	310	20%	30%
				METHYLENE CHLORIDE	51	95	20%	60%
				CARBON DISULFIDE	3	4	20%	29%
				1,1-DICHLOROETHENE	1800	3100	20%	53%
				1,1-DICHLOROETHANE	2700	4900	20%	58%
				1,2-DICHLOROETHENE (TOTAL)	89	63	20%	34%
				CHLOROFORM	14	20	20%	35%
				1,2-DICHLOROETHANE	890	1200	20%	30%
				2-BUTANONE	59	80	20%	30%
				1,1,1-TRICHLOROETHANE	3400	5900	20%	54%
				TRICHLOROETHENE	6	6	20%	0%
				BENZENE	71	83	20%	16[illegible]
				4-METHYL-2-PENTANONE	74	100	20%	30[illegible]
				TETRACHLOROETHENE	32	12	20%	91%
				TOLUENE	340	260	20%	27%
				ETHYLBENZENE	77	36	20%	73%
				XYLENE (TOTAL)	490	230	20%	72%
	TOTAL SAMPLES		6					

SEMIVOLATILES

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90290	GWG64	WATER	6	PHENOL	48	47	20%	2%
				2-METHYLPHENOL	380	370	20%	3%
				4-METHYLPHENOL	970	1100	20%	13%
				2,4-DIMETHYLPHENOL	51	56	20%	9%
				NAPHTHALENE	230	210	20%	9%
				2-METHYLNAPHTHALENE	770	700	20%	10%
				ACENAPHTHENE	48	39	20%	21%
				PHENANTHRENE	350	270	20%	26%
	TOTAL SAMPLES		6					

TABLE 2 - 1

ORGANIC FRACTIONS
WATER SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

DIOXIN/FURANS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	GWG64	WATER	2	OCDD	8630	6450	20%	29%
	TOTAL SAMPLES		2					

* - MPC; MAXIMUM POSSIBLE CONCENTRATION REPORTED IN SAMPLE AND /OR DUPLICATE SAMPLE. REPORTED AS MPC DUE TO THE PRESENCE OF POTENTIAL INTERFERENCES WHICH DO NOT SATISFY IDENTIFICATION CRITERIA (I.E., ION RATIOS).

PESTICIDES/AROCLORS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90290	GWG64	WATER	2	ALPHA-CHLORDANE	0	0.14	20%	ND
	TOTAL SAMPLES		2					

HERBICIDES

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90290	GWG64	WATER	2	NO COMPOUNDS DETECTED			20%	
	TOTAL SAMPLES		2					

TABLE 2 - 1
ORGANIC FRACTIONS
WATER SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

VOLATILES

% OF DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
16.7%	2	17	10.5%

SEMI VOLATILES

% OF DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
16.7%	6	2	75.0%

DIOXIN/FURANS

% OF DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	0	1	0.0%

PESTICIDES/AROCLORS

% OF DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	1	0	100.0%

HERBICIDES

% OF DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	1	0	100.0%

ND - INDICATES RPD CALCULATION NOT REQUIRED BECAUSE ONE (1) RESULT IS NON-DETECT AND THE OTHER RESULT IS BELOW THE CRQL.

TABLE 2 - 2

INORGANIC FRACTIONS
WATER SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

METALS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90290	GWG64	WATER	2	ALUMINUM	194000	127000	20%	42%
				ARSENIC	20.2	16.1	20%	23%
				BARIUM	771.0	639.0	20%	19%
				BERYLLIUM	0.73	0.29	20%	86%
				CADMIUM	5.4	3.4	20%	45%
				CALCIUM	145000	143000	20%	1%
				CHROMIUM	238	159	20%	40%
				COBALT	18.5	14.2	20%	26%
				COPPER	79.8	53.4	20%	40%
				IRON	34100	31500	20%	8%
				LEAD	533	178	20%	100%
				MAGNESIUM	11200	10800	20%	4%
				MANGANESE	903	877	20%	3%
				MERCURY	1.4	0.68	20%	69%
				NICKEL	46.5	44.3	20%	5%
				POTASSIUM	5900	6130	20%	4%
				SELENIUM	36	3.5	20%	165%
				VANADIUM	53.8	41.9	20%	25%
				ZINC	247	159	20%	43%
				CYANIDE	3.8	2.7	20%	34%
	TOTAL SAMPLES		2					

TOTAL PETROLEUM HYDROCARBONS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90290	GWG64	WATER	4	TPH	295	250	20%	17%
	TOTAL SAMPLES		4					

TOTAL ORGANIC CARBON

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90290	GWG64	WATER	2	TOC	270	302	20%	11%
	TOTAL SAMPLES		2					

TABLE 2 - 2
INORGANIC FRACTIONS
WATER SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

METALS

% OF DUPLICATE COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	7	13	35%

TOTAL PETROLEUM HYDROCARBONS

% OF DUPLICATE COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
25.0%	1	0	100.0%

TOTAL ORGANIC CARBON

% OF DUPLICATE COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	1	0	100.0%

ND - INDICATES RPD CALCULATION NOT REQUIRED BECAUSE ONE (1) RESULT IS NON-DETECT AND THE OTHER RESULT IS BELOW THE CRDL.

TABLE 2 - 3

ORGANIC FRACTIONS
SOIL SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

VOLATILES

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
CH001	SBG6503	SOIL	6	1,1-DICHLOROETHENE	1	0	35%	ND
				1,1-DICHLOROETHANE	3	0	35%	ND
				1,2-DICHLOROETHENE (TOTAL)	7	0	35%	ND
				1,2-DICHLOROETHANE	4	0	35%	ND
				2-BUTANONE	10	0	35%	ND
				TRICHLOROETHENE	3	3	35%	0%
				BENZENE	20	12	35%	50%
				TETRACHLOROETHENE	63	51	35%	21%
				TOLUENE	160	140	35%	13%
				ETHYLBENZENE	170	110	35%	43%
				XYLENE (TOTAL)	590	400	35%	38%
	TOTAL SAMPLES		6					

SEMIVOLATILES

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
92087	SBG6503	SOIL	5	4-METHYLPHENOL	250	350	35%	33%
				NAPHTHALENE	300	310	35%	3%
				2-METHYLNAPHTHALENE	260	0	35%	ND
90288			1					
	TOTAL SAMPLES		6					

DIOXIN/FURANS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	SBG6503	SOIL	2	OCDD	130*	0	35%	200%
	TOTAL SAMPLES		2					

* - MPC; MAXIMUM POSSIBLE CONCENTRATION REPORTED IN SAMPLE AND /OR DUPLICATE SAMPLE. REPORTED AS MPC DUE TO THE PRESENCE OF POTENTIAL INTERFERENCES WHICH DO NOT SATISFY CRITERIA, I.E., ION RATIOS.

TABLE 2 - 3

ORGANIC FRACTIONS
SOIL SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

PESTICIDES/AROCLORS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	SBG6503	SOIL	2	NO COMPOUNDS DETECTED				
	TOTAL SAMPLES		2					

HERBICIDES

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	SBG6503	SOIL	2	NO COMPOUNDS DETECTED				
	TOTAL SAMPLES		2					

TABLE 2 - 3

ORGANIC FRACTIONS
SOIL SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

VOLATILES

DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
16.7%	11	3	72.7%

SEMIVOLATILES

DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
16.7%	3	0	100.0%

DIOXIN/FURANS

DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	0	1	0.0%

PESTICIDES/AROCLORS

DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	1	0	100.0%

HERBICIDES

DUPLICATES COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	1	0	100.0%

ND - INDICATES RPD CALCULATION NOT REQUIRED BECAUSE ONE (1) RESULT IS NON-DETECT AND THE OTHER RESULT IS BELOW THE CRQL.

TABLE 2 - 4

INORGANIC FRACTIONS
SOIL SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

METALS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	SBG6503	SOIL	2	ALUMINUM	5840	8610	35%	38%
				ARSENIC	0.48	1.5	35%	103%
				BARIUM	32.0	29.4	35%	8%
				CHROMIUM	8.4	7.2	35%	15%
				COBALT	0	1.2	35%	ND
				IRON	1660	3040	35%	59%
				LEAD	62.1	90.2	35%	37%
				MERCURY	0.07	0	35%	200%
				NICKEL	3.8	5.2	35%	31%
				SELENIUM	0.69	0.8	35%	15%
				VANADIUM	4.5	10.5	35%	80%
				ZINC	0	17.7	35%	200%
	TOTAL SAMPLES		2					

TOTAL PETROLEUM HYDROCARBONS

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	SBG6503	SOIL	3	TPH	88000	16000	35%	138%
	TOTAL SAMPLES		3					

TOTAL ORGANIC CARBON

SDG	SAMPLE ID	MATRIX	NO. ASSC. SAMPLES	COMPOUND	SAMPLE CONC.	DUP CONC	MAX RPD	RPD
90287	SBG6720	SOIL	3	TOC	1960	2030	35%	4%
	TOTAL SAMPLES		3					

TABLE 2 - 4

INORGANIC FRACTIONS
SOIL SAMPLE AND DUPLICATE PRECISION
SITE 6 FTA

METALS

DUPLICATE COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
50.0%	5	7	41.7%

TOTAL PETROLEUM HYDROCARBONS

DUPLICATE COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
33.3%	0	1	0.0%

TOTAL ORGANIC CARBON

DUPLICATE COLLECTED	RPD IN	RPD OUT	% WITHIN RPD LIMIT
33.3%	1	0	100.0%

ND - INDICATES RPD CALCULATION NOT REQUIRED BECAUSE ONE (1) RESULT IS NON-DETECT AND THE OTHER RESULT IS BELOW THE CRDL.

TABLE 2 - 5

GC/MS VOLATILE ORGANICS COMPOUNDS
WATER SAMPLE MATRIX SPIKE/MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG CH007		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
VOA COMPOUNDS	UNITS			
1,1-DICHLOROETHENE	ug/L	70	84	*18
TRICHLOROETHENE	ug/L	102	104	2
BENZENE	ug/L	116	104	11
TOLUENE	ug/L	95	101	6
CHLOROBENZENE	ug/L	104	104	0

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

CH007: GWG64, GWG64D, GWG66, GWG65, GWG63, GWG67, GWG62

COMPOUND	ADVISORY LIMITS		RPD
	%R WATER		WATER
1,1-DICHLOROETHENE	61%-145%		14
TRICHLOROETHENE	71%-120%		14
BENZENE	76%-127%		11
TOLUENE	76%-125%		13
CHLOROBENZENE	75%-130%		13

TABLE 2 - 6

SEMIVOLATILE ORGANICS COMPOUNDS
WATER SAMPLE MATRIX SPIKE/MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
SVOA COMPOUNDS	UNITS			
PHENOL	ug/L	88	95	8
2-CHLOROPHENOL	ug/L	94	98	4
1,4-DICHLOROBENZENE	ug/L	58	50	15
N-NITROSO-DI-N-PROP.(1)	ug/L	74	72	3
1,2,4-TRICHLOROBENZENE	ug/L	*0	41	*200
4-CHLORO-3-METHYLPHENOL	ug/L	94	90	4
ACENAPHTHENE	ug/L	*2	*5	*86
4-NITROPHENOL	ug/L	*0	*0	0
2,4-DINITROTOLUENE	ug/L	*0	*0	0
PENTACHLOROPHENOL	ug/L	98	97	1
PYRENE	ug/L	76	47	2

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90290: GWG62, GWG63, GWG64, GWG64D, GWG65, GWG66, GWG67

COMPOUND	ADVISORY LIMITS	RPD
	% R WATER	WATER
PHENOL	12%-110%	42
2-CHLOROPHENOL	27%-123%	40
1,4-DICHLOROBENZENE	36%-97%	28
N-NITROSO-DI-N-PROP.(1)	41%-116%	38
1,2,4-TRICHLOROBENZENE	39%-98%	28
4-CHLORO-3-METHYLPHENOL	23%-97%	42
ACENAPHTHENE	46%-118%	31
4-NITROPHENOL	10%-80%	50
2,4-DINITROTOLUENE	24%-96%	38
PENTACHLOROPHENOL	9%-103%	50
PYRENE	26%-127%	31

TABLE 2 - 7

DIOXIN/FURAN
WATER SAMPLE MATRIX SPIKE/ DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	RPD
METALS COMPOUNDS	UNITS			
2378-TCDD	pg/uL	46.0	60.6	27.4
2378-TCDF	pg/uL	73.2	78.6	7.1
12378-PeCDD	pg/uL	52.4	70.8	29.9
12378-PeCDF	pg/uL	56.0	60.0	6.9
23478-PeCDF	pg/uL	66.8	67.4	0.9
123478-HxCDD	pg/uL	53.2	56.4	5.8
123789-HxCDD	pg/uL	58.0	81.0	33.1
123678-HxCDD	pg/uL	59.6	69.2	14.9
123478-HxCDF	pg/uL	44.8	45.2	0.9
123678-HxCDF	pg/uL	50.8	63.0	21.4
123789-HxCDF	pg/uL	76.2	58.2	26.8
234678-HxCDF	pg/uL	66.6	53.2	22.4
1234678-HpCDD	pg/uL	65.6	47.0	33.0
1234678-HpCDF	pg/uL	96.2	69.0	32.9
1234789-HpCDF	pg/uL	63.0	48.8	25.4
OCDD	pg/uL	51.3	51.2	0.2
OCDF	pg/uL	54.9	53.5	2.6

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90290: GWG64, GWG64D, GWG66

QC LIMITS WERE NOT PROVIDED BY THE LABORATORY.
%R AND RPDS WERE DEEMED IN CONTROL BY THE DATA REVIEWER.

TABLE 2 - 8

PESTICIDES/PCBS
WATER SAMPLE MATRIX SPIKE/MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
PEST COMPOUNDS	UNITS			
gamma-BHC (Lindane)	ug/L	*0	*0	0
Heptachlor	ug/L	*0	*0	0
Aldrin	ug/L	*0	*0	0
Dieldrin	ug/L	*0	*0	0
Endrin	ug/L	*0	*0	0
4,4'-DDT	ug/L	*0	*0	0

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG AND ASSOCIATED SAMPLES

SDG 90290: GWG64, GWG64D, GWG66

COMPOUND	ADVISORY LIMITS		RPD
	% R WATER		WATER
gamma-BHC(Lindane)	56%-123%		15
HEPTACHLOR	40%-131%		20
ALDRIN	40%-120%		22
DIELDRIN	52%-126%		18
ENDRIN	56%-121%		21
4,4'-DDT	38%-127%		27

TABLE 2 - 9

HERBICIDES

WATER SAMPLE MATRIX SPIKE.MATRIX SPIKE DUPLICATES

SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
HERB COMPOUNDS	UNITS			
MCPA	ug/L	108	90	18
DALAPON	ug/L	39	46	17
MCPP	ug/L	58	64	10
DICAMBA	ug/L	38	58	42
2,4'D	ug/L	48	64	29
DICHLOROPROP (2,4-DP)	ug/L	90	80	12
2,4,5-TP (SILVEX)	ug/L	280*	320*	13
2,4,5-T	ug/L	180*	94	63
2,4-DB	ug/L	114	58	32
DINOSEB	ug/L	25	35	34

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG AND ASSOCIATED SAMPLES

90290: GWG64,GWG64D, GWG66

NO QC LIMITS WERE REPORTED BY THE LABORATORY.

TABLE 2 - 10

METALS AND CYANIDE
WATER SAMPLE MATRIX SPIKE/ DUPLICATES
SITE6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290	
MD = MATRIX DUPLICATE *SAMPLE GWG64*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
METALS COMPOUNDS	UNITS		
ALUMINUM	ug/L	1345	0.0
ANTIMONY	ug/L	84.8	NC
ARSENIC	ug/L	*67.1	3.8
BARIUM	ug/L	107.8	0.9
BERYLLIUM	ug/L	104.0	10.4
CADMIUM	ug/L	96.0	200.0
CALCIUM	ug/L	NR	1.5
CHROMIUM	ug/L	98.8	1.1
COBALT	ug/L	93.6	6.3
COPPER	ug/L	97.5	3.6
IRON	ug/L	438.3	2.7
LEAD	ug/L	220.8	16.9
MAGNESIUM	ug/L	NR	1.0
MANGANESE	ug/L	101.2	1.3
MERCURY	ug/L	97.0	0.4
NICKEL	ug/L	95.9	16.2
POTASSIUM	ug/L	NR	2.6
SELENIUM	ug/L	*-298	*32.3
SILVER	ug/L	91.9	NC
SODIUM	ug/L	NR	1.8
THALLIUM	ug/L	*32.9	NC
VANADIUM	ug/L	91.2	9.0
ZINC	ug/L	100.6	0.1
CYANIDE	ug/L	92.0	14.1

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

NC DENOTES THAT BOTH SAMPLES ARE NON-DETECT AND A RPD CANNOT BE CALCULATED.
NR DENOTES THAT A MATRIX SPIKE RECOVERY CALCULATION IS NOT REQUIRED.

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90290: GWG64, GWG64D, GWG66

COMPOUND	ADVISORY LIMITS		RPD
	%R WATER		WATER
ALL COMPOUNDS	75%-125%		+/-20 OR +/-CRDL

+/- CRDL = RPD Limits applicable only on values 5 times the Contract Required Detection Limit (CRDL)

TABLE 2 - 11

TOTAL PETROLEUM HYDROCARBONS
WATER SAMPLE MATRIX SPIKE/ DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290	
MD = MATRIX DUPLICATE *SAMPLE GWG64*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
TPH RESULTS	UNITS		
TOTAL PETROLEUM HYDROCARBONS	mg/L	109.4	0.2

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

NC DENOTES THAT BOTH SAMPLES ARE NON-DETECT AND A RPD CANNOT BE CALCULATED.
NR DENOTES THAT A MATRIX SPIKE RECOVERY CALCULATION IS NOT REQUIRED.
NA DENOTES THAT A DUPLICATE ANALYSIS WAS NOT PERFORMED.

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90290: GWG64, GWG64D, GWG66, GWG63, GWG62

COMPOUND	ADVISORY LIMITS		RPD
	%R WATER		WATER
ALL COMPOUNDS	80-120		+/-20%

TABLE 2 - 12

TOTAL ORGANIC CARBON
WATER SAMPLE MATRIX SPIKE/ DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE GWG64*		SDG 90290	
MD = MATRIX DUPLICATE *SAMPLE GWG64*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
TOC RESULTS	UNITS		
TOTAL ORGANIC CARBON	mg/L	113.6	9.2

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90290: GWG64, GWG64D, GWG66

MS = MATRIX SPIKE *SAMPLE DBG601*		SDG 90287	
MD = MATRIX DUPLICATE *SAMPLE DBG601*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
TOC RESULTS	UNITS		
TOTAL ORGANIC CARBON	mg/L	92.6	0.0

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90290: GWG64, GWG64D, GWG66

COMPOUND	ADVISORY LIMITS		RPD
	%R WATER		WATER
ALL COMPOUNDS	78-118		+/-18%

TABLE 2 - 13

GC/MS VOLATILE ORGANICS COMPOUNDS
SOIL SAMPLE MATRIX SPIKE/MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG CH001		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
VOA COMPOUNDS	UNITS			
1,1-DICHLOROETHENE	ug/Kg	79	78	1
TRICHLOROETHENE	ug/Kg	86	83	4
BENZENE	ug/Kg	92	101	9
TOLUENE	ug/Kg	*334	*460	*32
CHLOROBENZENE	ug/Kg	102	110	8

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508, SBG6520, SBG6708.
SBG6720, SBG6745

COMPOUND	ADVISORY LIMITS		RPD
	% R SOIL		SOIL
1,1-DICHLOROETHENE	59%-172%		22
TRICHLOROETHENE	62%-137%		24
BENZENE	66%-142%		21
TOLUENE	59%-139%		21
CHLOROBENZENE	60%-133%		21

TABLE 2 - 14

SEMIVOLATILE ORGANICS COMPOUNDS
SOIL SAMPLE MATRIX SPIKE/MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG 90287		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
SVOA COMPOUNDS	UNITS			
PHENOL	ug/Kg	78	85	9
2-CHLOROPHENOL	ug/Kg	82	88	7
1,4-DICHLOROBENZENE	ug/Kg	76	83	9
N-NITROSO-DI-N-PROPYLAMINE	ug/Kg	102	113	10
1,2,4-TRICHLOROBENZENE	ug/Kg	83	91	9
4-CHLORO-3-METHYLPHENOL	ug/Kg	93	*108	15
ACENAPHTHENE	ug/Kg	35	38	8
4-NITROPHENOL	ug/Kg	91	*118	26
2,4-DINITROTOLUENE	ug/Kg	*8	*15	*61
PENTACHLOROPHENOL	ug/Kg	93	*187	*67
PYRENE	ug/Kg	102	78	27

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508, SBG6520, SBG6708, SBG6720, SBG6745

COMPOUND	ADVISORY LIMITS	RPD
	%R SOIL	SOIL
PHENOL	26%-90%	35
2-CHLOROPHENOL	25%-102%	50
1,4-DICHLOROBENZENE	28%-104%	27
N-NITROSO-DI-N-PROP	41%-126%	38
1,2,4-TRICHLOROBENZENE	38%-107%	23
4-CHLORO-3-METHYLPHENOL	26%-103%	33
ACENAPHTHENE	31%-137%	19
4-NITROPHENOL	11%-114%	50
2,4-DINITROTOLUENE	28%-89%	47
PENTACHLOROPHENOL	17%-109%	47
PYRENE	35%-142%	36

TABLE 2 - 15

DIOXIN/FURAN
SOIL SAMPLE MATRIX SPIKE/ DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG 90287		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	RPD
DIOXIN/FURAN COMPOUNDS	UNITS			
2378-TCDD	pg/uL	45.6	52.9	14.8
2378-TCDF	pg/uL	83.6	74.3	11.8
12378-PeCDD	pg/uL	68.4	77.8	12.9
12378-PeCDF	pg/uL	71.0	111.0	44.0
23478-PeCDF	pg/uL	73.2	79.4	8.1
123478-HxCDD	pg/uL	57.0	63.0	10.0
123789-HxCDD	pg/uL	58.8	46.4	23.6
123678-HxCDD	pg/uL	63.8	56.2	12.7
123478-HxCDF	pg/uL	83.4	78.2	6.4
123678-HxCDF	pg/uL	54.4	70.4	25.6
123789-HxCDF	pg/uL	70.6	84.4	17.8
234678-HxCDF	pg/uL	58.0	110.0	61.6
1234678-HpCDD	pg/uL	65.2	81.4	22.1
1234678-HpCDF	pg/uL	86.0	77.6	10.3
1234789-HpCDF	pg/uL	66.4	106.0	46.3
OCDD	pg/uL	69.6	56.0	21.7
OCDF	pg/uL	64.1	50.4	23.9

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508

QC LIMITS WERE NOT PROVIDED BY THE LABORATORY.
%R AND RPDS WERE DEEMED IN CONTROL BY THE REVIEWER.

TABLE 2 - 16

PESTICIDES/PCBS
SOIL SAMPLE MATRIX SPIKE/MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG 90287		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
PEST COMPOUNDS	UNITS			
gamma-BHC (Lindane)	ug/Kg	91	90	1
Heptachlor	ug/Kg	70	69	1
Aldrin	ug/Kg	99	99	0
Dieldrin	ug/Kg	64	63	2
Endrin	ug/Kg	82	79	4
4,4'-DDT	ug/Kg	99	100	1

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDGS AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508

COMPOUND	ADVISORY LIMITS		RPD
	%R SOIL		SOIL
gamma-BHC(LINDANE)	46%-127%		50
HEPTACHLOR	35%-130%		31
ALDRIN	34%-132%		43
DIELDRIN	31%-134%		38
ENDRIN	42%-139%		45
4,4'-DDT	23%-134%		50

TABLE 2 - 17

HERBICIDES
SOIL SAMPLE MATRIX SPIKE.MATRIX SPIKE DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG 90287		
MSD = MATRIX SPIKE DUPLICATE		MS	MSD	
RPD = RELATIVE PERCENT DIFFERENCE		%R	%R	%RPD
HERB COMPOUNDS	UNITS			
MCPA	ug/Kg	109	118	8.0
DALAPON	ug/Kg	86	79	8.7
MCPP	ug/Kg	109	109	0.0
DICAMBA	ug/Kg	61	91	40
2,4'D	ug/Kg	91	109	18
DICHLOROPROP (2,4-DP)	ug/Kg	74	91	21
2,4,5-TP (SILVEX)	ug/Kg	85	118	33
2,4,5-T	ug/Kg	65	87	30
2,4-DB	ug/Kg	75	89	18
DINOSEB	ug/Kg	59	59	0

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

CORRESPONDING SDG AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508

NO QC LIMITS WERE REPORTED BY THE LABORATORY.
DATA WAS DETERMINED TO BE IN CONTROL BY DATA VALIDATOR.

TABLE 2 - 18

METALS AND CYANIDE
SOIL SAMPLE MATRIX SPIKE/ DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG 90287	
MD = MATRIX DUPLICATE *SAMPLE SBG6503*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
METALS COMPOUNDS	UNITS		
ALUMINUM	mg/Kg	NR	6.3
ANTIMONY	mg/Kg	93.3	NC
ARSENIC	mg/Kg	104	59.6
BARIUM	mg/Kg	104	6.0
BERYLLIUM	mg/Kg	99.5	NC
CADMIUM	mg/Kg	106	NC
CALCIUM	mg/Kg	NR	*162
CHROMIUM	mg/Kg	91.4	0.9
COBALT	mg/Kg	91.9	NC
COPPER	mg/Kg	91.8	7.6
IRON	mg/Kg	NR	0.5
LEAD	mg/Kg	-4.6	8.5
MAGNESIUM	mg/Kg	NR	10.6
MANGANESE	mg/Kg	94.0	4.4
MERCURY	mg/Kg	94.5	*24.3
NICKEL	mg/Kg	93.4	9.7
POTASSIUM	mg/Kg	NR	200
SELENIUM	mg/Kg	99.9	3.3
SILVER	mg/Kg	87.2	NC
SODIUM	mg/Kg	NR	133
THALLIUM	mg/Kg	87.7	NC
VANADIUM	mg/Kg	88.5	7.4
ZINC	mg/Kg	93.3	3.3
CYANIDE	mg/Kg	98.9	NC

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

NC DENOTES THAT BOTH SAMPLES ARE NON-DETECT AND A RPD CANNOT BE CALCULATED.
NR DENOTES THAT A MATRIX SPIKE RECOVERY CALCULATION IS NOT REQUIRED.

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508

COMPOUND	ADVISORY LIMITS		RPD
	%R SOIL		SOIL
ALL COMPOUNDS	75%-125%		+/-35% OR +/-CRDL

+/- CRDL = RPD Limits applicable only on values 5 times the Contract Required Detection Limit (CRDL)

TABLE 2 - 19

TOTAL PETROLEUM HYDROCARBONS
SOIL SAMPLE MATRIX SPIKE/MATRIX DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6503*		SDG 90287	
MD = MATRIX DUPLICATE *SAMPLE SBG6503*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
TPH RESULTS	UNITS		
TOTAL PETROLEUM HYDROCARBONS	mg/KG	96.9	0.4

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

NC DENOTES THAT BOTH SAMPLES ARE NON-DETECT AND A RPD CANNOT BE CALCULATED.
NR DENOTES THAT A MATRIX SPIKE RECOVERY CALCULATION IS NOT REQUIRED.

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90287: SBG6503, SBG6503D, SBG6508, SBG6708

COMPOUND	ADVISORY LIMITS		RPD
	%R SOIL		SOIL
ALL COMPOUNDS	80-120		+/-20%

2 - 26

TABLE 2 - 20

TOTAL ORGANIC CARBON
SOIL SAMPLE MATRIX SPIKE/ DUPLICATES
SITE 6 FTA

MS = MATRIX SPIKE *SAMPLE SBG6720*		SDG 90287	
MD = MATRIX DUPLICATE *SAMPLE SBG6720*		MS	MD
RPD = RELATIVE PERCENT DIFFERENCE		%R	RPD
TOC RESULTS	UNITS		
TOTAL ORGANIC CARBON	mg/KG	100.4	0.4

*** DENOTES VALUE NOT WITHIN QA/QC ADVISORY LIMITS**

NC DENOTES THAT BOTH SAMPLES ARE NON-DETECT AND A RPD CANNOT BE CALCULATED.
NR DENOTES THAT A MATRIX SPIKE RECOVERY CALCULATION IS NOT REQUIRED.

CORRESPONDING SDG'S AND ASSOCIATED SAMPLES

90287: SBG6720, SBG6720D

COMPOUND	ADVISORY LIMITS		RPD
	%R SOIL		SOIL
ALL COMPOUNDS	74-128		+/-33%

2 - 27

2.1 Water Matrix

No target compounds requiring RPD calculation were detected in either the water samples or associated duplicates for the pesticides/PCBs and herbicides (Tables 2-1). Therefore, no precision assessment was conducted for those parameters.

The GC/MS volatile analysis of the field duplicate pair of sample GWG64 exhibited non-compliant RPDs for seventeen (17) of the nineteen (19) compounds detected (Table 2-1). The non-compliant compounds were chloromethane, vinyl chloride, chloroethane, methylene chloride, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethene (total), chloroform, 1,2-dichloroethane, 2-butanone, 1,1,1-trichloroethane, benzene, 4-methyl-2-pentanone, tetrachloroethene, toluene, ethylbenzene, and xylene (total). The compound chloromethane was detected at a concentration slightly above the CRQL in the original sample and was not detected in the field duplicate sample. The compound chloroethane exhibited a RPD of 30%. Assessment of the initial and continuing calibration criteria indicates that the compounds chloromethane and chloroethane were outside the continuing calibration percent difference (%D) criteria (Appendix A, Table A-1). Further, the compounds chloroethane in both the original sample and the field duplicate, and toluene in the original sample, were reported at concentrations which exceeded the linear range of the instrument. The concentrations which exceeded the linear range were appropriately qualified as estimated, J, and the non-compliance for the compounds chloroethane and toluene are attributed to this. The non-compliance for chloromethane is attributed to the low concentration detected. The compound methylene chloride was detected in the method blank associated with the field duplicate pair (Table 4-18). The compound concentration in the samples was above the action level. However, methylene chloride is a common laboratory contaminant and the poor precision in the field duplicate pair could be affected by the compounds common presence as a contaminant. The non-compliance for methylene chloride can be attributed to random laboratory contamination. The compound carbon disulfide was detected at concentrations below the CRQL in both samples. The non-compliance for carbon disulfide is attributed to the low concentrations detected. RPDs for the other compounds ranged from 30% to 91%. The poor precision may be due to either laboratory inconsistencies or field sampling techniques. There were high levels of target compounds in the samples. Four (4) compounds; 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, and 1,1,1-trichloroethane, required analysis at a dilution factor of 1:100 for accurate quantitation. However, dilution of the sample introduces further opportunity for inconsistency.

The semivolatile analysis of the field duplicate pair of sample GWG64 exhibited a non-compliant RPD for one (1) of the eight (8) compounds detected (Table 2-1). The non-compliant compound was phenanthrene. The non-compliance was slight (26%) and may be attributed to laboratory and/or field inconsistencies. Assessment of the calibration criteria indicates that the system was "in-control" (Appendix A, Table A-2).

The dioxin/furan analysis of the field duplicate pair of sample GWG64 exhibited a non-compliant RPD for the one (1) congener detected (Table 2-1), OCDD. The non-compliance was slight (29%) and may be attributed to laboratory extraction techniques, and/or field inconsistencies. All calibration criteria was met for the analysis of these samples.

Thirteen (13) of the twenty (20) target analytes detected in the metals analysis of the field duplicate pair of sample GWG64 exhibited non-compliant RPDs (Table 2-2). The target analytes with non-compliant RPDs were aluminum, arsenic, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, zinc, and cyanide. The non-compliance for the analytes beryllium, cadmium, cobalt, selenium, vanadium, and cyanide can be attributed to the low concentrations detected. Results were less than the CRDL in one or both of the samples. The analytes lead and zinc were detected in the field blank, PBG601, associated with the field duplicate

pair (Table 4-7). Although the concentrations in the samples were above the action levels for field blank contamination, the poor precision could be affected by the lead and zinc contamination in the field blank. The non-compliance for the analytes lead zinc can be attributed to field contamination. The non-compliant RPDs for the analytes aluminum, arsenic, copper, chromium, lead, and mercury may be attributed to potential field or laboratory inconsistencies.

The analysis of the field duplicate pair for TPH and TOC results exhibited compliant RPDs (Table 2-2).

The evaluation of precision of the water matrix for the MS/MSD samples is provided in Tables 2-5 through 2-12. All MS/MSD sample pairs analyzed for dioxin/furans, pesticides/PCBs, herbicides, TPH, and TOC exhibited acceptable RPDs between spike compounds.

One (1) compound, 1,1-dichloroethene, exhibited a non-compliant RPD value between the MS and MSD of the sample GWG64 (Table 2-5). The non-compliance was slight and based on the assessment of additional QC criteria, the data validator determined that the data did not require qualification.

Two (2) compounds, 1,2,4-trichlorobenzene and acenaphthene, exhibited non-compliant RPDs between the MS and MSD of sample GWG64 (Table 2-6). The recoveries in the MS/MSD pair were poor, with four (4) compounds recovering at less than 10%. 1,2,4-Trichlorobenzene was recovered at 0% in the MS and acceptably in the MSD. Acenaphthene was recovered at 2% in the MS, and 5% in the MSD. Qualifications based on the poor recoveries are discussed in Section 3 Accuracy.

The analyte selenium exhibited a non-compliant RPD between the MD pair analyzed of sample GWG64. All positive and non-detect results were appropriately qualified as estimated, J/UJ.

Based on assessment of duplicate precision evaluation criteria, the water matrix analytical data was acceptable for each SDG with the noted potential for bias. The two (2) volatile compounds, chloroethane and toluene in the field duplicate pair of sample GWG64, which were qualified as estimated, J, because the concentrations exceeded the linear range, should be considered potentially bias. The potential for bias for the analyte selenium is present in the metals analysis.

2.2 Soil Matrix

The assessment of soil matrix environmental and associated duplicate samples for precision is provided in Tables 2-3 and 2-4. No pesticides or herbicides were detected in the environmental sample or associated duplicate (Table 2-3), therefore no assessment of precision was conducted.

One soil sample, SBG6503, and its associated duplicate exhibited positive results requiring the calculation of RPDs for six (6) volatile compounds (Table 4-3). Three (3) of the six (6) compounds exhibited non-compliant RPDs. The non-compliant compounds were benzene, ethylbenzene, and xylene (total). The compounds ethylbenzene, benzene, and xylene (total) exhibited non-compliance (43%, 50%, and 38%, respectively) which could be attributed to laboratory and/or field sampling inconsistencies. In addition, the sample and duplicate required analysis at a dilution factor of 1:5 for accurate quantitation of the compound xylene (total). Sample dilution introduces inconsistency into the analysis and the presence of xylene isomers poses difficulties in accurate quantitation. Assessment of the initial and continuing calibration criteria samples for the non-compliant compounds indicates that they were "in-control" for the non-compliant compounds (Appendix A, Table A-1, SDG CH001).

The semivolatile analysis of the field duplicate pair of sample SBG6503 exhibited acceptable RPDs for the three (3) detected compounds (Table 2-3).

One (1) dioxin/furan compound was detected in the analysis of the sample SBG6503, and the associated duplicate (Table 2-3). The compound, OCDD exhibited a non-compliant RPD because it was detected in the duplicate but not in the original sample. OCDD was reported as MPC in the duplicate due to unsatisfied identification criteria, i.e. ion ratios. The non-compliance is attributed to laboratory and/or field inconsistencies. The MPC result should not be considered as a true positive result. It is a maximum possible concentration. The actual result may be less than the reported result or non-detect for that congener. All initial and continuing calibration criteria for the analysis of these samples was in control.

Seven (7) of the twelve (12) metals target analytes exhibited non-compliant RPDs for the soil field duplicate pair of sample SBG6503 (Table 2-4). The target analytes with non-compliant RPDs were aluminum, arsenic, iron, lead, mercury, vanadium, and zinc. The analytes arsenic and vanadium were detected at concentrations below the CRDLs in both the original sample and the field duplicate sample. The non-compliance for these compounds can be attributed to the low concentrations detected. The analyte mercury was detected in the original sample at a concentration slightly above the CRDL, but was not detected in the field duplicate sample. The analyte mercury was also non-compliant in the matrix duplicate analysis of this sample. This indicates laboratory inconsistency. The non-compliance for mercury may be attributed to the low concentration detected as well as to potential laboratory inconsistency. The non-compliant RPD for the analyte aluminum was slight and may be attributed to laboratory and/or field inconsistencies. The analytes iron, lead, and zinc were detected in the associated field blank (Table 4-7). Zinc was qualified as U in the original sample because the concentration was within the five times (5X) rule for qualification based on blank contamination. The concentration in the field duplicate sample was above the action limit. However, the non-compliance for zinc is attributed to field contamination because the poor precision could have been affected by the presence of the zinc in the field blank. The analytes iron and lead were detected in the field duplicate pair at concentrations above the 5X rule action level. However, the field blank contamination for iron and lead could affect precision results. The non-compliance for the analytes iron and lead can be attributed to field contamination also.

The TPH analysis of the environmental sample SBG6503 and its duplicate exhibited a non-compliant RPD (Table 2-4). The RPD value was 138%. The non-compliance may attributed to the difficulty in obtaining a true field duplicate for a soil sample or other laboratory and field inconsistencies. The method does not lend itself to precision measurements since it is very sensitive to non-homogenous sample aliquots. In addition, the method states that "a loss of about half of any gasoline present during the extraction manipulations can be expected" (Petroleum Hydrocarbons, Total Recoverable Method 418.1 (Spectrophotometric, Infrared) Issued 1978), which indicates that the method is also prone to extraction losses. The poor precision did not result in qualification based on the RPD results because the decision to use the method must also include consideration of the inherent difficulties of the methodology.

The TOC analysis of the environmental sample SBG6503 and its duplicate exhibited an acceptable RPD value (Table 2-4).

The assessment of precision of the soil matrix for the MS/MSD samples is provided in Tables 2-13 through 2-20. All MS/MSD sample pairs analyzed for dioxin/furans, pesticides/PCBs, herbicides, TPH, and TOC exhibited acceptable RPDs between spike compounds (Tables 2-15, 2-16, 2-17, 2-19, and 2-20).

The GC/MS volatile analysis of the MS/MSD pair of sample SBG6503 exhibited one (1) spike compound with a non-compliant RPD (Table 2-13). The non-compliant compound was toluene. The MS/MSD recoveries of the compound were high. The RPD value was affected by the disparity between the non-compliant spike recoveries, which can be attributed to the high concentration of toluene detected in the original sample. The MS/MSD concentrations of toluene exceeded the linear range of the instrument because the original sample concentration of toluene required dilution for accurate quantitation. However, the laboratory is not required to dilute the MS/MSD samples to bring spike compounds into linear range. Therefore, the data validator determined that the analytical result did not require qualification.

The semivolatile analysis of the MS/MSD pair of sample SBG6503 exhibited two (2) compounds with non-compliant RPDs (Table 2-14). The non-compliant compounds were 2,4-dinitrotoluene and pentachlorophenol. The spike recoveries were higher overall in the MSD. This disparity caused the RPD values to fall outside criteria. However, based on the assessment of additional QC criteria, analytical data did not require qualification.

The MS/MD sample pair analyzed for metals/cyanide for sample SBG6503 exhibited non-compliant RPDs for two (2) target analytes. The non-compliant target analytes were calcium and mercury (Table 2-18). The analyte calcium was detected in the rinseate blank associated with the sample (Table 4-15). The non-compliance is attributed to field and/or laboratory inconsistencies. The positive and non-detect values for calcium in samples associated with SDG 90287 were appropriately qualified as estimated, J/UJ. The non-compliance for mercury was slight and the data validator determined that the analytical data did not require qualification.

Based on assessment of duplicate precision evaluation criteria, the soil matrix analytical data was acceptable for each SDG. The potential for bias results is present in the metals analysis of soil samples in SDG 94003 for the analyte calcium.

3.0 ACCURACY

The assessment of accuracy is evaluated by comparison of the percent recovery (%R) computed from the known concentration of analyte spikes and their recovered concentration versus the analytical method acceptance criteria. Spike recoveries provide an indication of bias, where the reported data may either overestimate or underestimate the actual concentration of detected compounds and/or the detection limits. Recoveries outside acceptable criteria may be caused by factors such as matrix interference, poor analytical precision, or instrument calibration.

The following Sections summarize the evaluation of analytical accuracy for the water matrix (groundwater), and the soil matrix (soil boring samples) for the following analytical groups:

- GC/MS volatile organic compounds (GC/MS VOCs);
- semivolatile organic compounds (SVOCs);
- dioxin/furan compounds (D/F);
- pesticides, PCBs, and herbicides; and
- inorganics, cyanide, TPH and TOC.

Accuracy was assessed using MS and MSD samples for organic analyses and MS samples for inorganic analyses for each matrix, as well as surrogate compound recoveries for those analytical fraction which utilize them. Accuracy for the dioxin/furan fraction was assessed using the recovery of internal standards. The results of the evaluation of accuracy for the MS/MSD samples is provided in Tables 2-5 through 2-12 for water matrix and Tables 2-13 through 2-20 for soil matrix. The results of the evaluation of accuracy for the surrogates in the samples are provided in Table 3-1 through 3-4 for the water matrix, Tables 3-5 through 3-8 for the soil matrix. Internal standards recovery results for the evaluation of accuracy in the dioxin/furan fraction are provided in Table 3-9 for the water matrix, and Table 3-10 for the soil matrix.

3.1 Water Matrix

All MS/MSD sample pairs analyzed for GC/MS volatile organics, dioxin/furans, TPH and TOC exhibited "in-control" recovery results (Tables 2-5, 2-7, 2-11 & 2-12, respectively).

Three (3) GC/MS volatile samples exhibited non-compliant surrogate recoveries (Table 3-1). The surrogate compound toluene-d_8 was recovered slightly high in samples GWG64 and GWG66RE. The surrogate compound bromofluorobenzene was recovered slightly high in sample GWG64D. This indicates that positive results for target compounds in samples GWG64, GWG64D, and GWG66RE could be overestimated. The positive results for compounds in those three (3) samples were appropriately qualified as estimated, J. There were fifteen (15) positive results in each of the samples GWG64 and GWG64D. GWG66RE was rejected in favor of the original analysis.

The MS/MSD of sample GWG64 analyzed for semivolatile organics had non-compliant %Rs for 1,2,4-trichlorobenzene, acenaphthene, 4-nitrophenol, and 2,4-dinitrotoluene (Table 2-6). The %Rs for five (5) of the seven (7) spike recoveries were 0%, with the other two (2) recoveries less than 10%. This indicates that reported positive values for all compounds in the sample GWG64 underestimated and that the non-detect results are unreliable. Positive results were appropriately qualified as estimated, J, and non-detect results were rejected, R. This constituted a rejection of fifty-six (56) data points. However, the completion goal for this fraction was still met (85.4%).

Three (3) semivolatile samples exhibited surrogate recoveries which were outside the minimum acceptable criteria for accuracy. The surrogate compound phenol-d_5 was recovered less than 10% in samples PBG601 and PBG601RE. This indicates that positive results for the acid fraction in

TABLE 3 - 1

SURROGATE % RECOVERIES
GC/MS VOLATILE WATER SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	SMC1	SMC2	SMC3	TOTAL OUT
CH007	PBG604	101	113	109	0
	TRPBLK	106	101	99	0
	TBG602	106	103	106	0
	TBG603	110	102	109	0
	ERG603	107	103	108	0
	GWG64	*115	104	103	1
	GWG64D	107	*117	104	1
	GWG66	110	91	92	0
	GWG65	106	103	87	0
	GWG63	108	99	76	0
	GWG67	100	91	77	0
	ERG601	89	94	104	0
	ERG602	99	108	111	0
	GWG64DL	95	99	106	0
	GWG64DDL	89	101	100	0
	GWG62	100	106	101	0
	GWG64MS	92	100	91	0
	GWG64MSD	91	104	103	0
	DBG601	106	107	95	0
	GWG66RE	*114	102	83	1

SMC1 = TOLUENE-D8 QC LIMITS 88% - 110%
SMC2 = BROMOFLUOROBENZENE QC LIMITS 86% - 115%
SMC3 = 1,2-DICHLOROETHANE-D4 QC LIMITS 76% - 114%

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
20	57	3	95.0%

TABLE 3 - 2

SURROGATE % RECOVERIES
SEMIVOLATILE WATER SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	S1	S2	S3	S4	S5	S6	S7	S8	TOTAL OUT
90287	DBG601	101	100	113	97	90	103	96	86	0
	ERG601	101	97	114	94	87	100	94	86	0
	PBG601	101	104	119	*2	31	68	62	92	1
	PBG601RE	92	95	133	*3	37	68	81	67	1
90290	ERG603	98	109	129	87	80	96	93	93	0
	GWG62	89	100	76	83	74	98	86	88	0
	GWG63	99	105	72	90	80	113	94	92	0
	GWG64	97	65	45	99	79	112	103	57	0
	GWG64D	99	56	42	100	75	118	108	75	0
	GWG65	96	80	34	84	78	*130	90	89	1
	GWG66	94	80	40	92	79	110	100	85	0
	GWG67	98	95	40	82	75	110	89	93	0
	GWG64MS	91	52	42	99	78	98	106	60	0
	GWG64MSD	92	59	42	106	78	89	110	61	0
90288	ERG602	96	105	120	86	76	96	90	95	0

S1 = NITROBENZENE-D5 QC LIMITS = 35% - 114%
S2 = 2-FLUOROBIPHENYL QC LIMITS = 43% - 116%
S3 = TERPHENYL-D14 QC LIMITS = 33% - 141%
S4 = PHENOL D-5 QC LIMITS = 10% - 110%
S5 = 2-FLUOROPHENOL QC LIMITS = 21% - 110%
S6 = 2,4,6-TRIBROMOPHENOL QC LIMITS = 10% - 123%
S7 = 2-CHLOROPHENOL-D4 QC LIMITS = 33% - 110% (ADVISORY)
S8 = 1,2-DICHLOROBENZENE-D4 QC LIMITS = 16% - 110% (ADVISORY)

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
15	117	3	97.5%

TABLE 3 - 3

SURROGATE % RECOVERIES
PESTICIDES/PCB WATER SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	TCX1	TCX2	DCB1	DCB2	TOTAL OUT
90287	DBG601	91	85	63	61	0
	ERG601	93	89	60	*58	1
	PBG601	92	83	*52	*49	2
90290	ERG603	92	90	*43	*42	2
	GWG64	*0	*0	*0	*0	4
	GWG64D	*0	*0	*0	*0	4
	GWG66	*0	*0	*0	*0	4
	GWG64MS	*0	*0	*0	*0	4
	GWG64MSD	*0	*0	*0	*0	4

TCX = TETRACHLORO-M-XYLENE QC LIMITS = 60% - 150%
DCB = DECACHLOROBIPHENYL QC LIMITS = 60% - 150%

# SAMPLE	% REC IN	%REC OUT	% TOTAL IN
9	11	25	30.6%

TABLE 3 - 4

SURROGATE % RECOVERIES
HERBICIDE WATER SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	2,4-DCP	TOTAL OUT
90287	DBG601	123	0
	ERG601	109	0
	PBG601	119	0
90290	ERG603	78	0
	GWG64	*152	1
	GWG64D	*158	1
	GWG66	ND	1
	GWG64MS	ND	1
	GWG64MSD	ND	1

2,4-DCP - 2,4-DICHLOROPHENYLACETIC ACID

ND - NOT DETERMINED DUE TO MATRIX INTERFERENCE

NO QC LIMITS REPORTED BY LABORATORY.

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
9	4	5	44.4%

TABLE 3 - 5

SURROGATE % RECOVERIES
GC/MS VOLATILE SOIL SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	SMC1	SMC2	SMC3	TOTAL OUT
CH001	SBG6503	120	80	77	0
	SBG6503MS	124	105	98	0
	SBG6503MSD	126	105	78	0
	SBG6508	*202	*191	*58	3
	SBG6708	91	87	87	0
	SBG6720	93	95	83	0
	SBG6745	90	90	86	0
	SBG6503DL	120	104	94	0
	SBG6503D	*144	89	90	1
	SBG6520	131	100	87	0
	SBG6508DL	123	108	85	0
	SBG6508DL	99	98	115	0

SMC1 = TOLUENE-D8 QC LIMITS 84% - 138%
SMC2 = BROMOFLUOROBENZENE QC LIMITS 59% - 113%
SMC3 = 1,2-DICHLOROETHANE-D4 QC LIMITS 70% - 121%

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
12	32	4	88.9%

TABLE 3 - 6

SURROGATE % RECOVERIES
SEMIVOLATILE SOIL SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	S1	S2	S3	S4	S5	S6	S7	S8	TOTAL OUT
90287	SBG6503	100	95	79	94	82	102	90	84	0
	SBG6503MS	97	84	81	96	89	*130	92	84	1
	SBG6503MSD	111	35	80	104	94	*132	99	91	1
	SBG6508	96	84	91	90	83	99	89	84	0
	SBG6708	98	91	98	94	86	122	91	83	0
	SBG6720	88	85	95	84	78	98	81	74	0
	SBG6503D	114	*28	71	98	92	119	96	88	1
	SBG6520	93	77	68	89	78	103	86	79	0
90288	SBG6745	77	95	83	70	56	86	74	74	0

S1 = NITROBENZENE-D5 QC LIMITS = 23% - 120%
S2 = 2-FLUOROBIPHENYL QC LIMITS = 30% - 115%
S3 = TERPHENYL-D14 QC LIMITS = 18% - 137%
S4 = PHENOL D-5 QC LIMITS = 24% - 113%
S5 = 2-FLUOROPHENOL QC LIMITS = 25% - 121%
S6 = 2,4,6-TRIBROMOPHENOL QC LIMITS = 19% - 122%
S7 = 2-CHLOROPHENOL-D4 QC LIMITS = 20% - 130% (ADVISORY)
S8 = 1,2-DICHLOROBENZENE-D4 QC LIMITS = 20% - 130% (ADVISORY)

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
9	69	3	95.8%

3 - 7

TABLE 3 - 7

SURROGATE % RECOVERIES
PESTICIDES/PCB SOIL SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	TCX1	TCX2	DCB1	DCB2	TOTAL OUT
90287	SBG6503	84	82	*27	*26	2
	SBG6503MS	83	79	*30	*28	2
	SBG6503MSD	82	81	*27	*24	2
	SBG6503D	82	81	*28	*27	2
	SBG6508	82	*59	*28	*24	3

TCX = TETRACHLORO-M-XYLENE QC LIMITS = 60% - 150%
DCB = DECACHLOROBIPHENYL QC LIMITS = 60% - 150%

* VALUES OUTSIDE OF QC LIMITS

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
5	9	11	45.0%

3-8

TABLE 3 - 8

SURROGATE % RECOVERIES
HERBICIDE SOIL SAMPLES
SITE 6 FTA

SDG	SAMPLE ID	2,4-DCP	TOTAL OUT
90287	SBG6503	123	0
	SBG6503MS	109	0
	SBG6503MSD	119	0
	SBG6508	124	0
	SBG6503D	165*	1

2,4-DCP - 2,4-DICHLOROPHENYLACETIC ACID

NO QC LIMITS REPORTED BY LABORATORY.

# SAMPLES	% REC IN	%REC OUT	% TOTAL IN
5	4	1	80.0%

TABLE 3 - 9

WATER SAMPLE INTERNAL STANDARDS % RECOVERIES
DIOXIN/FURAN
SITE 6 FTA

	DBG601	PBG601	ERG601	ERG603	GWG64	GWG64M	GWG64MSD	GWG64D	GWG66
I.S. COMPOUND									
13C-2378-TCDD	CN	77.8	79	CN	68.9	81.2	47.3	63	69.1
13C-2378-TCDF	58.3	66.6	56.8	64.3	48.3	55.6	38.5	43.9	47.2
13C-12378-PeCDD	82.8	87.5	79.6	83.3	54.4	75.4	40.9	55.6	51.8
13C-12378-PeCDF	66	71.8	*36.3	59.2	44.1	58.5	53.3	70	72.4
13C-23478-PeCDF	83.8	83.2	61.3	82.7	52.4	55.1	46.6	52.4	54.8
13C-123478-HxCDD	61	55.3	70.8	55.7	113	104	79.6	85.8	72.2
13C-123678-HxCDD	83.5	89.5	57	72.9	122	92.5	66.1	124	65.7
13C-123478-HxCDF	73.7	75.1	49.7	63.4	106	129	105	115	98.9
13C-123678-HxCDF	69.2	68.9	74	52	114	104	84.5	103	74.7
13C-234678-HxCDF	77.5	69.5	47	63.6	111	71.4	82	98	74.3
13C-123789-HXCDF	74.5	74.3	62.1	66.2	86.5	69.3	73.4	76.3	66.5
13C-1234678-HpCDD	83.3	102	97	75.9	134	89.6	93.9	83.3	58.2
13C-1234678-HpCDF	78.7	87.9	86.3	64.8	112	66.3	79.5	74.2	73.9
13C-1234789-HpCDF	79.8	102	95.1	72.6	89.5	88.7	88.5	97	60.5
13C-OCDD	97.9	121	116	94.5	100	113	97.3	113	52.4
TOTAL OUT	0	0	1	0	0	0	0	0	0

QC LIMITS: 40% - 120%
* - VALUE OUTSIDE OF QC LIMITS
CN - A NON-SPECIFIC INTERFERENCE DID NOT ALLOW ADEQUATE PERFORMANCE FOR TETRA- AND PENTA- HOMOLOGUES.

# SAMPLE	% REC IN	% REC OUT	% TOTAL IN
9	134	1	99.3%

TABLE 3 - 10

SOIL SAMPLE INTERNAL STANDARDS % RECOVERIES
DIOXIN/FURAN
SITE 6 FTA

	SBG6503	SBG6503MS	SBG6503MD	SBG6503D	SBG6508
I.S. COMPOUND					
13C-2378-TCDD	131	107	122	72.5	103
13C-2378-TCDF	76.4	115	80.2	95.9	77.2
13C-12378-PeCDD	93.3	120	66.2	89.5	97.8
13C-12378-PeCDF	89	91.6	48.3	*39.5	100
13C-23478-PeCDF	84.9	105	62.6	79.1	81.7
13C-123478-HxCDD	126	145	130	123	*159
13C-123678-HxCDD	*154	121	120	107	130
13C-123478-HxCDF	110	86.3	92.4	111	*193
13C-123678-HxCDF	146	150	91.8	109	150
13C-234678-HxCDF	93.4	108	78.7	85.1	130
13C-123789-HXCDF	96.8	109	49.8	100	120
13C-1234678-HpCDD	121	110	74.4	132	119
13C-1234678-HpCDF	137	92.5	89.6	121	103
13C-1234789-HpCDF	106	99.3	49.5	84.1	110
13C-OCDD	137	121	129	135	*166
TOTAL OUT	**1**	**0**	**0**	**1**	**3**

QC LIMITS: 40% - 120%
* - VALUE OUTSIDE OF QC LIMITS

# SAMPLES	% REC IN	% REC OUT	% TOTAL IN
5	70	5	93.3%

two (2) samples may be underestimated and that non-detect results are unreliable. All positive results in samples PBG601 and PBG601RE were appropriately qualified as estimated, J, and non-detect results were rejected, R. As noted in the previous paragraph, the completion goal for the fraction was still met. The surrogate compound 2,4,6-tribromophenol was recovered high in sample GWG65. However, the functional guidelines allows one (1) surrogate compound for each fraction to be outside criteria as long as the recovery is above 10%. Therefore, the data were not qualified for this sample.

The internal standard (IS) recoveries for the dioxin/furan fraction were acceptable with the exception of one (1) IS in sample ERG601, which was recovered low. The reported non-detect result for 1,2,3,7,8-PeCDF in sample ERG601 was appropriately qualified as estimated, UJ, and should be considered potentially underestimated.

The pesticide analysis of the MS/MSD pair of sample GWG64 exhibited 0% recovery for all spike compounds (Table 2-8). In addition, the MS/MSD exhibited 0% surrogate recovery on both columns, which resulted in rejection of all of the non-detect results (Table 3-3). This action is confirmed by the lack of recoveries (0%) for the spike compounds in the MS/MSD. Further, the surrogate compounds exhibited 0% recovery in the three (3) field samples, GWG64, GWG64D, and GWG66. No positive results were reported in these samples. All non-detect results in these three (3) samples were appropriately rejected, R. The groundwater matrix exhibited a 0% completion goal for this (water) matrix. The surrogate compound DCB was recovered low in the QC blank samples ERG601, ERG603, and PBG601. All positive and non-detect results in these three (3) QC blanks were appropriately qualified as estimated, J/UJ.

The MS/MSD analysis of the sample GWG64 for the herbicide fraction exhibited high recoveries for the compound silvex in both the MS and MSD and for 2,4,5-T in the MS(Table 2-9). The laboratory noted matrix interferences which biased the recoveries high. The compound 2,4,5-T was recovered acceptably in the MSD. Therefore, the non-detect results reported for silvex in the associated samples in SDG 90290 were qualified as estimated, UJ, due to the potential for masking of low level postive results. The non-detect results for the compound 2,4,5-T were not qualified because the compound were recovered acceptably in the MSD sample.

The herbicide surrogate recoveries for one (1) field sample, GWG66, and the MS/MSD of sample GWG64 were reported as ND (not determined due to matrix interferences) (Table 3-4). The recoveries for samples GWG64 and GWG64D were above acceptable limits. Postive and non-detect results in sample GWG66 were rejected, R, due to the lack of surrogate recovery. This constituted a rejection of ten (10) data points, which is 50% of the total data points for the matrix. The completion goal for the matrix was not met. The samples GWG64 and GWG64D did not require qualification because there were no positive results reported for the target compounds in these samples.

The MS/MD analyzed for inorganic analytes exhibited three (3) compounds with non-compliant %Rs (Table 2-10). The non-compliant target analytes were arsenic, selenium, and thallium in the MS sample GWG64. The %Rs for arsenic and thallium were below the minimum criteria for accuracy, which indicates that the quantified values for these detected target analytes associated with SDG 90290 may be underestimated. Positive and non-detect results for arsenic and thallium were appropriately qualified as estimated, J/UJ. The analyte selenium was recovered at less than 30%. This indicates that positive results for selenium may be underestimated and non-detect results are unreliable. Positive results for selenium in the samples associated with SDG 90290 were qualified as estimated, J, and non-detect results were rejected, R. This constituted a rejection of one (1) data point in the field duplicate sample GWG64D. The completion goal for the matrix (QC) was still met.

The MS recoveries for the TPH and TOC fractions exhibited compliant recoveries (Tables 2-11 and 2-12, respectively).

Based on assessment of MS/MSD and surrogate sample accuracy evaluation criteria, the water matrix analytical data was acceptable for each SDG with the exception of the pesticide fraction and the herbicide fraction. Some of the analytical results may be overestimated or underestimated. For the pesticide/PCB fraction, no viable results were obtained for the two (2) field samples or the field duplicate sample due to 0% surrogate recoveries. For the herbicide fraction, no viable results were obtained for sample GWG66, due to a lack of surrogate recovery caused by matrix interferences.

3.2 Soil Matrix

The assessment of accuracy for soil matrix MS/MSD samples is provided in Tables 2-13 through 2-20. All MS/MSD sample pairs analyzed for dioxin/furans, pesticides/PCBs, herbicides, metals/cyanide, TPH, and TOC exhibited "in-control" recovery results (Tables 2-15, 2-16, 2-17, 2-18, 2-19, and 2-20, respectively). The assessment of accuracy for soil matrix surrogate recoveries is provided in Tables 3-5 through 3-8. All surrogate compound recovery results for herbicides were "in-control" (Table 3-8).

The MS/MSD sample pair of sample SBG6503 analyzed for GC/MS volatiles exhibited a non-compliant %R for one compound, toluene (Table 2-13). The recovery results were above the maximum criteria for accuracy, which indicates that the quantified values for the positive for this compound associated with SDGs CH001 may be overestimated. However, the MS/MSD concentrations which were reported exceeded the linear range of the instrument due to the high concentration of toluene in the original sample. Values reported near or above the instrument linear range should be considered estimated. However, accurate quantitation of sample SBG6503 required dilution to bring the concentration within the linear range. Therefore, the data validator determined that the result for toluene in sample SBG6503 did not require qualification.

Two (2) samples analyzed for GC/MS volatiles exhibited non-compliant surrogate recoveries (Table 3-5). Sample SBG6508 exhibited two (2) surrogate compounds, toluene-d_8 and 1,2-dichloroethane-d_4, were recovered high, and one (1) surrogate compound, bromofluorobenzene, was recovered low. The variable recoveries indicate potential low and/or high bias. Positive and non-detect results in the sample were appropriately qualified as estimated, J/UJ. Sample SBG6503D exhibited one (1) surrogate compound, toluene-d_8, which was recovered high. This indicates that positive results reported in this sample may be overestimated. Positive results reported in sample SBG6503D were appropriately qualified as estimated, J.

Four (4) compounds, 4-chloro3-methylphenol, 4-nitrophenol, and pentachlorophenol in the semivolatile analysis of sample SBG6503 exhibited high recoveries in the MD (Table 2-14). The compound 2,4-dinitrotoluene exhibited a low recovery in both the MS and the MSD. However, based on the assessment of additional QC criteria, data were not qualified.

Three (3) samples analyzed for semivolatiles exhibited non-compliant recoveries for one surrogate compound each (Table 3-2). The compound 2,4,6-tribromophenol was recovered high in the MS and MSD of sample SBG6503. The compound 2-fluorobiphenyl was recovered low in sample SBG6503D. However, the functional guidelines allows one (1) surrogate compound per fraction to be outside criteria, as long as the recovery is above 10%. Therefore, the analytical data did not require qualification.

Two (2) samples exhibited high IS recovery in the dioxin/furan fraction (Table 3-10). The positive results for OCDD in sample SBG6508 was appropriately qualified as estimated, J. No other positive results requiring qualification were noted.

The pesticides/PCB surrogate compound DCB was recovered low in sample SBG6503, SBG6503MS, SBG6503MD, and SBG6503D (Table 3-7). DCB and TCX were recovered low in sample SBG6508. This indicates that reported results in these samples may be underestimated. Positive and non-detect results for the noted samples were appropriately qualified as estimated, J/UJ.

The herbicide surrogate compound 2,4-DCP was recovered high in the sample SBG6503D. Qualification was not required because there were no positive results reported in the sample.

Based on assessment of MS/MSD and surrogate sample accuracy evaluation criteria, the soil matrix analytical data was acceptable for each SDG. However, some of the analytical results may be overestimated or underestimated.

4.0 REPRESENTATIVENESS

Representativeness of the environmental sample analytical data was assessed using trip blanks, field blanks, equipment rinseate blanks, and laboratory method blanks. The environmental samples and associated blanks were analyzed for the following target analyte groups:

- GC/MS volatile organic compounds (GC/MS VOCs);
- semivolatile organic compounds (SVOCs);
- dioxin/furan compounds (D/Fs);
- pesticides, PCBs, and herbicides; and
- inorganics, cyanide, TPH, and TOC.

The trip blank samples were analyzed for only GC/MS volatile organic target analytes. Field blanks, equipment rinseate blanks, and laboratory method blanks were analyzed for target analytes in each listed category. The assessment of representativeness is summarized in tabular form for each type of blank, trip blank results are summarized in Table 4-1, source blank results are summarized in Tables 4-2 through 4-9, equipment blank results are summarized in Tables 4-10 through 4-17 and method blank results are summarized in Tables 4-18 through 4-23.

If contaminants were detected in a blank, corrective actions were made for the chemical analytical data during data validation by Heartland. The corrective action consisted of amending the laboratory reported results for organic and inorganic target analytes by the criteria. The following describes the Validation Qualifier code in the blank summary tables.

Organic Target Analytes

- CRDL Validation Qualifier. If a sample result for the blank contaminant was less than the CRQL and less than 5 times the blank value (10 times for common laboratory contaminants), the sample result was rejected and amended as estimated non-detected at the CRQL for the target compound.

- U Validation Qualifier. If a sample result for the blank contaminant was greater than the sample CRQL and less than 5 times the blank value (10 times for common laboratory contaminants), the sample result for the blank contaminant was amended as non detect at the concentration reported in the sample results.

- No Action (NA). If a sample result for the blank contaminant was greater than the CRQL and 5 time the blank value (10 times for common laboratory contaminants), the result was not amended.

Inorganic Target Analytes

- U Validation Qualifier. If a sample result for the blank contaminant was less than the IDL and less than 5 times the blank value, the sample result was amended as non-detected.

- UJ Validation Qualifier. If a sample result for the blank contaminant was less than the sample IDL when the absolute value of the negative blank value was greater than the IDL, the sample result for the blank contaminant was amended as estimated non-detected.

TABLE 4 - 1

GC/MS VOLATILE COMPOUNDS DETECTED IN TRIP BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	TB CONC.	UNITS	VALIDATION QUALIFIER
CH007	TBG602	SBG6745	NO CONTAMINATION FOUND			
CH007	TBG603	GWG64, GWG64D, GWG66, GWG65, GWG63, GWG67, GWG62 GWG64MS, GWG64MD	NO CONTAMINATION FOUND			
CH007	TRPBLK	SBG6503, SBG6503D, SBG6508, SBG6520, SBG6708, SBG6720, SBG6503MS, SBG6503MD, ERG601, PBG601, DBG601	NO CONTAMINATION FOUND			

4-2

TABLE 4 - 2

GC/MS VOLATILES DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
CH007	DBG601	GWG63	XYLENE (TOTAL)	3	ug/L	
		GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, GWG65, GWG63, GWG67, GWG62, SBG6503, SBG6503MS, SBG6503MD, SBG6503 SBG6508, SBG6520, SBG6708, SBG6720, SBG6745				
		GWG64, GWG64D, SBG6503D, SBG6520	ACETONE	42	ug/L	U
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, GWG65, GWG63, GWG67, GWG62, SBG6503, SBG6503MS, SBG6503MD, SBG6503 SBG6508, SBG6520, SBG6708, SBG6720, SBG6745	BROMODICHLOROMETHANE DIBROMOCHLOROMETHANE	1 1	ug/L ug/L	

TABLE 4 - 3

SEMIVOLATILES DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, GWG65, GWG63, GWG67, GWG62, SBG6503, SBG6503MS, SBG6503MD, SBG6503 SBG6508, SBG6520, SBG6708, SBG6720, SBG6745	NO CONTAMINATION FOUND			
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, GWG65, GWG63, GWG67, GWG62, SBG6503, SBG6503MS, SBG6503MD, SBG6503 SBG6508, SBG6520, SBG6708, SBG6720, SBG6745	NO CONTAMINATION FOUND			

TABLE 4 - 4

DIOXIN/FURANs DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	OCDD	5.44	pg/L	
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	OCDD	6.09	pg/L	

TABLE 4 - 5

PESTICIDES/PCBs DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	NO CONTAMINATION FOUND			
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	NO CONTAMINATION FOUND			

TABLE 4 - 8

TOTAL PETROLEUM HYDROCARBONs DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, GWG63, GWG62, SBG6503MS, SBG6503MD, SBG6503D, SBG6508, SBG6708	NO CONTAMINATION FOUND			
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, GWG63, GWG62, SBG6503MS, SBG6503MD, SBG6503D, SBG6508, SBG6708	NO CONTAMINATION FOUND			

TABLE 4 - 9

TOTAL ORGANIC CARBON DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6720, SBG6720MS, SBG6720MD, SBG6720D	NO CONTAMINATION FOUND			
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6720, SBG6720MS, SBG6720MD, SBG6720D	TOC	1.1	mg/L	

TABLE 4 - 10

GC/MS VOLATILES DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
CH007	ERG601	DBG601, ERG602, ERG603	CHLOROBENZENE	3	ug/L	CRQL
		PBG604	CHLOROFORM	1	ug/L	CRQL
		DBG601, PBG601, SBG6503, SBG6503D, SBG6508, SBG6520, SBG6708, SBG6720	CARBON DISULFIDE	3	ug/L	
CH007	ERG602	SBG6745	NO CONTAMINATION FOUND			
CH007	ERG603	GWG64, GWG64D, GWG66, GWG65, GWG67, GWG62,	NO CONTAMINATION FOUND			

TABLE 4 - 6

HERBICIDES DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	NO CONTAMINATION FOUND			
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	NO CONTAMINATION FOUND			

TABLE 4 - 7

METALS/CYANIDE DETECTED IN FIELD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	FB CONC.	UNITS	VALIDATION QUALIFIER
90287	DBG601	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	CALCIUM	36.5	ug/L	
			IRON	20.7	ug/L	
			MANGANESE	8.2	ug/L	
	PBG604	GWG64, GWG64MS, GWG64MD, GWG64D, GWG66, SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	BARIUM	8.1	ug/L	
			CALCIUM	2110	ug/L	
			COPPER	2.1	ug/L	
			IRON	62.5	ug/L	
			LEAD	4.6	ug/L	
			MAGNESIUM	63.0	ug/L	
			MANGANESE	37.2	ug/L	
			SODIUM	55200	ug/L	
			ZINC	7.7	ug/L	

TABLE 4 - 11

SEMIVOLATILES DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6503, SBG6503D, SBG6508, SBG6520, SBG6708, SBG6720	NO CONTAMINATION FOUND			
90288	ERG602	SBG6745	NO CONTAMINATION FOUND			
90290	ERG603	GWG64, GWG64D, GWG66, GWG65, GWG67, GWG62, GWG63	NO CONTAMINATION FOUND			

TABLE 4 - 13

PESTICIDES/PCBs DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6503, SBG6503D, SBG6508,	NO CONTAMINATION FOUND			
90290	ERG603	GWG64, GWG64D, GWG66	NO CONTAMINATION FOUND			

4 - 14

TABLE 4 - 12

DIOXIN/FURANs DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6503, SBG6503D, SBG6508,	NO CONTAMINATION FOUND			
90290	ERG603	GWG64, GWG64D, GWG66,	OCDD	7.34	pg/L	

TABLE 4 - 14

HERBICIDES DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6503, SBG6503D, SBG6508,	NO CONTAMINATION FOUND			
90290	ERG603	GWG64, GWG64D, GWG66	NO CONTAMINATION FOUND			

TABLE 4 - 15

METALS/CYANIDE DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6503, SBG6503D, SBG6508,	NO CONTAMINATION FOUND			
90290	ERG603	GWG64, GWG64D, GWG66	NO CONTAMINATION FOUND			

TABLE 4 - 16

TOTAL PETROLEUM HYDROCARBONs DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6503, SBG6503D, SBG6508, SBG6708	NO CONTAMINATON FOUND			
90290	ERG603	GWG64, GWG64D, GWG66, GWG63, GWG62	NO CONTAMINATION FOUND			

4 - 17

TABLE 4 - 17

TOTAL ORGANIC CARBON DETECTED IN EQUIPMENT RINSE BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	RB CONC.	UNITS	VALIDATION QUALIFIER
90287	ERG601	DBG601, PBG601, SBG6720, SBG6720D	NO CONTAMINATON FOUND			
90290	ERG603	GWG64, GWG64D, GWG66, GWG63, GWG62	NO CONTAMINATION FOUND			

TABLE 4 - 18

GC/MS VOLATILES DETECTED IN METHOD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	MB CONC.	UNITS	VALIDATION QUALIFIER
CH001	VBLKDD	SBG6503, SBG6745	METHYLENE CHLORIDE	15	ug/Kg	CRQL
		SBG6708, SBG6720				U
		SBG6503, SBG6708, SBG6720, SBG6745	ACETONE	12	ug/Kg	U
	VBLKEE	SBG6503DL, SBG6503DDL	METHYLENE CHLORIDE	4	ug/Kg	CRQL
		SBG6503D, SBG6520				U
	VBLKMM	SBG6508DL	METHYLENE CHLORIDE	310	ug/Kg	
CH007	VBLKAA	PBG604, TRPBLK, TBG602, TBG603, ERG603, GWG66, GWG65, GWG63, GWG67	METHYLENE CHLORIDE	3	ug/L	CRQL
		GWG64, GWG64D				NA
		PBG604, TRPBLK, TBG602, TBG603	ACETONE	14	ug/L	CRQL
		GWG64D, GWG66, GWG65, GWG63, GWG67				U
		GWG64				NA
	VBLKBB	ERG601, ERG602, GWG64DL, GWG64DDL, GWG62	METHYLENE CHLORIDE	2	ug/L	CRQL
		ERG601, GWG64DL, GWG64DDL	ACETONE	7	ug/L	CRQL
		ERG602, GWG62				U
	VBLKCC	DBG601, GWG66RE	METHYLENE CHLORIDE	4	ug/L	CRQL

TABLE 4 - 19

SEMIVOLATILES DETECTED IN METHOD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	MB CONC.	UNITS	VALIDATION QUALIFIER
90287	SBLKW11216	DBG601, ERG601, PBG601	NO CONTAMINATION FOUND			
	SBLK210105	PBG601RE	NO CONTAMINATION FOUND			
	SBLKS11220	SBG6520, SBG6708, SBG6720	N-NITROSODIPHENYLAMINE	46	ug/Kg	CRQL
	SBLKS21220	SBG6508	N-NITROSODIPHENYLAMINE	40	ug/Kg	CRQL
	SBLKS11223	SBG6503, SBG6503MS, SBG6503MD	NO CONTAMINATION FOUND			
90288	SBLKW11217	ERG602	NO CONTAMINATION FOUND			
	SBLKS11220	SBG6745	BIS(2-ETHYLHEXYL)PHTHALATE	36	ug/Kg	CRQL
90290	SBLKW11217	ERG603, GWG64, GWG64D	NO CONTAMINATION FOUND			
	SBLKW21217	GWG62, GWG63, GWG65, GWG66, GWG67, GWG64MS, GWG64MD	BIS(2-ETHYLHEXYL)PHTHALATE	1	ug/L	

TABLE 4 - 20

DIOXIN/FURANS DETECTED IN METHOD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	MB CONC.	UNITS	VALIDATION QUALIFIER
90287/90290	WBL01044	GWG64, GWG64MS, GWG64D, GWG66, DBG601, PBG601, ERG601, ERG603	NO CONTAMINATION FOUND			
90290	SBL01024	SBG6503, SBG6503MS, SBG6503MD, SBG6503D, SBG6508	NO CONTAMINATION FOUND			

4 - 21

TABLE 4 - 21

PESTICIDES/AROCLORS DETECTED IN METHOD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	MB CONC.	UNITS	VALIDATION QUALIFIER
90287	PBLKW11217	DBG601, ERG601, PBG601	NO CONTAMINATION FOUND			
	PBLKS11220	SBG6503, SBG6503D, SBG6503MS, SBG6503MD	NO CONTAMINATION FOUND			
90290	PBLKW11217	ERG603, GWG64, GWG64MS, GWG64MD, GWG64D, GWG66	NO CONTAMINATION FOUND			

TABLE 4 - 22

HERBICIDES DETECTED IN METHOD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	MB CONC.	UNITS	VALIDATION QUALIFIER
90287	HBLKW11217	DBG601, PBG601, ERG601	NO CONTAMINATION FOUND			
	HBLKS11221	SBG6503, SBG6503D, SBG6508, SBG6503MS, SBG6503MD	NO CONTAMINATION FOUND			
90290	HBLKW11217	ERG603	NO CONTAMINATION FOUND			
	HBLK21217	GWG64, GWG64D, GWG66, GWG64MS, GWG64MSD	NO CONTAMINATION FOUND			

TABLE 4 - 23

METALS/CYANIDE DETECTED IN METHOD BLANKS
SITE 6 FTA

SDG NUMBER	BLANK ID	RELATED ENVIRONMENTAL SAMPLES	CONTAMINANT	MB CONC.	UNITS	VALIDATION QUALIFIER
90287	PBW	DBG601, PBG601, ERG601	BERYLLIUM	-0.22	ug/L	UJ
	PBS	SBG6503, SBG6503D, SBG6508,	ARSENIC	-0.37	mg/Kg	J/UJ
			BERYLLIUM	-0.04	mg/Kg	UJ
			NICKEL	-2.26	mg/Kg	J/UJ
90290	PBW	ERG603, GWG64, GWG64MS, GWG64MD, GWG64D, GWG66,	BERYLLIUM	-0.22	ug/L	J/UJ

- J Validation Qualifier. If a sample result for the blank contaminant was greater than the IDL and less than 10 times the blank value, when the absolute of the negative blank value id greater than the IDL the result was amended as estimated at the laboratory value.

4.1 Trip Blanks

Trip blanks contained deionized water from the laboratory and consisted of samples bottles which were similar to the environmental sample containers. The trip blanks were prepared and packaged at the laboratory prior to the sampling event and traveled with the sample bottles to the site. The trip blank bottles were not opened at the site or anytime prior to laboratory analysis. No target compounds were detected in the trip blank samples (Table 4-1).

4.2 Field Blanks

The field blank, PBG601, was a sample of potable water from the source at the field staging area and the deionized water blank, DBG601, was prepared from the source potable water by a three (3) tank distillation system. The field blanks were prepared at the site and placed in containers that were similar to those used for the environmental samples. Semivolatile organics, pesticides/PCBs, herbicide, and TPH target compounds were not detected in source blank samples (Tables 4-3, 4-4, 4-6 and 4-8). Target compounds and analytes detected in the field blank samples (Table 4-2, 4-5, and 4-7) consisted of:

- GC/MS Volatiles (Table 4-2)
  - xylene (total)
  - acetone
  - bromodichloromethane
  - dibromochloromethane
- Dioxin/Furan (Table 4-3)
  - OCDD
- Inorganics (Table 4-7)

magnesium	barium
manganese	calcium
sodium	copper
potassium	iron
lead	zinc

- TOC (Table 4-9)

The detected acetone result in the DI field blank is attributed to laboratory and/or field contamination because acetone is a common laboratory contaminant. The xylene (total) was detected below the CRQL. Some of field samples exhibited positive acetone results which required qualification. Xylene (total) results were above the action level in the field samples so no qualifications were required. The bromodichloromethane and dibromochloromethane were detected below the CRQL and are trihalomethanes, which can be formed when "free" chloride ions are present. They are an artifact of the water source. The trihalomethanes were detected in the potable water field blank only. Contamination was not noted in the field samples. Therefore, the trihalomethane field blank results do not impact the data. The dioxin/furan compound OCDD was detected in the field blanks. Dioxin/furan congeners are not common blank contaminants. The OCDD results detected are most likely a laboraotry artifact in the glassware used by the laboratory

for the extraction process. The inorganic analytes can be attributed to the water source, the water treatment system that was used to make the water or laboratory artifacts. The metals analytes were detected below the CRDL with the exception of iron in the DI field blank and lead, manganese and zinc in the potable water field blank. Some of the analytical data required qualification due to the metals analytes detected in the field blanks.

Target analytes were detected in some of the field blanks. Some of the analytical data required qualification. However, based on assessment of field blanks for representativeness the analytical data was acceptable for each SDG.

4.3 Equipment Rinseate Blanks

The equipment rinseate blank was a piece of sampling equipment that which was decontaminated, then rinsed with deionized water from a field D unit. A sample of this water was collected and placed in sample containers similar to those used for the environmental samples. Semivolatile organics, pesticides/PCBs, herbicide, TPH, and TOC target compounds were not detected in equipment rinseate blank samples (Tables 4-11, 4-13, 4-14, 4-16, and 4-17). Target analytes detected in the equipment rinseate blank samples consisted of:

- GC/MS Volatiles (Table 4-10)
  - chlorobenzene
  - chloroform
  - carbon disulfide

- Dioxin/Furan (Table 4-12)
  - OCDD

The detected chloroform is a trihalomethane and is be attributed to the water source. The chlorobenzene and carbon disulfide are attributed to laboratory contamination. Analytical data were qualified due to the chloroform and chlorobenzene contamination. Carbon disulfide contamination was not noted in the field samples, so qualification was not required. The dioxin/furan compound OCDD was detected in the field blanks, as well as in the one (1) of the rinseate blanks. Dioxin/furan congeners are not common blank contaminants. The OCDD results detected are most likely laboratory artifacts in the glassware used by the laboratory for the extraction process.

Target analytes were detected in some of the equipment rinseate blanks; therefore some of the analytical results required qualification. Metals target analytes were not qualified per ABB-ES. Based on assessment of equipment rinseate blanks for representativeness the analytical data was acceptable for each SDG.

4.4 Method Blanks

The method blanks were a sample of deionized water that is prepared by the laboratory at the time of analysis. Method blanks undergo the same analytical process as the corresponding environmental samples and associated field blanks. The purpose of the method blank is to assess the potential for target compounds and analytes to "contaminate" the sample during analysis. Dioxin/Furans, pesticides/PCBs and herbicides target compounds were not detected in method blank samples (Tables 4-20, Table 4-21 and 4-22). Target analytes detected in the method blank samples consisted of:

- GC/MS Volatiles (Table 4-18)
  acetone
  methylene chloride

- Semivolatile Organics (Table 4-19)
  bis(2-ethylhexyl)phthalate
  n-nitrosodiphenylamine

- Inorganics (Table 4-23)
  beryllium arsenic nickel

The detectable acetone, methylene chloride, and bis(2-ethylhexyl)phthalate results are common laboratory contaminants and are attributed to laboratory contamination. The n-nitrosodiphenylamine is possibly due to carry over from the instrument calibration or dirty glassware encountered during the extraction process. The inorganic analytes were all negative in concentration and can be attributed to instrumentation anomalies.

Because target analytes were detected in some of the method blanks, some of the analytical results were qualified. However, based on assessment of method blanks for representativeness the analytical data was acceptable for each SDG.

4.5 Holding Times

Holding times requirements are utilized in an effort to minimize the degradation or concentration of constituents in a particular matrix over time. The stability of the constituents is determined to the best extent and then a reasonable time limit is imposed under which the samples must be extracted or prepared and then analyzed. The holding times regulations assume that the samples have been properly preserved according to the guidelines, either at the laboratory or in the field. Analytical results from samples with holding time violations are qualified as estimated, J/UJ, due to the potential for compromising the integrity of the samples.

All holding times requirements, extraction and analytical, were met with the exception of sample PBG601RE for semivolatiles. This sample was rejected, R, in favor of the original analysis. Therefore, the non-compliant extraction holding time did not impact the analytical data.

5.0 COMPARABILITY

Comparability is qualitative measure designed to express the confidence with which one data set may be compared to another. The analytical samples were collected and transported to the chemical analytical laboratory in accordance with standard procedures and were analyzed in conformance with acceptable USEPA procedures (Refer to Table 5-1 below). The analytical data are reported in standard units (micrograms per liter, micrograms per kilogram, etc.).

The methods used to collect the environmental samples and the methods used to analyze the samples should assure comparability of the analytical data.

TABLE 5-1
USEPA Procedures (CLP, SW-846, or EPA Methodologies)

U.S. EPA Method	Description
CLP SOW OLM01.8	CLP TCL Volatile Organics without TICs
CLP SOW OLM01.8	CLP TCL Semivolatile Organics without TICs
CLP SOW OLM01.8	CLP TCL Pesticides/PCBs
SW-846, Method 8140	Chlorinated Herbicides
SW-846, Method 1613	High Resolution MS Dioxin Furans, Isotopic Dilution
CLP SOW ILM02.1	CLP TAL Metals
CLP SOW ILM02.1	CLP Cyanide
EPA Method 418.1	Total Petroleum Hydrocarbons
EPA Method 415.2	Total Organic Carbon

6.0 COMPLETENESS

Completeness is the quantitative measure of the amount of data obtained from a measurement process compared with the amount expected to be obtained under the conditions of measurement. The completeness goal for laboratory analysis for this project was 85 percent useable data. Unusable analytical data are those results reported by the laboratory but rejected during the data validation process. A summary of the completeness goal for NCBC Gulfport is provided in Table 6-1. For more detailed completeness goal tables, please refer to Appendix C.

TABLE 6-1
COMPLETION GOAL (>85%)

	QC	GW	SB	OVERALL
GC/MS Volatiles	100.0	100.0	100.0	100.0
Semivolatiles	95.5	85.4	100.0	93.7
Dioxin/Furans	100.0	100.0	100.0	100.0
Pesticide/PCBs	83.9	0.0	100.0	61.3
Herbicides	100.0	50.0	100.0	83.3
Inorganics	99.3	100.0	100.0	99.8
TPH	100.0	100.0	100.0	100.0
TOC	100.0	100.0	100.0	100.0

MATRIX KEY
QC = QC Samples
GW = Ground Water Samples
SB = Soil Boring Samples

The analytical data met the 85 percent completeness goal for every fraction for every matrix with the exception of the pesticides/PCBs and herbicides. The pesticides/PCBs ground water fraction and QC sample fraction fell below the completeness goal because the surrogate compounds were not recovered in the groundwater field samples or the field duplicate sample. As a result of this, all of the reported non-detect results required rejection, R. The herbicide fraction fell below the completeness goal because the surrogate compound could not be recovered in one (1) sample due to matrix interference. The semivolatiles, herbicides, and metals/cyanide fractions all contained rejected data. All circumstances upon which the data were rejected were discussed in the body of the narrative. The narrative following describes any extenuating factors involved in the data resolution.

GC/MS Volatiles The positive results reported for several of the target compounds in samples GWG64, GWG64D, SBG6508, SBG6503D, and SBG6503 were "rejected" in favor of results reported from a dilution analysis of the samples because the results from the undiluted analysis exceeded the linear range of the calibration curves. This action does not constitute a true rejection since viable results were obtained from the dilution analyses. Therefore, the "rejections" were not counted in the rejection tables and did not affect the completeness results.

Semivolatiles The re-extraction and analysis of sample PBG601 was "rejected" in favor of the original analysis due to the holding time violation of the re-extracted sample. This "rejection" was not counted in the rejection tables and did not affect completeness results.

GC/MS Volatiles/Semivolatiles Target compounds for both the volatile and semivolatile fractions were qualified because of non-compliant calibrations in some SDGs. Volatile and semivolatile

compounds did not always meet the initial and/or continuing calibration criteria for RSD (Relative Standard Deviation), and %D (Percent Difference). All results qualified for calibration % RSD and % D deficiencies (J/UJ) are considered to be useable. For the compounds in the GC/MS volatile and semivolatile analyses that did not meet calibration criteria, all positive results are qualified as estimated (J) (%Ds >25%) and all non detect results are qualified as estimated (UJ) (>50% D <90%) due to calibration deficiencies. No analytical data was rejected due to calibration deficiencies.

Metals Target analytes arsenic, selenium, and thallium were qualified as estimated, J/UJ, due to unacceptable graphite furnace MSA results in samples from each of the SDGs. All results qualified for non-compliant MSA recoveries are considered to be useable. If the recovery was above the QC limits, only the positive results for the analyte were qualified. If the recovery was below the QC limits, or the correlation coefficient of an MSA curve was below the QC limits, positive and non-detect results were qualified as estimated, J/UJ.

7.0 PARCC SUMMARY

The purpose of evaluating the quality of the analytical data using the PARCC criteria was to address the qualification of the data in regards to evaluation of the presence, magnitude and characteristics of hazardous substances at NCBC Gulfport. Overall, the chemical analytical data are acceptable and exceeded the completion goal of 85 percent with the exception of the Pesticide/PCBs and Herbicides. Tables 7-1 through 7-3 provides a tabulation of the assessment of PARCC criteria each SDG for water samples, soil samples, and quality control samples, respectively.

7.1 Water Samples

The analytical data for this matrix was acceptable for all SDGs for all PARCC criteria categories except accuracy for SDG 90290. Fifty-six (56) semivolatile data points were rejected in field samples due to MS/MSD recoveries below 10%. The completion goal was met. Fifty-six (56) pesticide/PCB data points were rejected due to 0% recovery of surrogate compounds. The completion goal was not met. Ten (10) herbicide data points in the field duplicate sample GWG66 were rejected due to high recovery of Silvex in the MS/MSD. The completion goal was not met.

7.2 Soil Samples All criteria for all SDGs were acceptable.

7.3 QC Samples The analytical data for this matrix was acceptable for all SDGs for all PARCC criteria categories except accuracy for SDGs 90287 and 90290. Twenty (20) semivolatile data points in the potable water field blank were rejected due to surrogate recovery less than 10%. The completion goal was met. Twenty-seven (27) pesticide data points in the field duplicate sample GWG64D were rejected due to 0% surrogate recovery. The completion goal was not met. One (1) metals data point in the field duplicate sample GWG64D was rejected due to MS recovery less than 10%. The completion goal was met.

TABLE 7-1
PARCC CRITERIA SUMMARY
WATER SAMPLES
SITE 6 FTA

SDGs	PRECISION	ACCURACY	REPRESENT-ATIVENESS	COMPARABILITY	COMPLETENESS
CH001	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
CH007	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90287	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90288	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90290	ACCEPTABLE	UNACCEPTABLE (3) (2) ACCEPTABLE (1) WITH REJECTIONS	ACCEPTABLE	ACCEPTABLE	UNACCEPTABLE (2) (3) ACCEPTABLE (1) WITH REJECTIONS

(1) Fifty-six (56) semivolatile data points were rejected due to MS/MSD recoveries <10%. Completion goal was met.
(2) Fifty-six (56) pesticide/PCB data points were rejected due to 0% surrogate recoveries. Completion goal was not met.
(3) Ten (10) herbicide data points were rejected due to high (280%, 320%) recovery of Silvex in the MS/MSD. Completion goal was not met.

TABLE 7-2
PARCC CRITERIA SUMMARY
SOIL SAMPLES
SITE 6 FTA

SDGs	PRECISION	ACCURACY	REPRESENT-ATIVENESS	COMPARABILITY	COMPLETENESS
CH001	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
CH007	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90287	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90288	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90290	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

TABLE 7 - 3
PARCC CRITERIA SUMMARY
QUALITY CONTROL SAMPLES
SITE 6 FTA

SDGs	PRECISION	ACCURACY	REPRESENT-ATIVENESS	COMPARABILITY	COMPLETENESS
CH001	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
CH007	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90287	ACCEPTABLE	ACCEPTABLE (1) WITH REJECTIONS	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE (1) WITH REJECTIONS
90288	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE
90290	ACCEPTABLE	ACCEPTABLE (2) (3) WITH REJECTIONS	ACCEPTABLE	ACCEPTABLE	UNACCEPTABLE (2) ACCEPTABLE (3) WITH REJECTIONS

(1) Twenty (20) semivolatile data points in the potable water blank were rejected due to surrogate recovery less than 10%. Completion goal was met.
(2) Twenty-seven (27) pesticide data points in GWG64D, a field duplicate sample, were rejected due to 0% surrogate recovery. Completion goal was not met.
(3) One (1) metals data point, selenium, was rejected in GWG64D, a field duplicate sample, due to MS recovery < 30%. Completion goal was met.

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APPENDIX A

CALIBRATION SUMMARY

TABLE A-1

INITIAL AND CONTINUING CALIBRATION
VOLATILE ORGANIC COMPOUNDS
SITE 6 FTA

ICAL = INITIAL CALIBRATION = %RSD	SDG CH001	
CCAL = CONTINUING CALIBRATION = %D	**ICAL1**	**CCAL1**
DATE	122093	122193
INSTRUMENT ID	9601 #1	9601 #1
CALIBRATION CRITERIA	%RSD	%D
2-BUTANONE		34.9
2-HEXANONE		34.0
4-METHYL-2-PENTANONE		32.7
ACETONE	45.6	43.3

SDGS, STANDARDS, AND ASSOCIATED SAMPLES

SDG CH001

ICAL1: VBLKDD, SBG6503, SBG6503MS, SBG6503MD, SDG6508, SDG6720, SBG6745

CCAL1: VBLKEE, VBLKMM, SBG6503DL, SBG6503D, SBG6508DL, SBG6520,

TABLE A-1, CONTINUED

INITIAL AND CONTINUING CALIBRATION
VOLATILE ORGANIC COMPOUNDS
SITE 6 FTA

ICAL = INITIAL CALIBRATION = %RSD	SDG CH007			
CCAL = CONTINUING CALIBRATION = %D	**ICAL1**	**CCAL1**	**CCAL2**	**CCAL3**
DATE	122093	121893	122093	122193
INSTRUMENT ID	9601 #1	9601 #3	9601 #3	9601 #1
CALIBRATION CRITERIA	%RSD	%D	%D	%D
2-BUTANONE				34.9
CHLOROETHANE		38.9		
CHLOROMETHANE		39.7	42.0	
2-HEXANONE				34.0
4-METHYL-2-PENTANONE				32.7
ACETONE	45.6			43.3

SDGS, STANDARDS, AND ASSOCIATED SAMPLES

SDG CH007

ICAL1: NONE ASSOCIATED

CCAL1: PBG604, TRPBLK, TBG602, TG603, ERG603, GWG64, GWG64D, GWG66, GWG65, GWG63, GWG67

CCAL2: ERG601, ERG602, GWG64DL, GWG64DDL, GWG62, GWG64MS, GWG64MD

CCAL3: DBG601, GWG66RE

TABLE A - 2

INITIAL AND CONTINUING CALIBRATION
SEMIVOLATILE ORGANIC COMPOUNDS
SITE 6 FTA

ICAL = INITIAL CALIBRATION = %RSD	SDG 90287
CCAL = CONTINUING CALIBRATION = %D	**CCAL1**
DATE	010494
INSTRUMENT ID	4600
CALIBRATION CRITERIA	%D
4-CHLOROANILINE	31.3
N-NITROSO-DI-PROPYLAMINE	-25.9
2,2'-OXYBIS(1-CHLOROPROPANE)	-31.3
2-NITROANILINE	-25.7
4-NITROPHENOL	-41.2

SDGS, CALIBRATIONS AND ASSOCIATED SAMPLES:

SDG 90287
CCAL1: SBLKS2_1220, SBG6508

APPENDIX B

SERIAL DILUTION SUMMARY

(Not included with Level C QC)

APPENDIX C

REJECTED DATA SUMMARY

TABLE C-1
GC/MS VOLATILES - REJECTED DATA
SITE 6 FTA

					# OF COMPOUNDS REJECTED PER MATIX			
SDG	# SAMPLES/MATRIX				QC	GW	SB	
	QC	GW	SB					
CH001	9	6	0		0	0	0	
CH007	1	0	6		0	0	0	
GRAND TOTAL	10	6	6		0	0	0	
COMPLETION GOAL (>85%)					100.0%	100.0%	100.0%	

OVERALL COMPLETENESS
100.0%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 33 TARGET COMPOUNDS PER SAMPLE**

TABLE C-2
SEMIVOLATILES - REJECTED DATA
SITE 6 FTA

				# OF COMPOUNDS REJECTED PER MATIX		
SDG	# SAMPLES/MATRIX			QC	GW	SB
	QC	GW	SB			
90287	4	0	5	20	0	0
90288	1	0	1	0	0	0
90290	2	6	0	0	56	0
GRAND TOTAL	7	6	6	20	56	0
COMPLETION GOAL (>85%)				95.5%	85.4%	100.0%

OVERALL COMPLETENESS
93.7%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 64 TARGET COMPOUNDS PER SAMPLE**

TABLE C-3
DIOXIN/FURAN - REJECTED DATA
SITE 6 FTA

SDG	# SAMPLES/MATRIX				# OF COMPOUNDS REJECTED PER MATIX			
	QC	GW	SB		QC	GW	SB	
90287	4	0	2		0	0	0	
90290	2	2	0		0	0	0	
GRAND TOTAL	6	2	2		0	0	0	
COMPLETION GOAL (>85%)					100.0%	100.0%	100.0%	

OVERALL COMPLETENESS
100.0%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 17 TARGET COMPOUNDS PER SAMPLE**

TABLE C-4
PESTICIDES/PCBs - REJECTED DATA
SITE 6 FTA

					# OF COMPOUNDS REJECTED PER MATIX			
SDG	# SAMPLES/MATRIX				QC	GW	SB	
	QC	GW	SB					
90287	4	0	2		0	0	0	
90290	2	2	0		27	56	0	
GRAND TOTAL	6	2	2		27	56	0	
COMPLETION GOAL (>85%)					83.9%	0.0%	100.0%	

OVERALL COMPLETENESS
61.3%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 28 TARGET COMPOUNDS PER SAMPLE**

TABLE C-5
HERBICIDES - REJECTED DATA
SITE 6 FTA

SDG	# SAMPLES/MATRIX				# OF COMPOUNDS REJECTED PER MATIX			
	QC	GW	SB		QC	GW	SB	
90287	4	0	2		0	0	0	
90290	2	2	0		0	10	0	
GRAND TOTAL	6	2	2		0	10	0	
COMPLETION GOAL (>85%)					100.0%	50.0%	100.0%	

OVERALL COMPLETENESS
83.3%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 10 TARGET COMPOUNDS PER SAMPLE**

TABLE C-6
METALS/CYANIDE - REJECTED DATA
SITE 6 FTA

					# OF COMPOUNDS REJECTED PER MATIX			
SDG	# SAMPLES/MATRIX				QC	GW	SB	
	QC	GW	SB					
90287	4	0	2		0	0	0	
90290	2	2	0		1	0	0	
GRAND TOTAL	6	2	2		1	0	0	
COMPLETION GOAL (>85%)					99.3%	100.0%	100.0%	

OVERALL COMPLETENESS
99.8%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 24 TARGET ANALYTES PER SAMPLE**

TABLE C-7
TOTAL PETROLEUM HYDROCARBONS - REJECTED DATA
SITE 6 FTA

					# OF COMPOUNDS REJECTED PER MATIX			
SDG	# SAMPLES/MATRIX				QC	GW	SB	
	QC	GW	SB					
90287	4	0	3		0	0	0	
90290	2	4	0		0	0	0	
GRAND TOTAL	6	4	3		0	0	0	
COMPLETION GOAL (>85%)					100.0%	100.0%	100.0%	

OVERALL COMPLETENESS
100.0%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 1 TARGET COMPOUND PER SAMPLE**

TABLE C-8
TOTAL ORGANIC CARBON - REJECTED DATA
SITE 6 FTA

					# OF COMPOUNDS REJECTED PER MATIX			
SDG	# SAMPLES/MATRIX				QC	GW	SB	
	QC	GW	SB					
90287	4	0	1		0	0	0	
90290	2	2	0		0	0	0	
GRAND TOTAL	6	2	1		0	0	0	
COMPLETION GOAL (>85%)					100.0%	100.0%	100.0%	

OVERALL COMPLETENESS
100.0%

MATRIX KEY

QC = QC SAMPLES
GW = GROUND WATER SAMPLES
SB = SOIL BORING SAMPLES

*** 1 TARGET COMPOUND PER SAMPLE**