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NWS YORKTOWN
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SITE CHARACTERIZATION ANALYSIS AND PENETROMETER SYSTEM INVESTIGATION REPORT FUEL FARM WITH TRANSMITTAL NWS YORKTOWN VA
2/15/2002
SCAPS

SCAPS INVESTIGATION REPORT

SCAPS Project #02-002

SCAPS Project:

Yorktown Fuel Farm
National Park Services Area

Prepared for:

POC: John Conway
Atlantic Division, Naval Facilities
Engineering Command
1510 Gilbert Street
Norfolk, Virginia 23511

January 2002

DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION, MID-ATLANTIC
6506 HAMPTON BLVD.
NORFOLK, VA 23508-1273

IN REPLY REFER TO:
5090
RE970/16/2109
FEB 15 2002

Ms. Erinn Tisdale
Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, VA 23462

Dear Ms. Tisdale:

SUBJECT: YORKTOWN NAVAL WEAPONS STATION, FUEL TERMINAL, SITE CHARACTERIZATION ANALYSIS AND PENETROMETER SYSTEM (SCAPS) INVESTIGATION REPORT, COLONIAL NATIONAL HISTORICAL PARK

Enclosed is the Yorktown Fuel Terminal (PC# 90-1301) SCAPS Investigation Report of the Colonial National Historical Park area near the Moore House. The report confirms the presence of petroleum contamination in the area around MW-31. All of the contamination appears to be within about 100 feet of Ballard Street (Washington Road). We will continue to closely monitor conditions in this area to detect plume movement. To facilitate this effort, we are investigating the feasibility of installing an additional sentinel well.

If you have any questions, our point of contact is Mr. William McGowan, P.E. at (757) 444-3009, extension 395, or E-Mail mcgowanwr@pwcnorva.navy.mil.

Sincerely,

SEAN S. HEANEY
Director
Technical Support Department
By direction of the Commander

Enclosures

Copy to:
Atlantic Division, Naval Facilities Engineering Command (Code EV21)
Robert S. Williamson, PG (2 copies)
Regional Manager
Apex Environmental, Inc.
468 Southlake Boulevard
Richmond, Virginia 23236

Table of Contents

SIGNATURE/CERTIFICATION SHEET

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TITLE: Yorktown Fuel Farm, National Park Service Area

PREPARED FOR: Atlantic Division, Naval Facilities Engineering Command
1510 Gilbert Street
Norfolk, Virginia 23511
Contact: John Conway (757) 322-4761

DATE: 9 January 2002

Site Investigation Summary

The Navy Public Works Center (PWC) Norfolk conducted a site screening investigation at the Colonial National Historical Park area located across from the Navy Fuel Farm, Yorktown Virginia. The investigation was conducted for the Atlantic Division, Naval Facilities Engineering Command (LANTDIV). The investigation area is located outside the navy fence line between the historic site known as the Moore House, and the Yorktown Fuel Farm and Coast Guard Station main gate. This investigation was conducted in accordance with the scope of work developed by the LANTDIV field engineer overseeing the navy's groundwater remediation project at the Yorktown Fuel Farm and the Navy Regional Environmental Group. The objective of this project was to determine the presence and extent of any "free" phase fuel in the subsurface of the investigation area. Free phase fuel was identified in an existing monitoring well, MW-#31 which is located within the investigation area.

PWC Norfolk's Site Characterization Analysis and Penetrometer System (SCAPS) completed the field investigation between 3 - 14 December 2001. A total of 51 Laser Induced Fluorescence (LIF) pushes, appendix A, and one Video probe were completed as part of this project. The LIF detector systems used to identify subsurface contamination were tested against a sample of recovered fuel obtained from the contractor personnel operating the navy groundwater remediation project on the fuel farm. The fuel was aged Navy Special Fuel Oil (NSFO) which was once stored in Underground Storage Tanks (UST's) located just inside the navy fence line. This sample was used to determine the LIF system response to "free" phase contamination.

Prior to collecting LIF data the existing monitoring wells were sounded to determine the local depth to groundwater. Free product contamination was observed in several of the push locations located across the southeast end of the site. The vertical extent of raw contamination measured greater than ten feet, while the average extent was approximately five feet thick. Sufficient LIF data was collected to allow for a Groundwater Model Simulation (GMS), linear interpolation of the data to be completed and the determination of the free product plume. A specially constructed video probe was used at one of the push locations to confirm the LIF data for the detection of free product, (VHS Tape, enclosed).

Introduction:

The navy is currently operating a groundwater remediation project within the Yorktown fence line over the location of eight demolished underground storage tanks (UST's). As part of that project a number monitoring wells were installed around the former UST's to include wells being installed outside the navy property. One of the monitoring wells located outside the navy property, MW #31, was inspected and free phase product was observed in the well. As a result of that finding the navy implemented a project to identify the presence and extent of any free phase fuel outside navy fenceline on the Colonial National Historic Park property in the vicinity of MW #31. One of the requirements in completing this investigation was that there was to be little to no impact to the Park Service property. Therefore, the navy's SCAPS unit was employed to use Laser Induced Fluorescence (LIF) technology to locate petroleum contamination in the subsurface. The LIF system response to a free product sample of Navy Special Fuel Oil (NSFO) was compared to raw data collected in the field to determine the optimum locations of suspected free phase fuel across the investigation site.

Objective:

The purpose of the SCAPS investigation was to determine the presence and extent of petroleum contamination in the subsurface on the grounds of the National Park site in the vicinity of MW #31. Specifically, the SCAPS systems were to be used to locate the presence of any free phase fuel in the subsurface. There are 5 monitoring wells located across the National Park Service site. An initial grid of LIF pushes was set up to extend from Moore House Road to the main gate of the Coast Guard station along Ballard Street, diagram #2. As real time LIF data was collected in the field it was compared to a standard data set acquired from the NSFO sample obtained from the groundwater remediation contractor. Subsequent LIF pushes were made based LIF data gathered from the initial grid of pushes. Additional pushes were placed around the north side of the tree and to the east side of the site adjacent to the Coast Guard fence.

The results of the raw LIF data was used to generate a Groundwater Modeling Simulation (GMS) map of the site, diagram #3. This diagram represents a linear interpolation of the peak fluorescence, light intensity values for each LIF push. These raw intensity values were compared to those acquired from the sample of NSFO, which allowed for a depiction of the free product plume based on the LIF data.

Field Activities:

The SCAPS technology selected for this investigation uses the traditional Cone Penetrometer Test (CPT) concurrently with the Laser Induced Fluorescence (LIF) probe to collect real time data of the both the soil stratigraphy and petroleum contamination along a vertical push. A separate video probe was employed at one of the LIF push locations to acquire video imagery of the subsurface. The video image was copied to a VHS tape, attached.

The SCAPS field crew set up an initial grid of push locations spaced 50 ft apart along three separate transects. The first transect was marked off on the north side of Ballard Street between the edge of the road surface and the line of brush and trees. Crews working in and along the roadside followed appropriate Maintenance Of Traffic (MOT) procedures. A second transect was oriented parallel to the Ballard St., seventy feet to the north of the road. These push locations were also placed approximately 50 apart however the pushes along this transect

were off-set from the first line. The third transect was placed fifty feet to the north of the middle line in the anticipation that this would represent a line of pushes beyond the furthest extent of any contamination.

The existing monitoring wells were sounded to determine the depth to groundwater. Depth to groundwater is depicted on each LIF push profile sheet as the uniform symbol for GW. The depth to GW was determined to be approximately 18 ft BGS.

Field crews completed 51 LIF pushes along each of the three transects collecting and reviewing the data, real time. Interpretation of the LIF data indicated that contamination had extended to the furthest transect to the north and to the edge of the brush/tree line at the east side of the site. Subsequent LIF data was collected to ensure the furthest extents of contamination had been identified, diagrams #2 and #3.

The average depth of each LIF push was made to approximately 26 ft BGS, with the deepest pushes reaching approximately 35 ft BGS. All pushes were completed to a depth greater than the GW. At the time of this investigation the Hampton Roads area had been experiencing a drought resulting in a lowered water table. LIF data was collected to a depth approximately 7 ft deeper then the existing WT. LIF procedures for collecting field data included the advancement of the probe to a point that extended beyond the boundary of the deepest contamination.

The SCAPS field crews repaired any disturbances made to the site, which included backfilling, each LIF push with a grout mixture of Portland cement and bentonite. During the first LIF push at location –001 the field crews encountered a problem with the decontamination system on the SCAPS vehicle, which resulted in the oil sheen being wiped off the probe and onto the ground surface during the extraction of the probe from below ground. The SCAPS rig was set up to facilitate a field expedient decontamination of the probe however, the NFSO fuel encountered on that push became adhered to the metal probe and rods. The SCAPS crew activated the full steam and IDW recovery system on all subsequent pushes. All fluid was washed from the probe to the ground was removed including approximately half of a five-gallon bucket of soil.

The field crews completed a topographic survey of the site to allow for the accurate placement of GW symbol on each of the LIF profiles sheets. This information also facilitated the determination of the minimum depth for LIF pushes.

LIF Pushes:

The LIF pushes are printed as individual push profiles and contained in this report under their own tab. A total of 51 pushes were accomplished. The profile sheets contain the CPT data, soil classification as well as the results of LIF. The LIF data is represented by the ""Peak Intensity" and "Wavelength @ Peak" values, which are plotted as vertical graphs. A depth scale is located on the far left of each sheet and a horizontal blue line indicates GW elevation for each push.

A sample of NFSO was obtained from the groundwater remediation contractor and analyzed using the LIF systems. The response of the system indicated unique characteristics produced by fluorescing NSFO. Two significant features were obtained and used to screen all raw field data collected. The peak intensity, or amount of fluorescence (light) returned to the detector is plotted as peak intensity points. The peak intensity occurs at a significant wavelength, which is

also plotted on the LIF profile sheets. The NFSO sample obtained from the contractor produced the following LIF system respons:

Table 1: NFSO Fluorescence characteristics

Peak Intensity	Wavelength @ Peak
12,500	435-445nm

Subsurface contamination is indicated on each LIF push profile as a "gray" region. This region indicates the presence of polynuclear aromatic hydrocarbons fluorescing under the induced energy of the Excimer laser, which operates at 308nm wavelength. This data is a qualitative measure of the amount of contamination present in the subsurface. The NFSO sample allows for the comparison of the raw data to a known product. The assumption made for this project is that any fluorescence meeting minimum peak intensity and within the given range of wavelength would be considered potential "free" product. Additionally, comparisons were made to the presence of the WT and the vertical extent or thickness of contamination.

There is no way to ensure that meeting the above criteria assures there is free product in the subsurface. The definition of free product relates solely to a field measurement of floating fuel taken from a groundwater monitoring well after the well has been bailed and allowed to recharge.

Video Probe:

In an effort to confirm the results of the LIF data the SCAPS crews employed a video-imaging probe at one of the push locations, which was evaluated and considered to have free product. The video image was obtained using a specially constructed probe, which houses a Sony camera system. The camera is mounted vertically in the probe. A small sapphire window is mounted to the probe whereby the reflected light is focused on a mirror just inside the probe and directed up to the camera. A light source is provided to allow luminescence of the objects just outside the probe window.

A real time image is projected back into the SCAPS vehicle, which the push room operator can view. The image is feed through a VHS tape deck to enable copying of the push. The camera image is displayed on the screen through a small box which scaled 2mm high X 2.5mm wide. The reference scale allows the ability to perform particle size distribution and grain size analysis.

The video provided was taken within approximately 1 foot of LIF push –050. LIF data from this location indicated a high degree of contamination and the high likelihood of free product. The videotape was initiated at the ground surface and terminated approximately 20 ft BGS. At the time this video was taken the depth indicator was not working properly so no reference data was superimposed on the tape. It is recommended that to view the film, first advance the tape fast forward until the dark fuel patches appear. Significant observations can be made that show the capillary fringe, WT and contaminated zones.

GMS:

LIF data was used to construct a Groundwater Model Simulation (GMS) for the site, diagram #3. The LIF intensity values were imported into GMS allowing for a linear interpolation of the data to

be accomplished and the development of a free product plume. The simulation was accomplished by setting a bounding grid around the data and interpolating between the cell nodes. The LIF data was filtered according to the criteria listed in table 1. The interpolation scheme was based on inverse distance weighted methods. Note, LIF data points are generated every 2cm along the vertical extent of the push.

Several assumptions were necessary to allow for the generation of the GMS model. These include the location of the suspected source and the filter settings to screen all peak intensity and wavelength values of all insignificant and potentially false positive data. The interpolation provided in this report does not attempt to generate any mass transport, groundwater flow, or advection-dispersion modeling.

Diagram #3 provides the resultant interpolation of the LIF data. Note, the GMS plot is a color interpretation of the intensity values of LIF data. The bar scale indicates fluorescence intensities from 2187.5 to 18812.5. This range of intensity represents those LIF values resulting from low to high contamination respectively. The recovered sample tested and reported in table 1 fluoresced with a peak intensity of 12,500, "brighter green" range in color. In order to obtain the clearest graphic diagram of the LIF intensities certain data cells were cropped and no interpretation was of data was made. Computer simulation of cells along the outer boundary edge can be misleading since the interpretation scheme uses only the nearest point of known data as a reference. Data from the cells to the north of push locations –047 and -048 were cropped as part of simulation.

Findings:

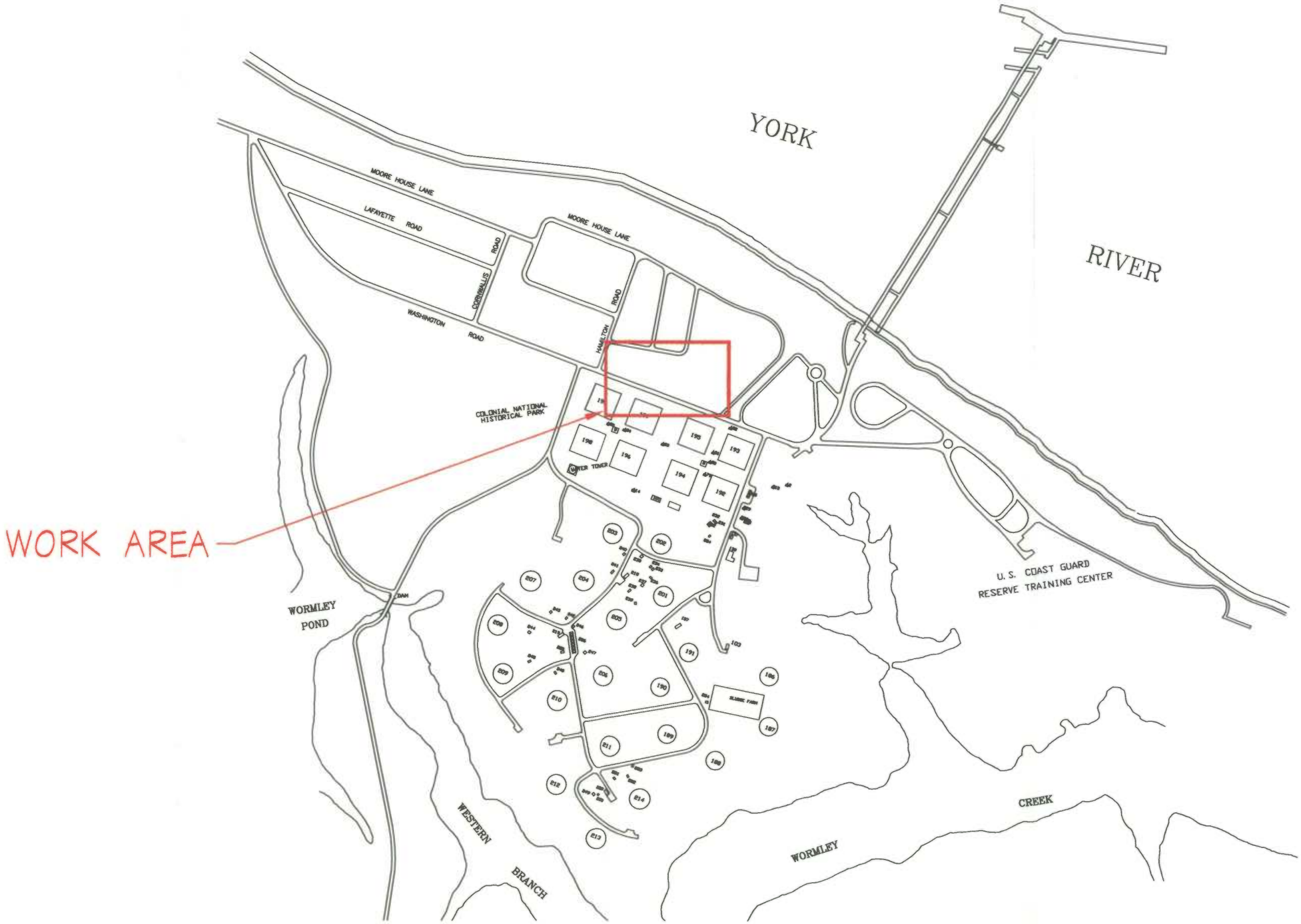
The presence of extent of subsurface contamination and the identification of potentially free product areas was successfully accomplished. The objective of this project was to locate "gross" levels of contamination using Laser Induced Fluorescence (LIF) technology. No attempt was made to define lower levels or any dissolved phase existence of petroleum contamination. The one unique finding is that the tree located at the North end of the site might be influencing localized movement of the plume. Groundwater Modeling Software (GMS) was used to generate a graphical representation of LIF intensities as they relate to the extent of contamination and to identify those areas, which pose the highest likely hood of containing free product, diagram #3. The legend on diagram #3 labeled Inverse Distance Weighted (IDW) indicates the color shading of peak intensities for LIF data. A sample of free product obtained from the remediation contractor fluoresced with a peak intensity on the order of 12500, depicted as the darker green areas on diagram #3. Those areas on the GMS diagram, which are darker green to bright red, represent areas with the greatest potential to have free product. Optimum placement of monitoring and recovery wells however, would be within the areas depicted by the orange to bright red color bands.

The SCAPS field crews used a specially configured video probe to capture down hole imagery of the soil particles, occurrence of groundwater and the presence of contamination on one select push. The push location was chosen based on the results of the LIF data which indicated the presence of petroleum impacted soil from 13-18-ft BGS; push location –050, diagram #2. The image generated shows the presence of groundwater and the occurrence of contamination,

signified by the dark black non-aqueous liquid occupying soil void spaces created by the advancement of the probe. The video imagery was used to confirm the presence of liquid phase product in the soil void spaces. The criteria that suggest LIF peak intensities greater than 12,500 and which fall between the wavelengths of 435 – 445 nm are representative of free product appear to be valid.

In October 1997 the SCAPS unit collected LIF data from the area within the fence line of the navy property, surrounding the abandoned UST's site. At the time of the 1997 project the high levels of contamination were encountered just inside the navy property between 11-25-ft BGS. The 1997 project was confined to the area within the boundaries of the navy property. The extent and location of petroleum impacted soil identified in 1997 matches the data obtained in 2001.

The data obtained during this project represents a snapshot of the locations and levels of petroleum contamination observed December 2001. This SCAPS project was not tasked to determine the fate and transport of any constituents nor site specific hydrogeologic parameters which would effect contaminant mobility.



BASE MAP

YORKTOWN FUELS

PWC NORFOLK CODE 440

Moore House Rd

Ballard St

Grass

TREE

Dead Tree

Brush/Trees

Brush/Trees

Brush/Trees

Abandoned Valve Box

Yorktown
Fuel Farm

COAST
GUARD GATE

LIF 042
LIF 041
LIF 016
LIF 017
MW 32
LIF 018
LIF 044
LIF 045
LIF 046
LIF 040
LIF 039
LIF 038
LIF 019
LIF 037
LIF 047
LIF 048
LIF 015
LIF 020
LIF 036
LIF 014
LIF 021
MW 31
LIF 035
LIF 022
LIF 034
LIF 013
LIF 023
LIF 033
LIF 012
LIF 011
LIF 024
MW 69
LIF 032
LIF 025
LIF 031
MW 5
LIF 010
LIF 026
LIF 030
LIF 009
LIF 027
LIF 049
MW 66
LIF 008
MW 22
LIF 028
LIF 029
LIF 053
LIF 007
LIF 050
(Video)
LIF 006
LIF 005
LIF 052
LIF 004
LIF 003
LIF 002
LIF 051
MW 19
LIF 001

Site Characterization and Analysis Penetrometer System
S·C·A·P·S

LEGEND:

MW-00 MONITORING WELL

LIF-00 LIF PUSH LOCATION NO DETECTION

LIF-00 LIF PUSH LOCATION LOW DETECTION

LIF-00 LIF PUSH LOCATION HIGH DETECTION

GRAPHIC SCALE

30' 0 30' 60'

LIF/CPT SITE MAP

SITE INVESTIGATION
NATIONAL PARK SERVICE AREA
YORKTOWN FUEL FARM
YORKTOWN, VA

PWC NORFOLK
FACILITY ENGINEERING DIVISION

SCAPS PROJECT #02-002 JAN 02
DIAGRAM #2

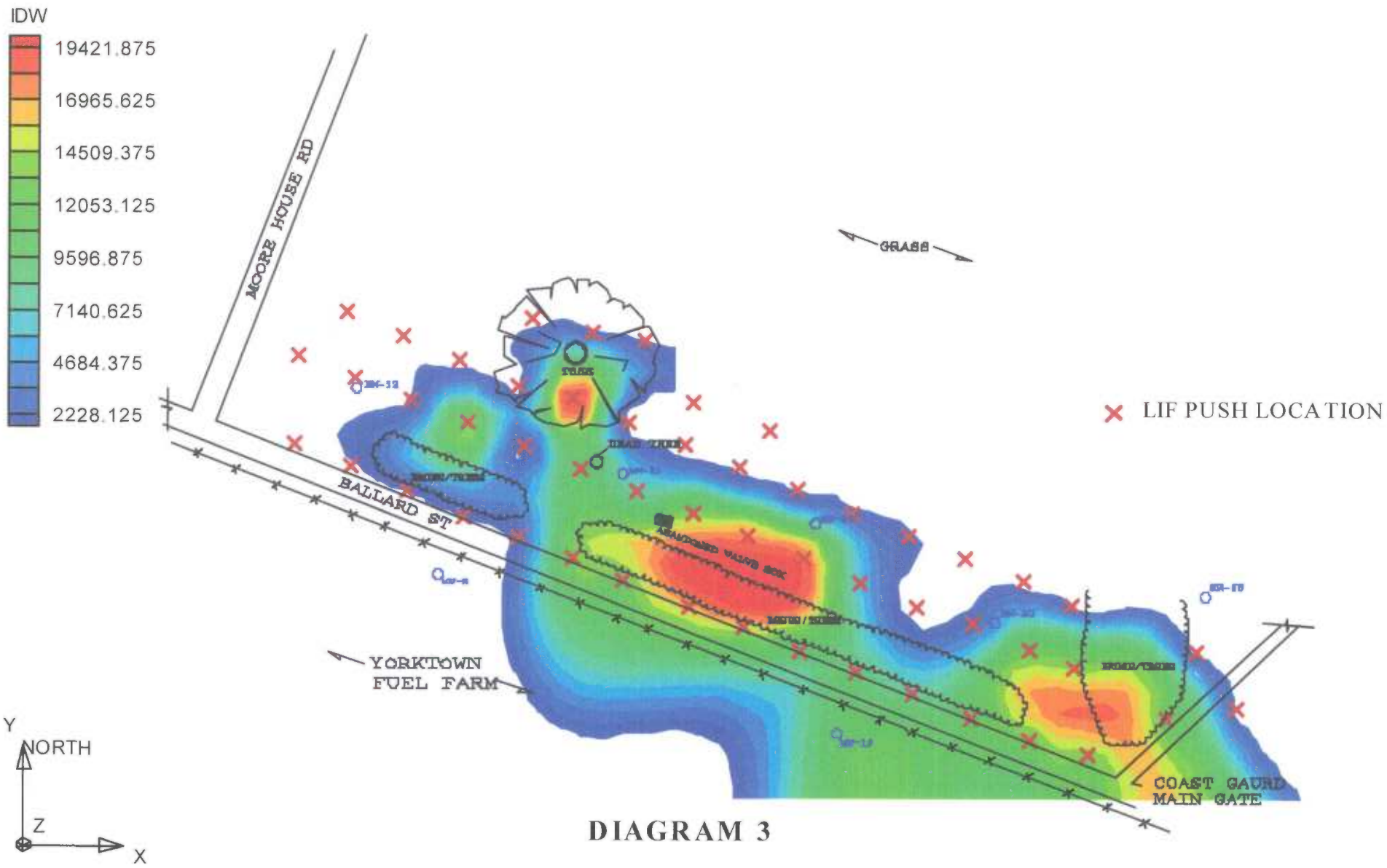

IDW
19421.875
16965.625
14509.375
12053.125
9596.875
7140.625
4684.375
2228.125
MOORE HOUSE RD
GRASS
LIF PUSH LOCATION
BALLARD ST
ABANDONED VALVE BOX
YORKTOWN
FUEL FARM
COAST GAURD
MAIN GATE
Y
NORTH
Z
X

DIAGRAM 3

SCAPS LIF Description

SCAPS Laser Induced Fluorescence (LIF) is a field screening technology that detects petroleum hydrocarbons. SCAPS is capable of measuring the occurrence of polycyclic aromatic hydrocarbons (PAH) of 2 or more rings. A schematic of the fiber optic fluorometer system is shown as Figure 1. The system was adapted from a design originally developed for in-situ fluorescence measurements in seawater (Lieberman, 1991 - Inmand, 1990: Lieberman, 1989). Excitation radiation is provided by one of two pulsed energy laser systems. The first is the 308nm XnCl (Eximer) laser used to detect lighter 2 ring PAH constituents found in JP-5, JP-8, Diesel and Mogas. The second, SCAPS original system, is a pulsed nitrogen laser (Model PL2300, Photon Technology, Inc.) that operates at 337 nanometers with a pulse width of 0.8 nanoseconds and pulse energy of 1.4 millijoules. This system can accurately detect 3 ring and greater PAH constituents, like those found in waste oil, bunker "C" and Navy special fuel oil.

The penetrometer sensor system uses two 365 Micron diameter UV/visible transmitting (high OH clad silica) optical fibers. One fiber is used to carry excitation radiation down through the penetrometer rod and a second fiber collects the fluorescence generated in the soil sample and carries it back to the detector system at the surface. The standard fiber length is 100 meters, which permits collection of fluorescence data to the maximum push depth (50 meters) using a standard 20-ton penetrometer rig. Excitation and emission fibers are isolated from the soil at the probe tip by a 6.35 millimeter diameter sapphire window mounted flush with the outside of the probe approximately 60 centimeters from the tip. The beam is coupled into the excitation fiber using a 2-inch focal length quartz lens. In order to minimize the contribution of secondary fluorescence lines to the measured backgrounds, a mirror that selectively reflects each lasers primary output is used to redirect the laser line before coupling it into the excitation fiber. Optical triggering of the detector eliminates problems associated with laser jitter.

A photodiode array detector system is used to quantify the fluorescence emission spectrum brought back to the surface over the receiving fiber. The detector system consists of a Model 1420 Intensified Photodiode Array Detector (EG&G PARC) coupled to a quarter-meter spectrograph that houses a 300 line/millimeter diffraction grating. The 1024 element array (700 elements are intensified) consists of 25 micron wide diodes centered at 25 micron increments. For the 300 line/millimeter grating, the dispersion of the spectrograph translates to a spectral resolution of 0.45 nanometers per pixel at the array surface when a 25 micron input slit is used. Emission spectra readout requires approximately 16 milliseconds. Because the detector can be read quickly, it is possible to add spectra from multiple laser shots in order to improve the signal-to-noise ratio of the measurement. At present, 20 laser shots are used per sample interval.

Control and read-out of the detector is performed by a Model 1460 optical multichannel analyzer (OMA) (EG&G PARC). Measurements are initiated by an electronic signal from the OMA that fires the laser. The laser pulse then triggers an optical detector that sends an electronic signal to a fast-pulsed amplifier (Model 1304, EG&G PARC). The pulse implements an appropriate delay (approximately 350 nanoseconds for a 50 meter fiber and 750 nanoseconds for a 100 meter fiber), and gates the detectors "on" for a period of 100 nanoseconds. Time-gating for the detector is set so that it is "on" to coincide with the arrival of the fluorescence signal at the detector. Because most fluorophores of interest have fluorescent lifetimes in the range of 5 to 100 nanoseconds, time-gating the detector maximizes signal-to-noise by minimizing contributions to the signal from background light and detector noise. The resulting fluorescent intensity is a measure of the response to the input energy.

A Pentium Pro 200 microprocessor host computer is used to automate the overall measurement process. The host computer controls the OMA system and stores fluorescence emission data, collects data from strain gauges, estimates soil type from strain gauge data and monitors depths from transducers on the hydraulic ram. As the probe is pushed into the soil, the data acquisition software generates real-time depth plots of maximum fluorescence intensity, wavelength of maximum intensity, point resistance, sleeve friction and soil characteristics. A fluorescence emission spectrum is collected approximately every 2 seconds. For the standard push rate of 2 centimeters/sec, this corresponds to a vertical resolution between measurements of 2-4 centimeters. The entire fluorescence emission spectrum is stored on a fixed disk to facilitate post-processing of the data.

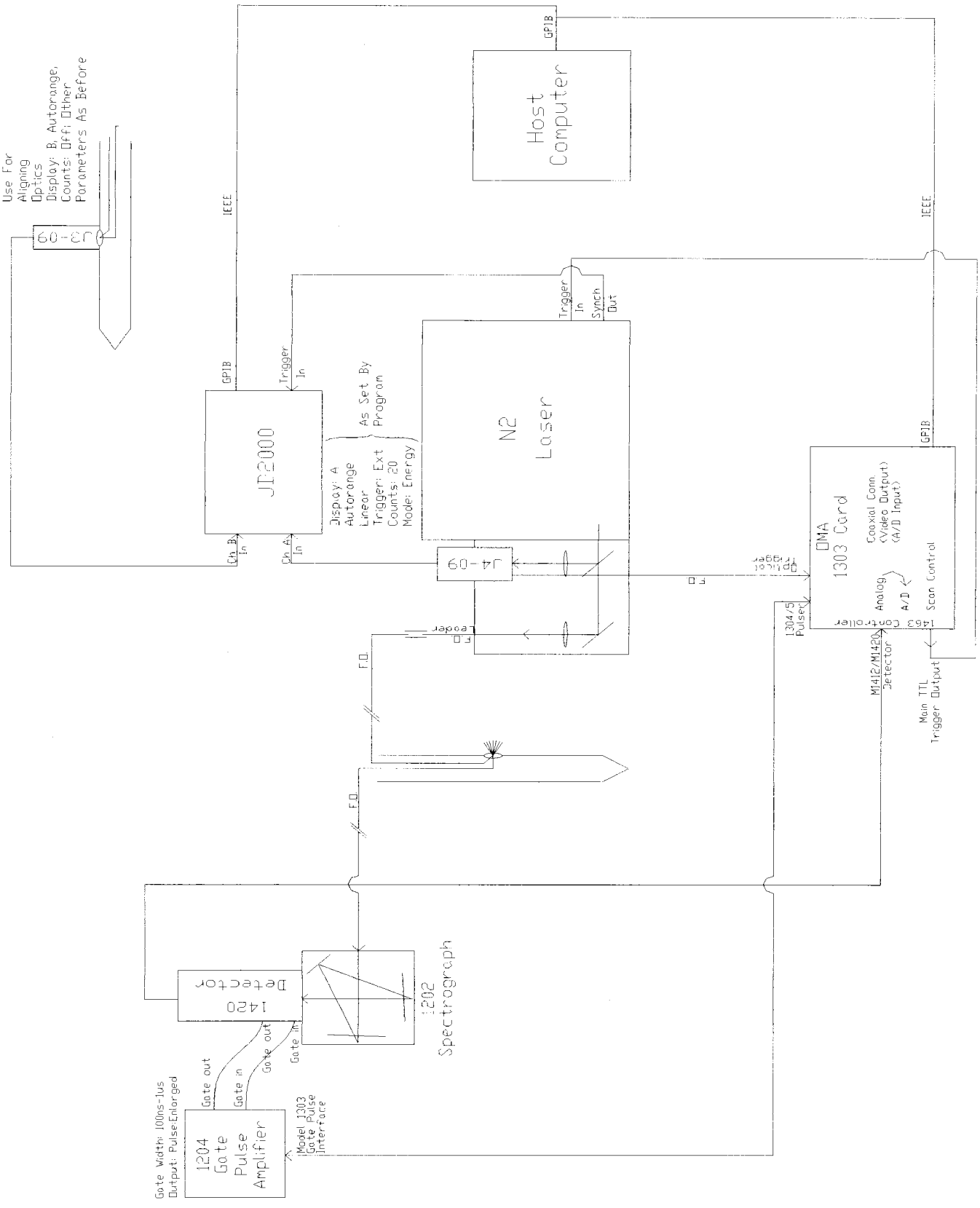


FIGURE 1: FIBER OPTIC FLUOROMETER SYSTEM SCHEMATIC

Quality Control & Calibration Standards

Two different standards are used during field operations. A quality control standard based on a solution of quinine sulfate is used to ensure the system is functioning correctly. This standard also allows the data to be normalized if the probe is changed in the middle of field operations. A set of calibration standards is prepared to evaluate the sensitivity of the sensor to the soil type at the site and the fuel type expected to be encountered. This set of standards is used to establish the noise in the measurement as well as the sensitivity of the sensor to the soil/fuel combination.

The quality control standard, designed to evaluate the system performance and internal noise, consists of dilute sulfuric acid mixed with 10 parts per million (ppm), by weight, quinine sulfate. Quinine sulfate has high quantum efficiency so it fluoresces quite strongly, is chemically stable, easily reproducible, and exhibits minimal photo degradation. A single measurement of the quinine sulfate standard averages 20 fluorescence spectra, analogous to the in-situ push averaging. The measurement is repeated three times directly before and after each push. The short-term system stability is defined as the standard deviation of the three measurements. Typical results show an average standard deviation of 1 to 2 percent of the fluorescent intensity.

The sensitivity of the sensor depends on the type of hydrocarbons encountered. Diesel fuel, which is composed mostly of heavy PAH, tends to fluoresce strongly when excited by a nitrogen laser (SCAPS 337) such that a small amount of fuel can give a large fluorescence signal. Conversely, jet fuels (e.g. JP-5) are composed of a greater fraction of lighter PAH, which are not efficiently excited by the nitrogen laser. Therefore, the nitrogen laser requires a greater amount of jet fuel to give the same fluorescence signal as a lesser amount of diesel fuel. The inverse relationship is true for a xenon-chloride laser (SCAPS 308).

Interpreting Laser Induced Fluorescence Data

PAH are virtually found in all petroleum fuel mixtures and fluoresce under ultraviolet excitation, such that the amount of fluorescence is related to the amount of PAH. The sensitivity of SCAPS varies with the portion of PAH in the petroleum fuel and the laser system utilized. The LIF system is quantitative in a known soil matrix with a known contaminant. However, when operated in the field the LIF system is semi-quantitative due to typical variations in the soil matrix and contaminant type.

SCAPS LIF system measures the responding fluorescent intensity that results from the chosen lasers input energy. A larger number indicates a greater amount of responding energy. The relationship is linear such that the responding energy increases with increasing amounts of PAH. SCAPS is a semi-quantitative analysis technique because the response is relative to the type of PAH and the relationship cannot be exactly determined.

SCAPS results are used to gain a better understanding of contaminant distribution while reducing the number of investigation iterations at a site. Experience has shown that the measured fluorescent intensity is a good gross indicator of the location and amount of petroleum at a site. SCAPS data is then combined with a reduced number of soil samples that provide a quantitative measurement of contamination to characterize a site.

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 001

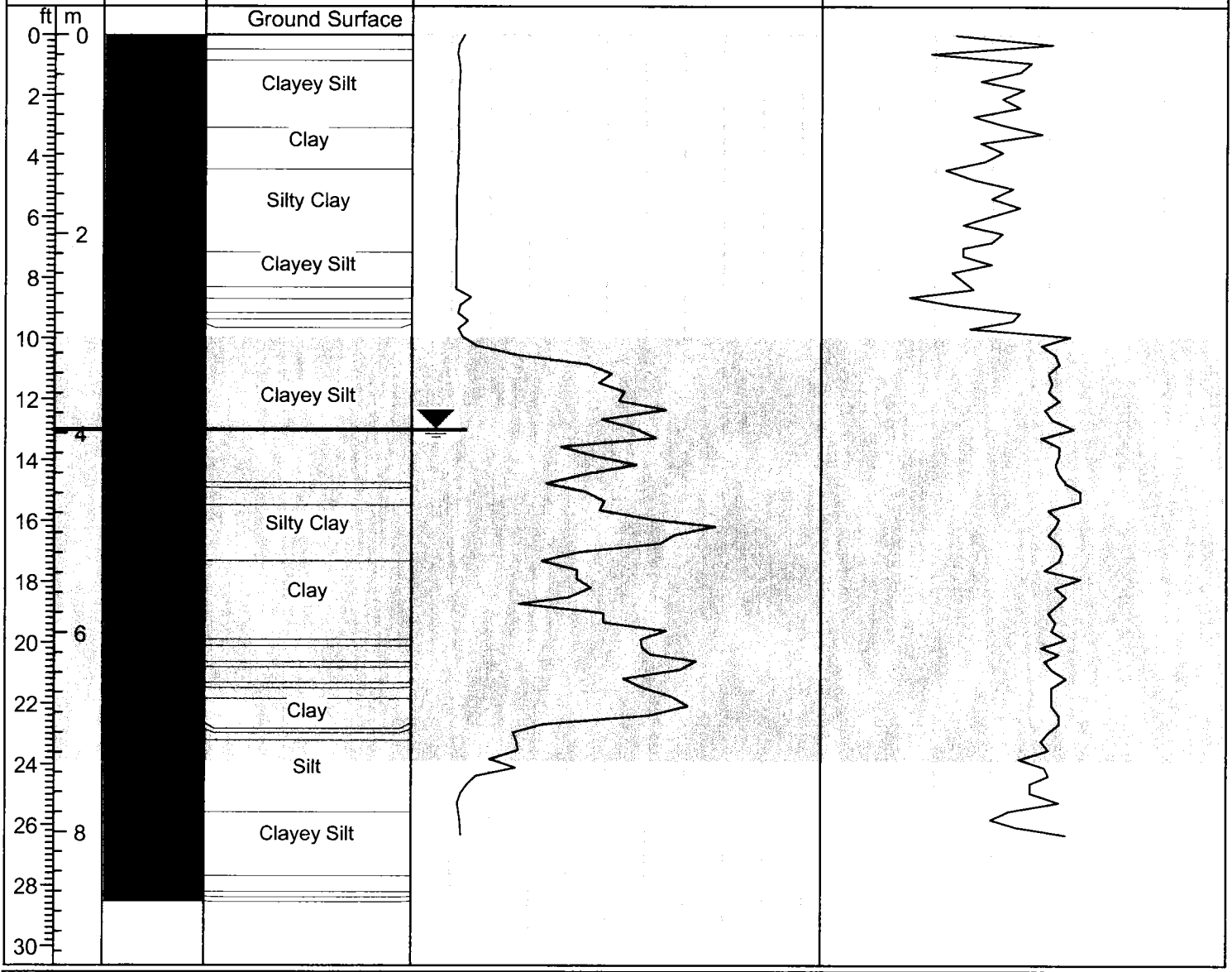
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/4/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 10-24' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 002

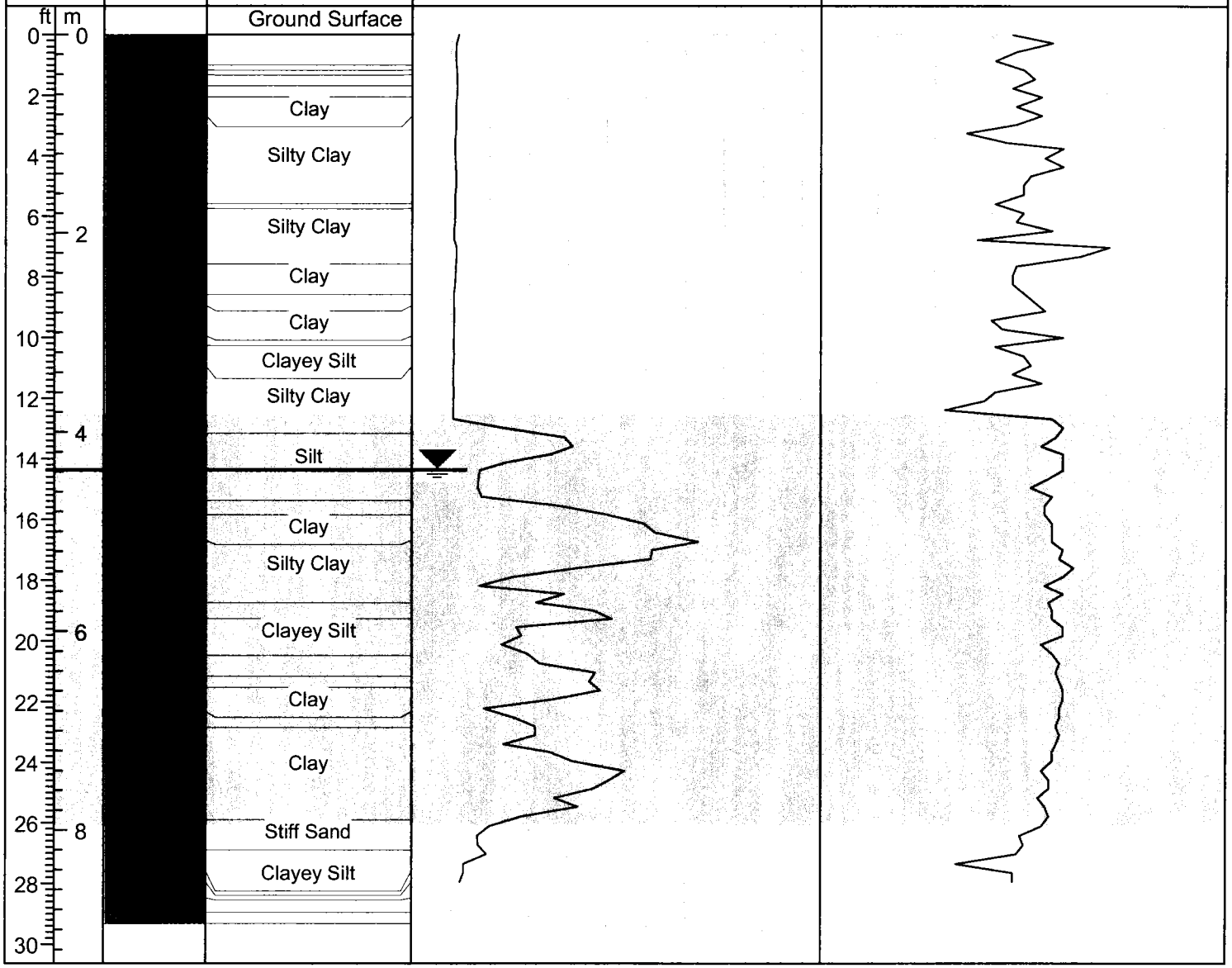
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/4/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 12.5-26' BGS
High Relative Intensity

NAVY PWC NORFOLK
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Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 003

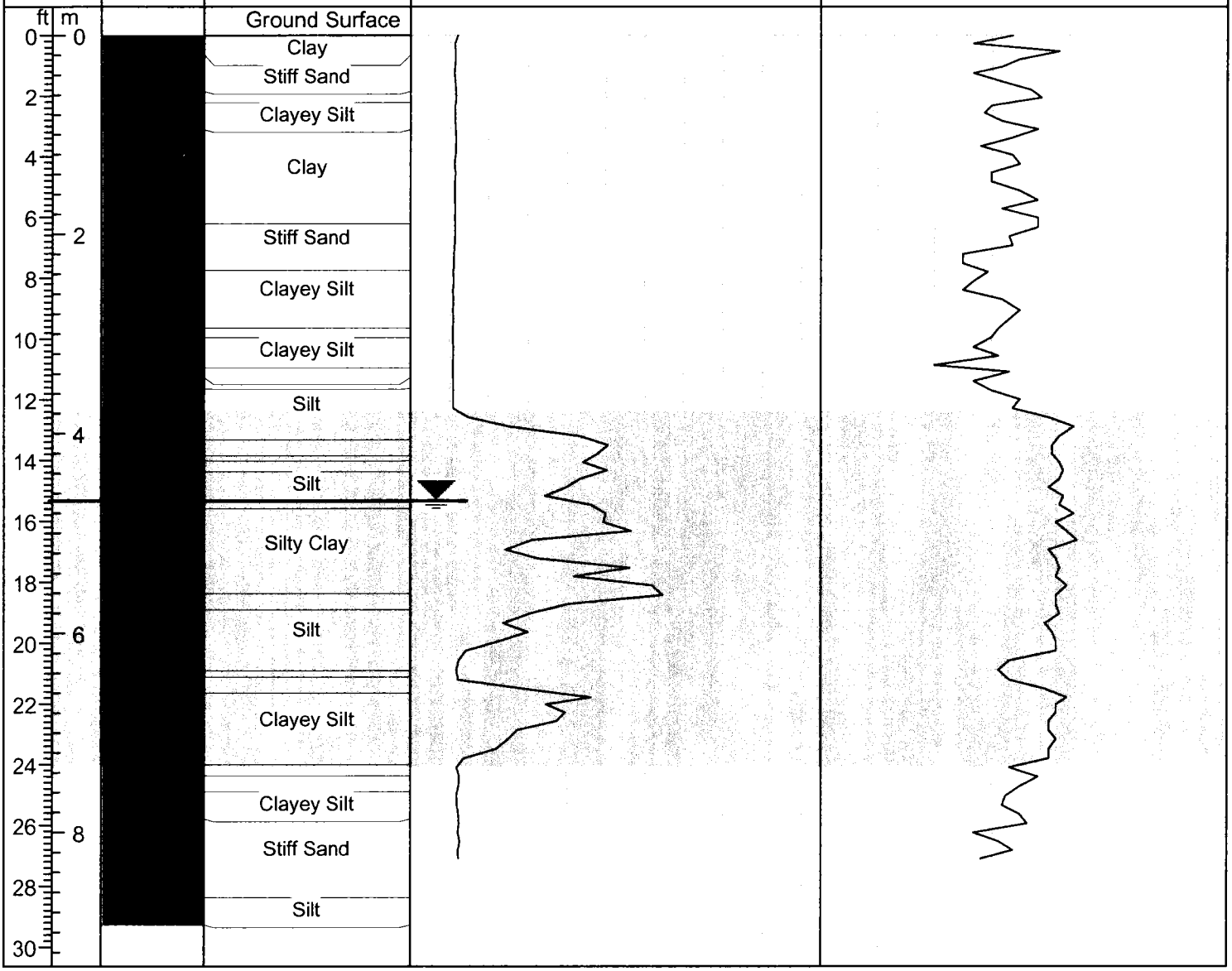
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/5/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 12.5-24' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 004

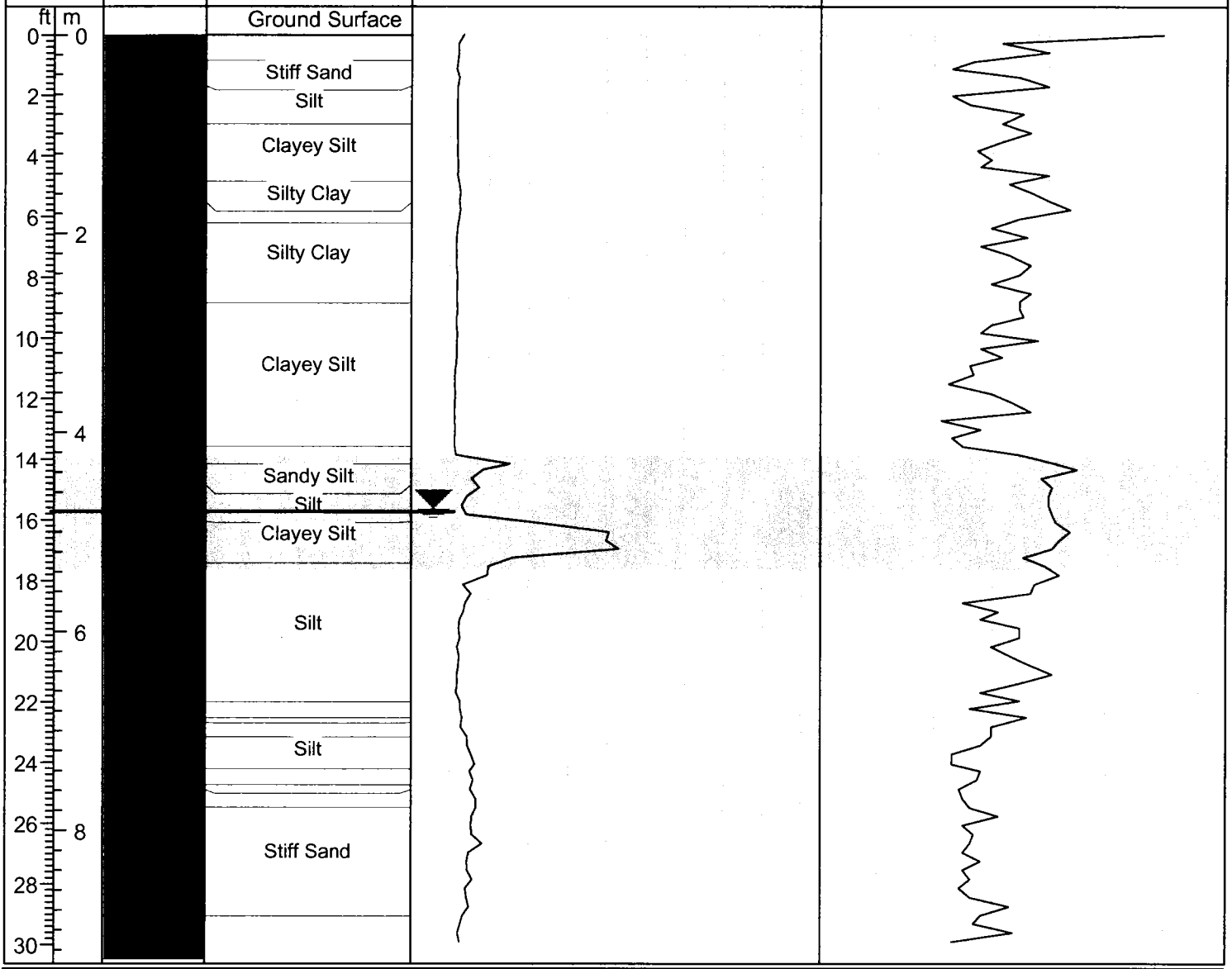
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/4/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 14-17.5' BGS
High Relative Intensity

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9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 005

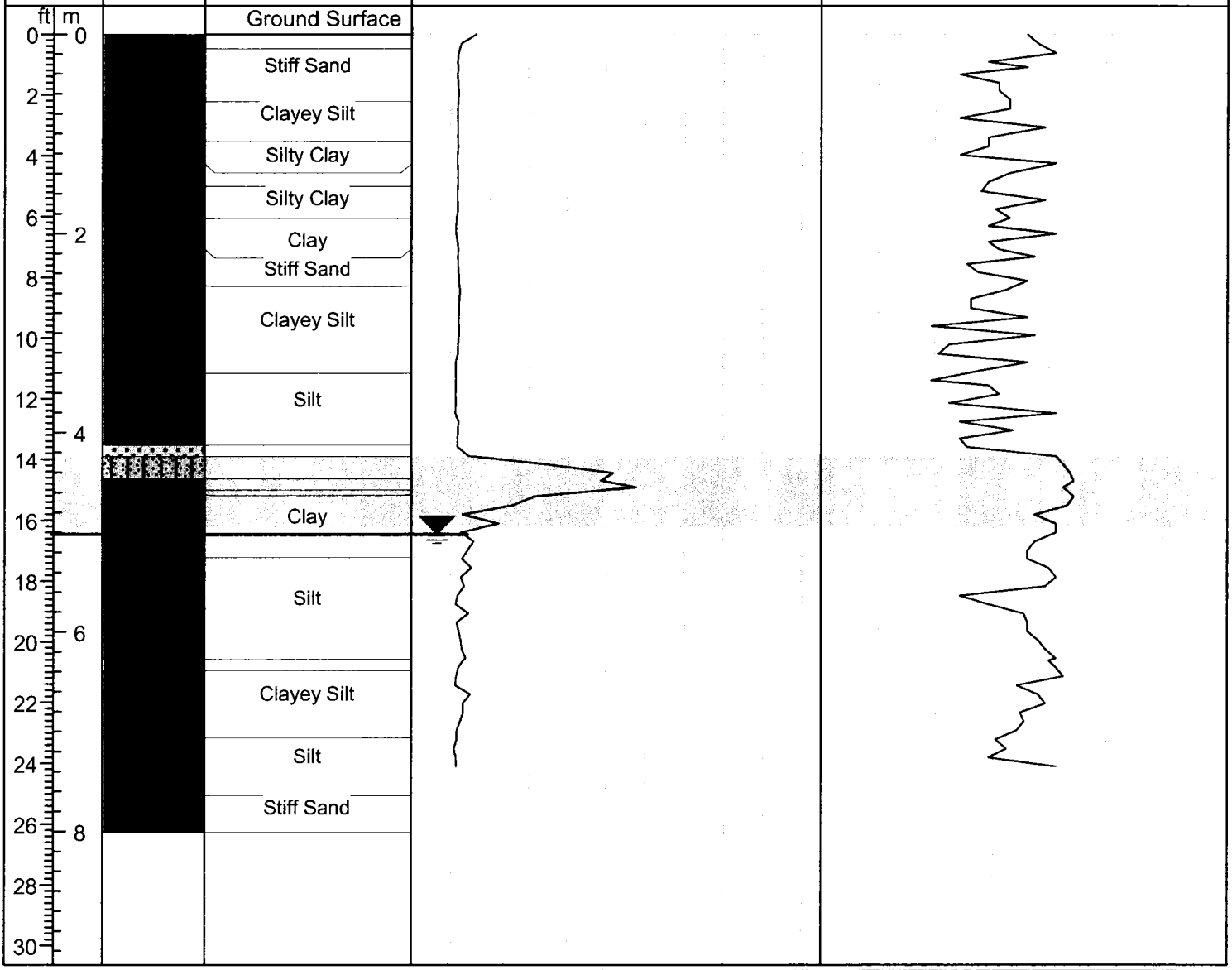
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/5/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 14-16' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 006

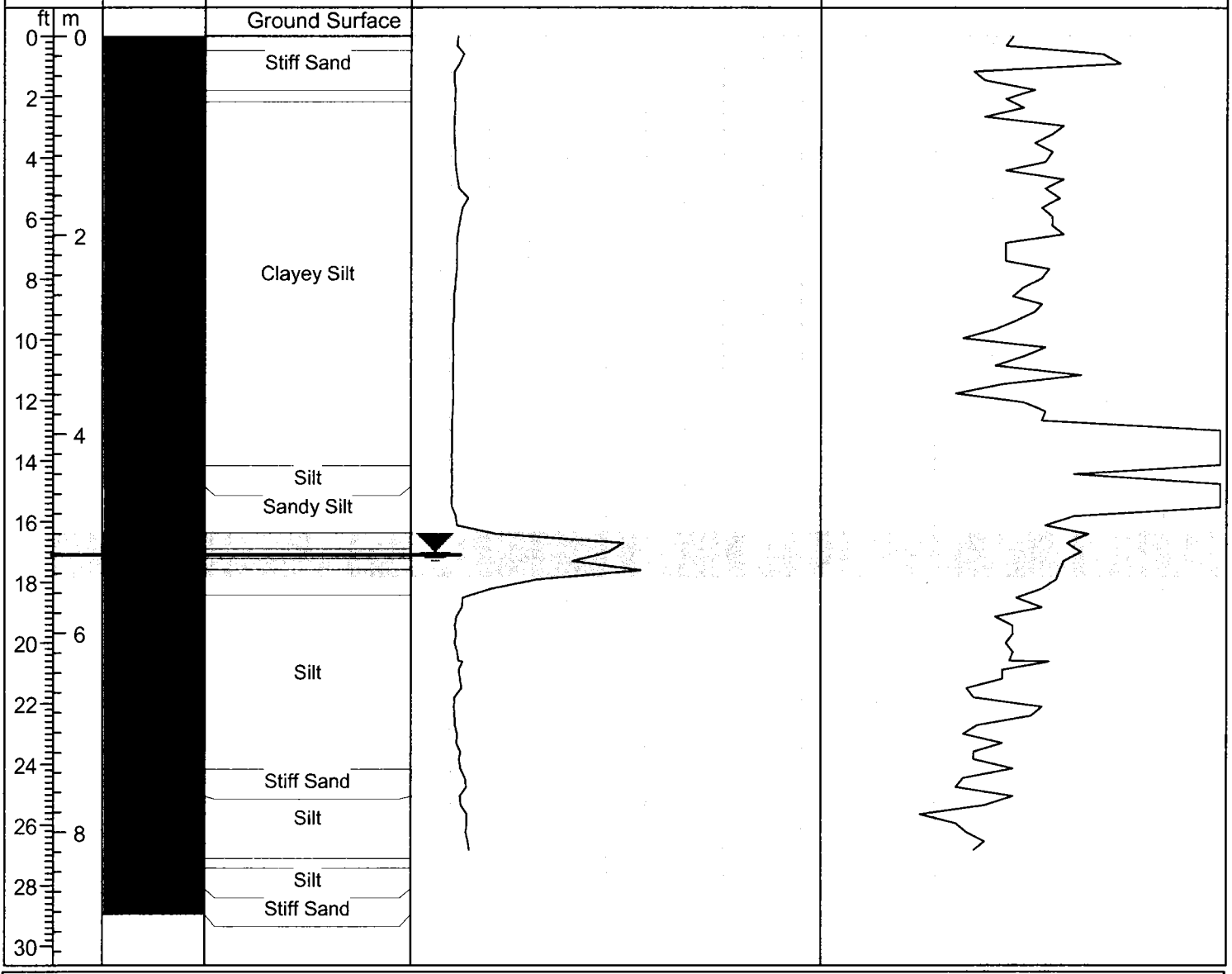
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/5/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 16.5-18' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 007

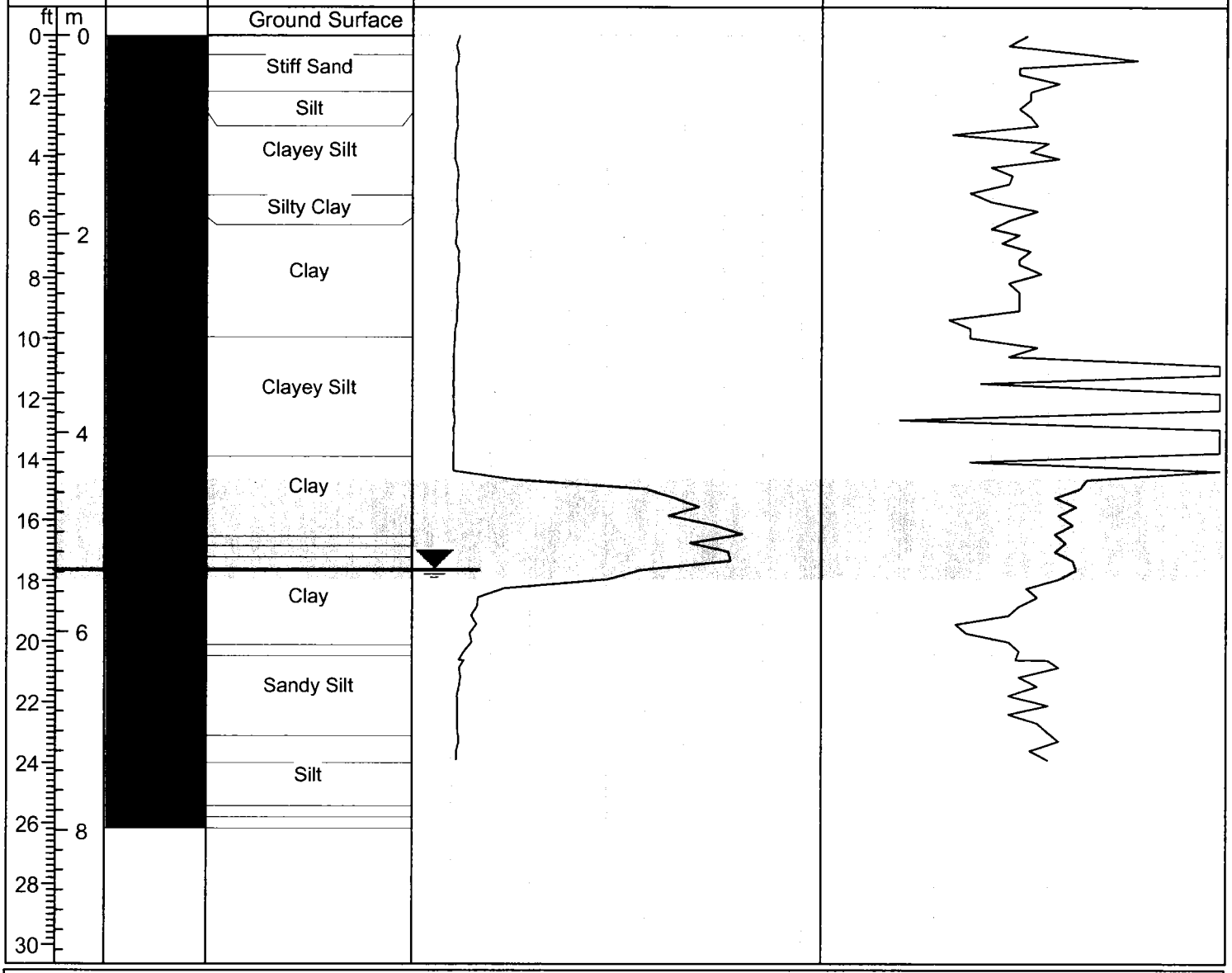
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/5/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 15-18' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 008

Project #: 02-002

Project Manager: GS

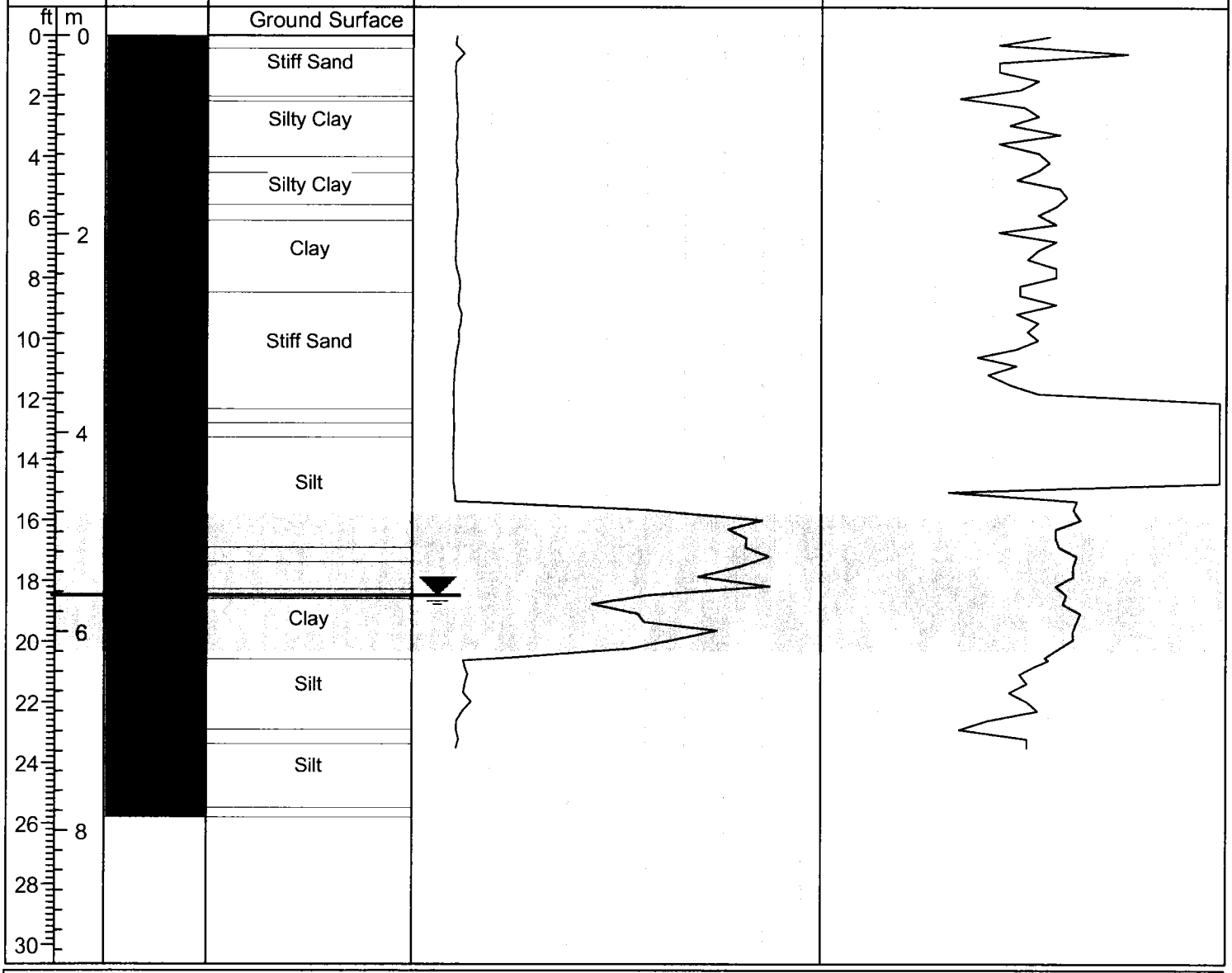
Client: CNRMA, Regional Env Group

Date: 12/5/01

SUBSURFACE PROFILE

LIF RESULTS

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Stiff Sand
2		Silty Clay
4		Silty Clay
6		Clay
8		Stiff Sand
10		
12		
14		Silt
16		
18		
20		Clay
22		Silt
24		Silt
26		
28		
30		



Contamination Identified @ 16-20' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 009

Project #: 02-002

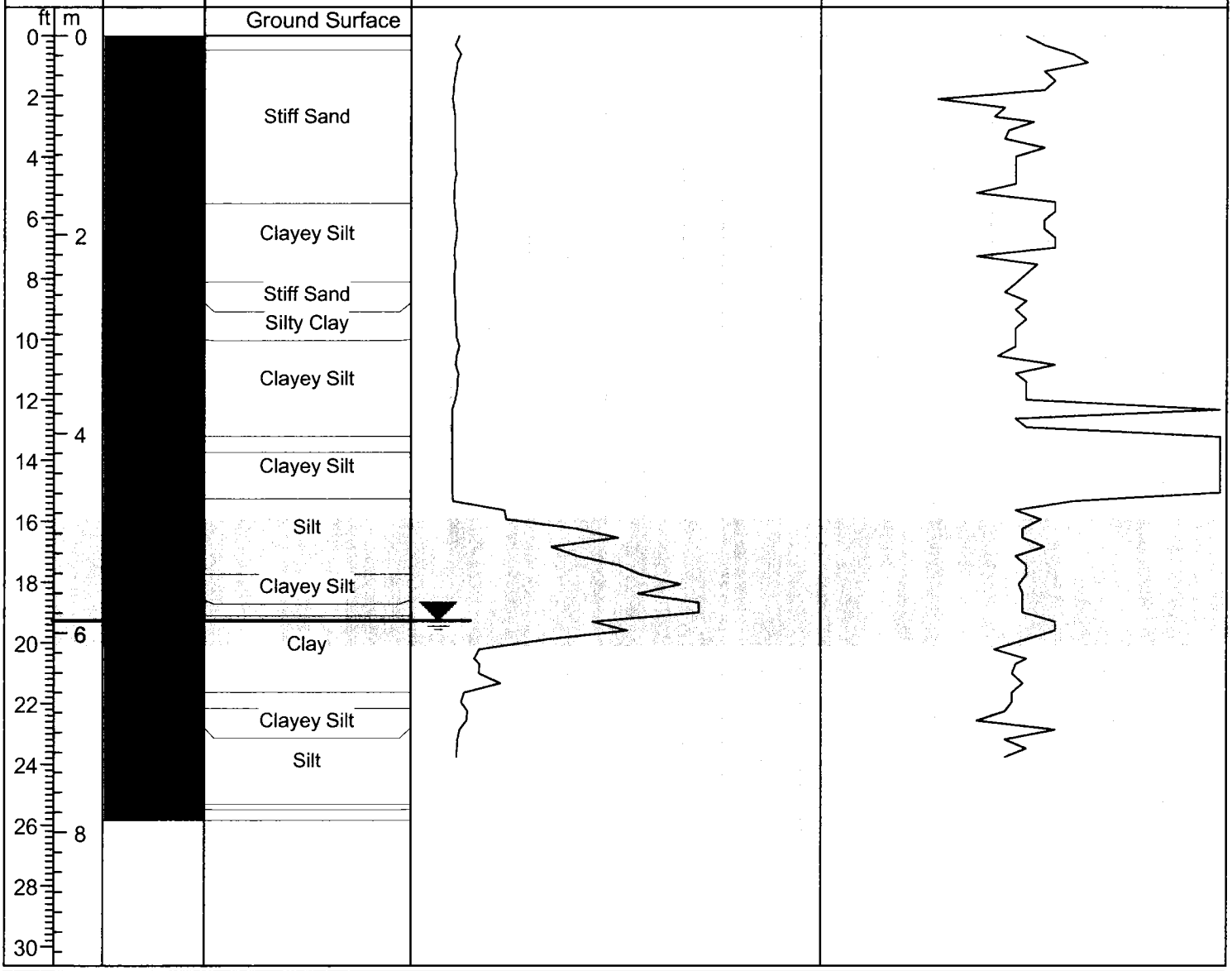
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/5/01

SUBSURFACE PROFILE

LIF RESULTS



Contamination Identified @ 16-20' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 010

Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

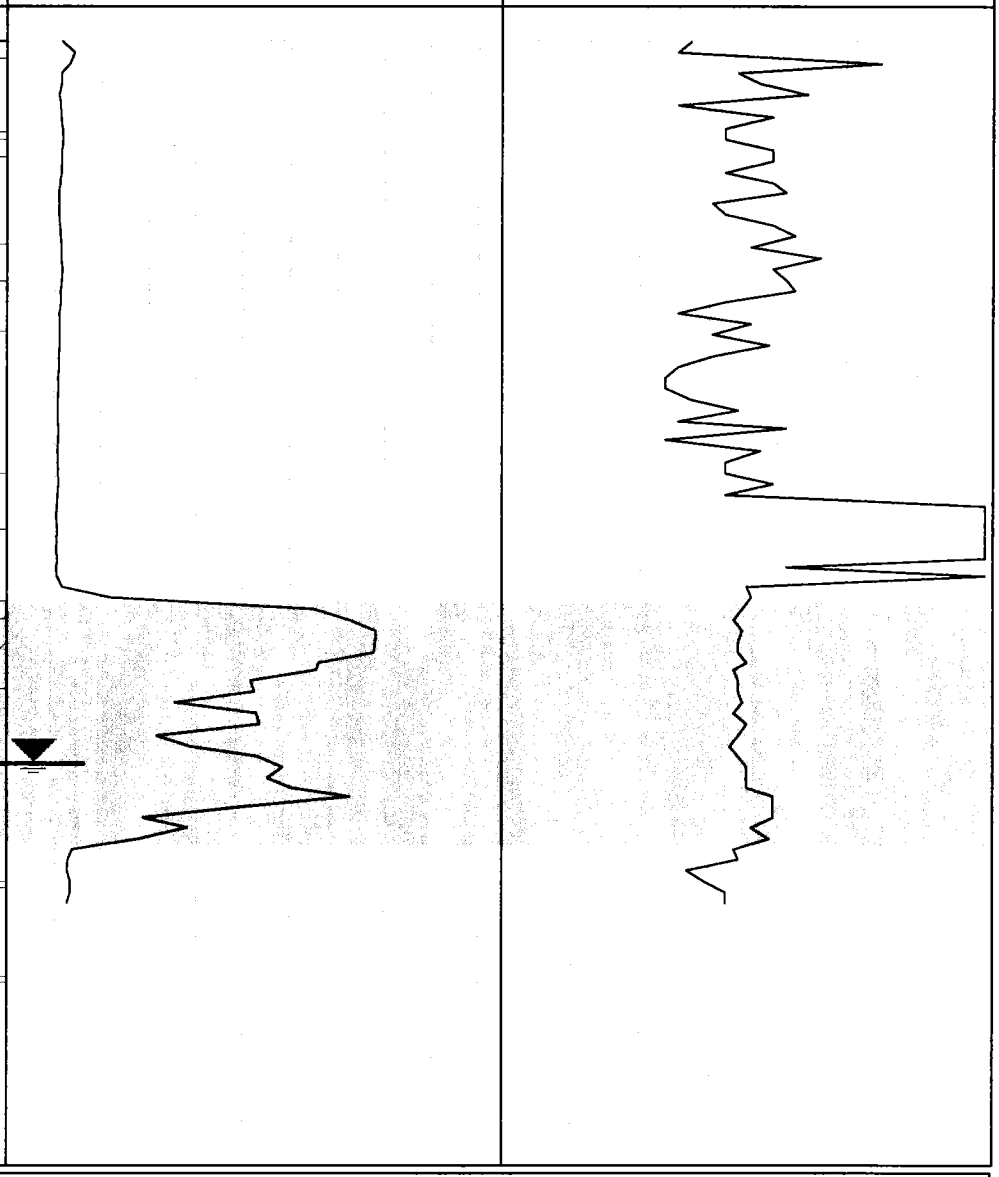
Date: 12/5/01

SUBSURFACE PROFILE

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Stiff Sand
2		Clayey Silt
4		Silty Clay
6		Clayey Silt
8		Silty Clay
10		Clayey Silt
12		Silty Clay
14		Clay
16		Silty Clay
18		Clay
20		Silt
22		
24		
26		
28		
30		

ft / m: 0, 2, 4, 6, 8

LIF RESULTS



Contamination Identified @ 15.5-21.5' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 011

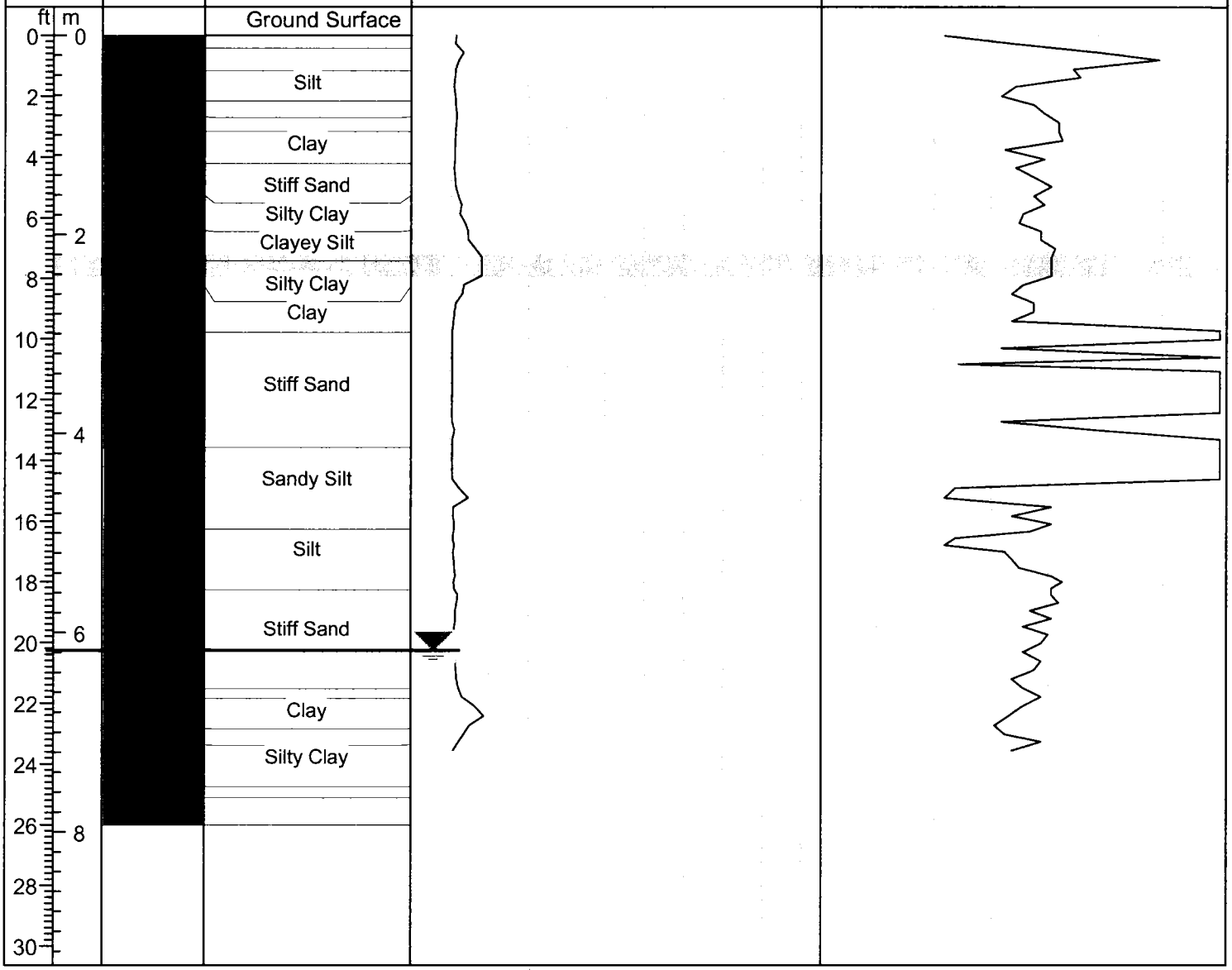
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/6/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 7.5' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 012

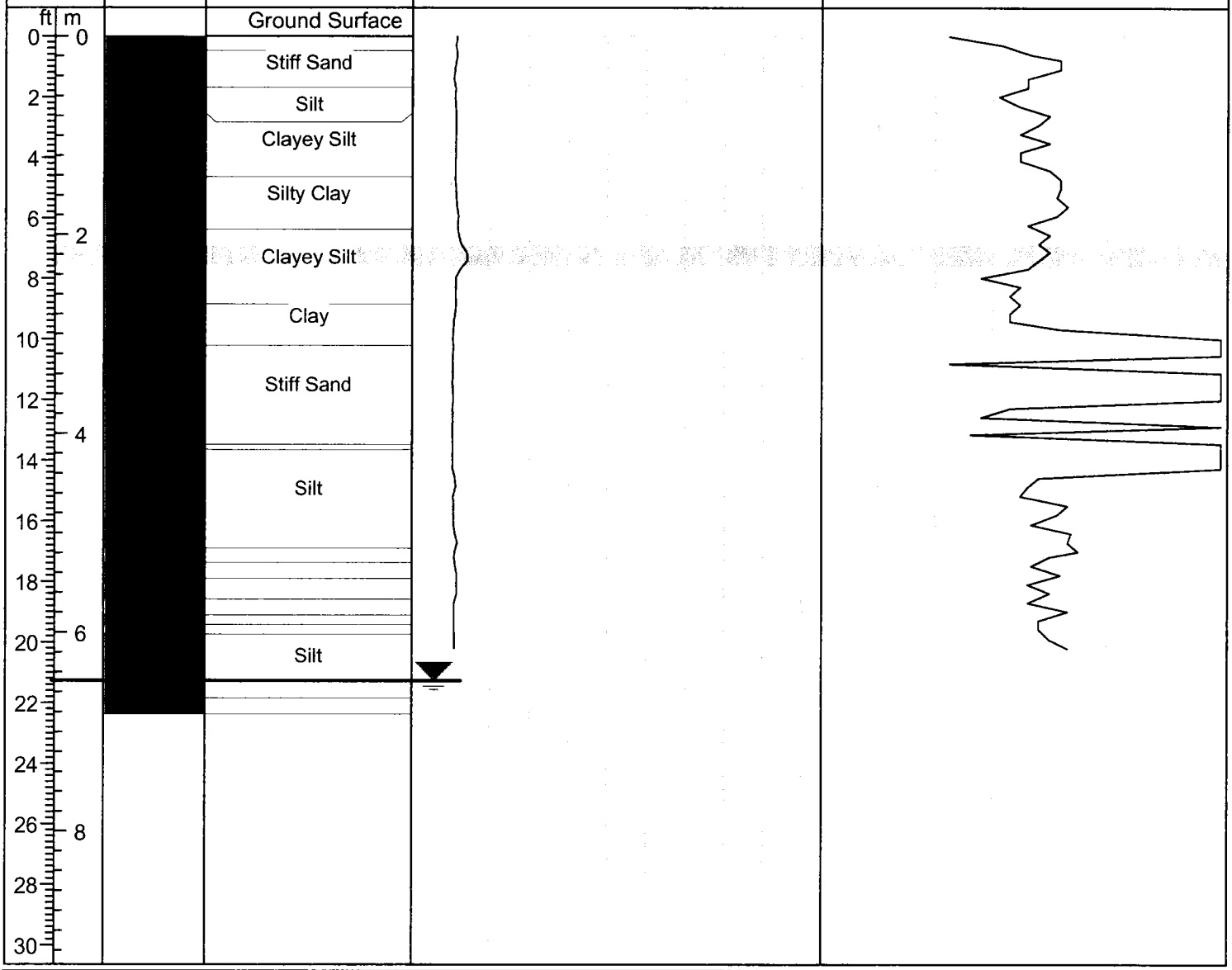
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/6/01

SUBSURFACE PROFILE			LIF RESULTS	
Depth BGS	Symbol	Soil Class	Peak Intensity (Counts X 1000)	Wavelength @ Peak (nm)
			0 2 4 6 8 10 12 14 16 18	400 415 430 445 460 475



Contamination Identified @ 7' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 013

Project #: 02-002

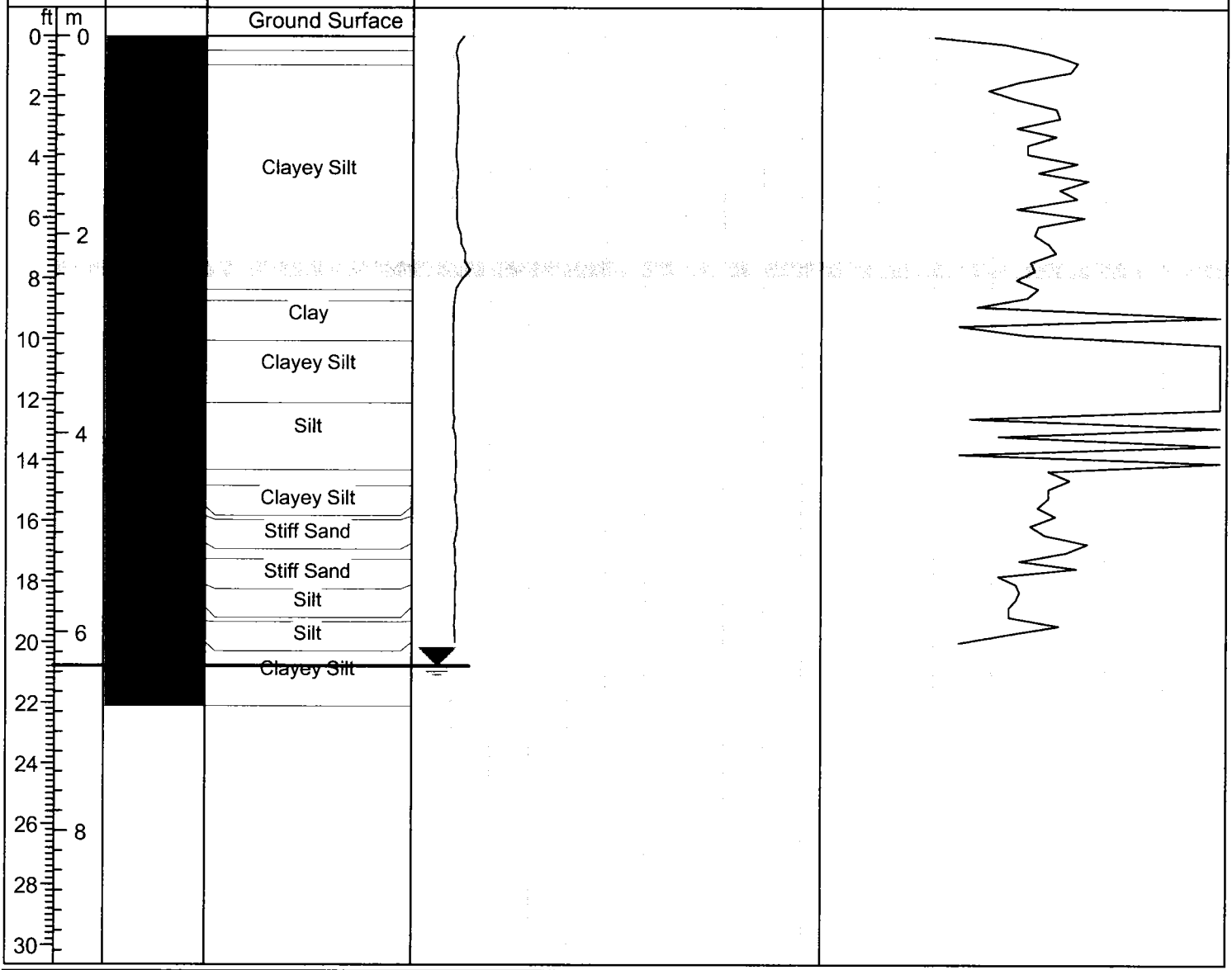
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/6/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0–2		Clayey Silt
2–3		Clay
3–4		Clayey Silt
4–6		Silt
6–7		Clayey Silt
7–8		Stiff Sand
8–9		Stiff Sand
9–10		Silt
10–11		Silt
11–12		Clayey Silt



Contamination Identified @ 7.5' BGS
Low Relative Contamination

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 014

Project #: 02-002

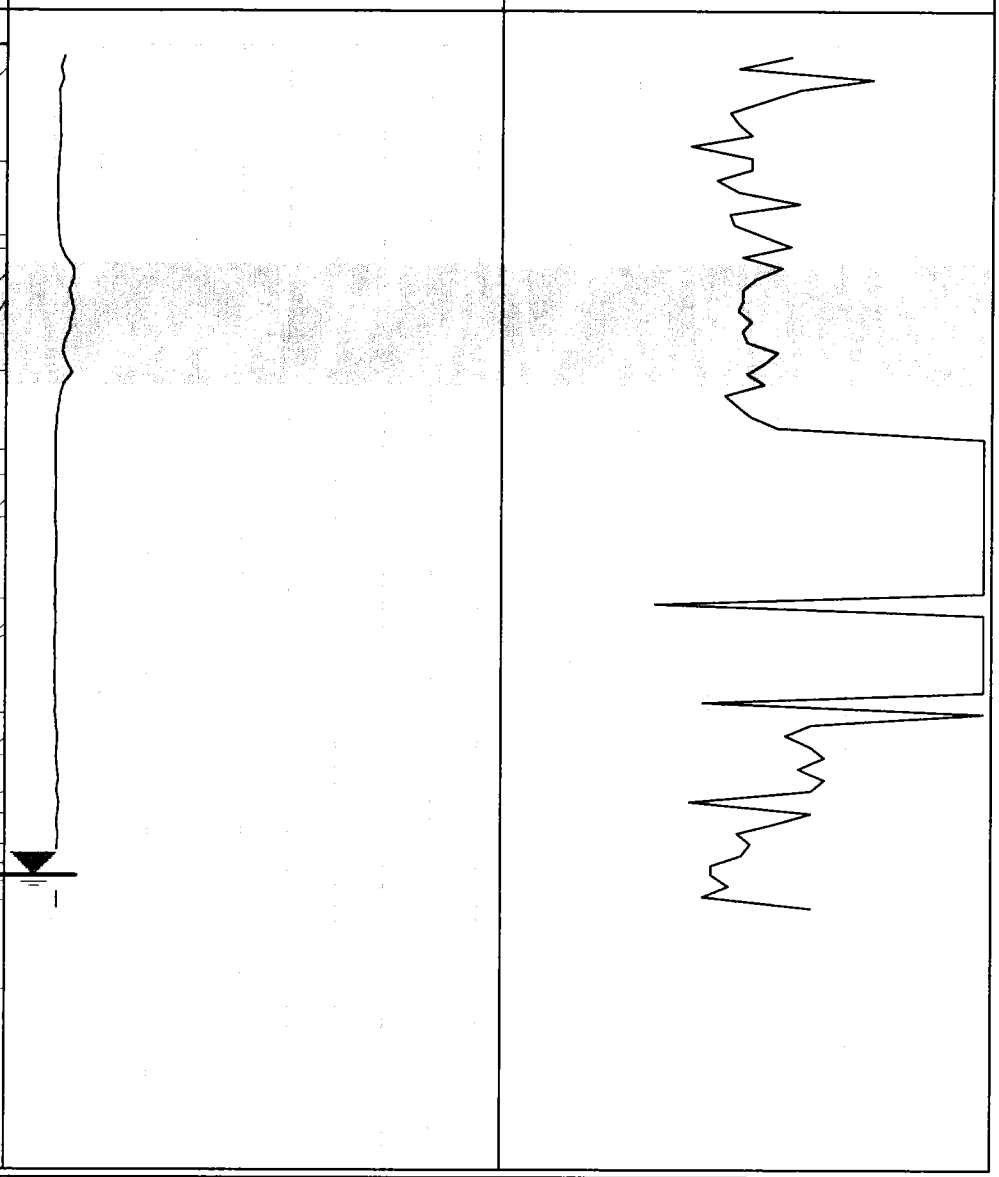
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/6/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Stiff Sand
2		Silt
4		Clayey Silt
6		Clay
2		Stiff Sand
8		Clayey Silt
10		Silty Clay
12		Silty Clay
4		Clayey Silt
14		Silt
16		Silt
18		Silty Clay
20	6	Silt
22		
24		Silt
26	8	
28		
30		



Contamination Identified @ 6-9' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 015

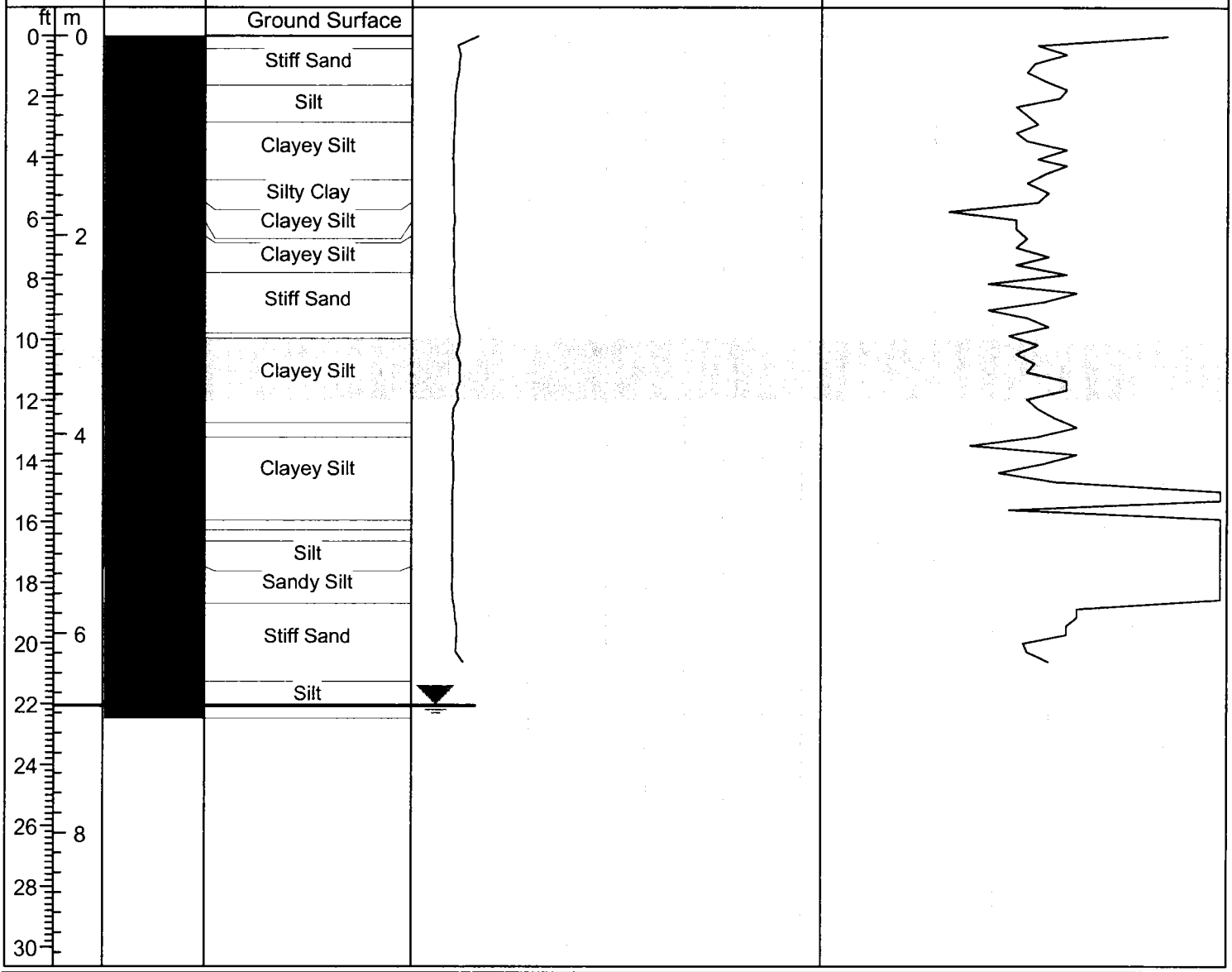
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/6/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 10-12' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 016

Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

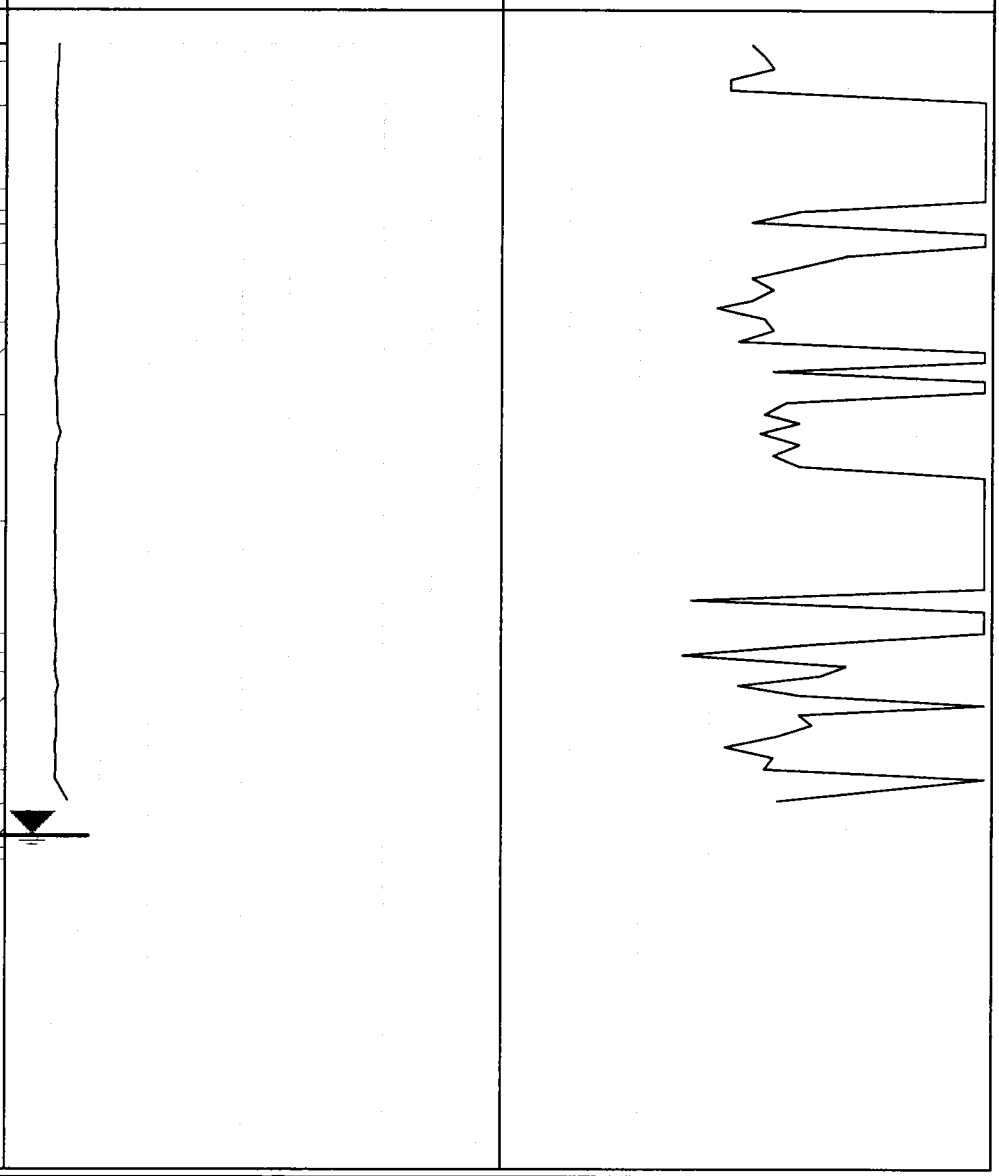
Date: 12/6/01

SUBSURFACE PROFILE

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Silt
2		Clayey Silt
4		
6		Stiff Sand
8		Clayey Silt
10		Stiff Sand
12		Clayey Silt
14		Silt
16		
18		Stiff Sand
20		Silt
22		Stiff Sand
24		Silt
26		
28		
30		

ft: 0, 2, 4, 6, 8
m: 0, 2, 4, 6, 8

LIF RESULTS



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 017

Project #: 02-002

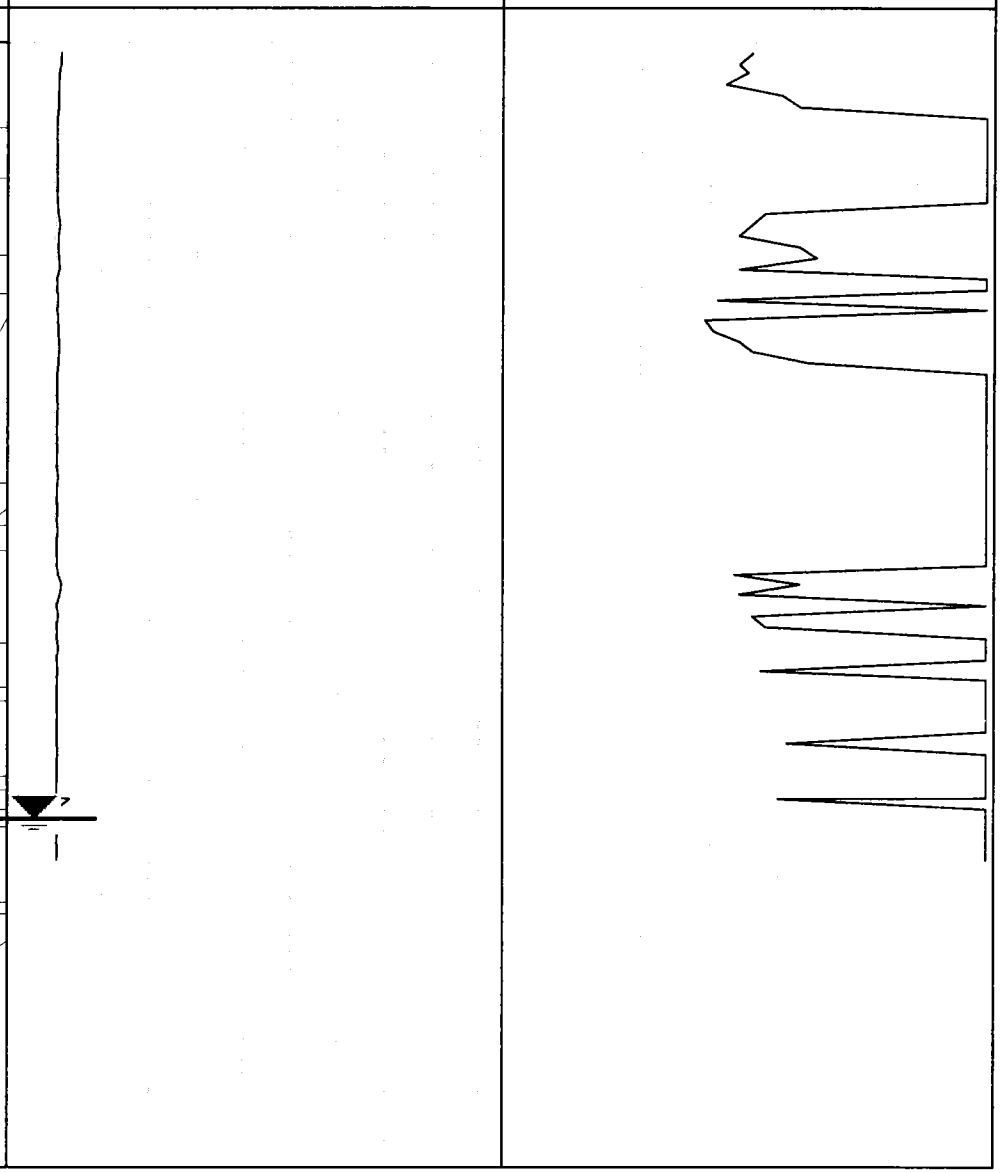
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/6/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS (ft)	Depth BGS (m)	Symbol	Soil Class
0	0		Ground Surface
0	0		Clayey Silt
2			Silt
4			Clayey Silt
6	2		Silty Clay
8			Clayey Silt
10			Stiff Sand
12	4		Clayey Silt
14			Sandy Silt
16			Silt
18			Silt
20	6		
22			Silt
24			Silt
26	8		
28			
30			



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 018

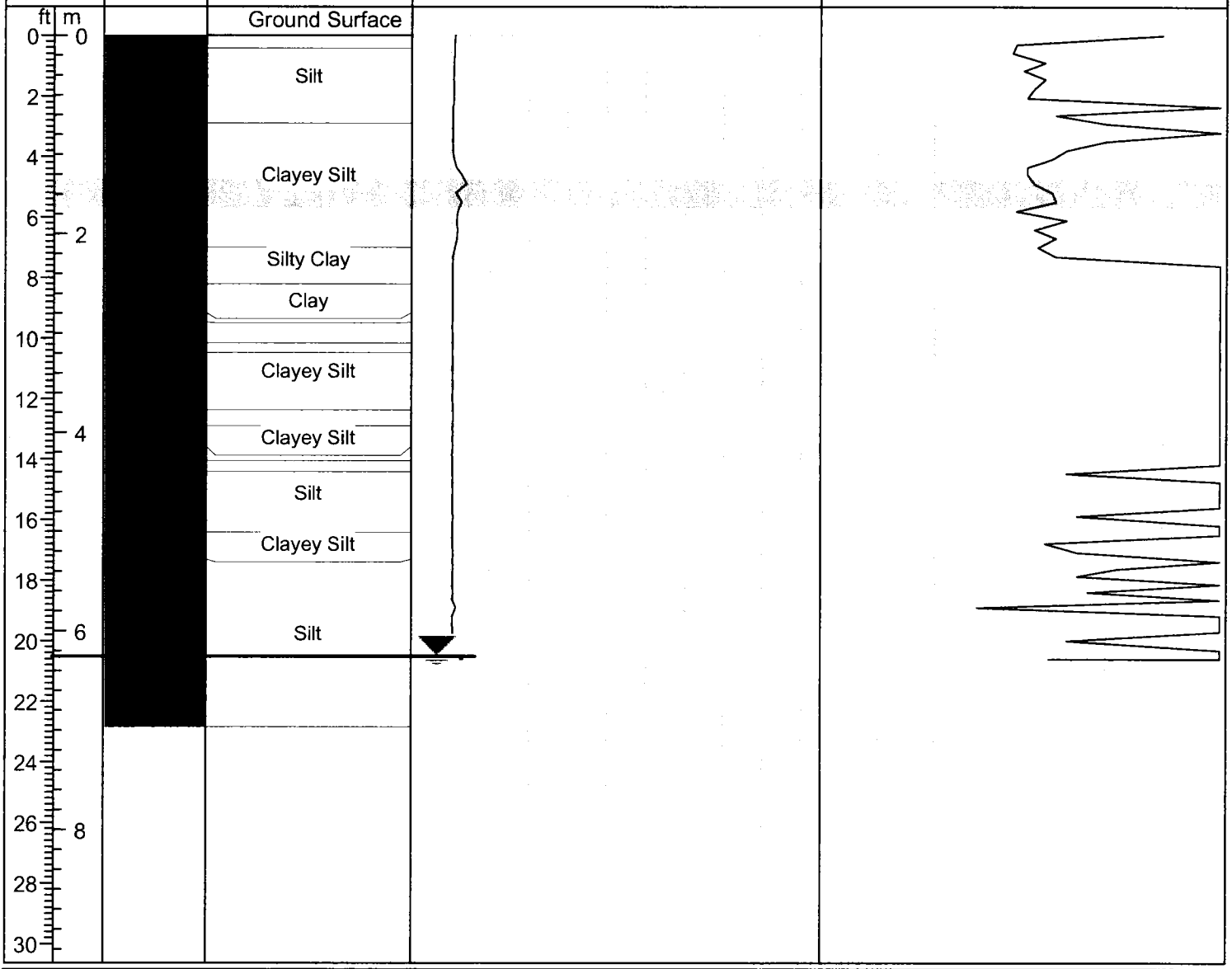
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 4.5-5.5' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 019

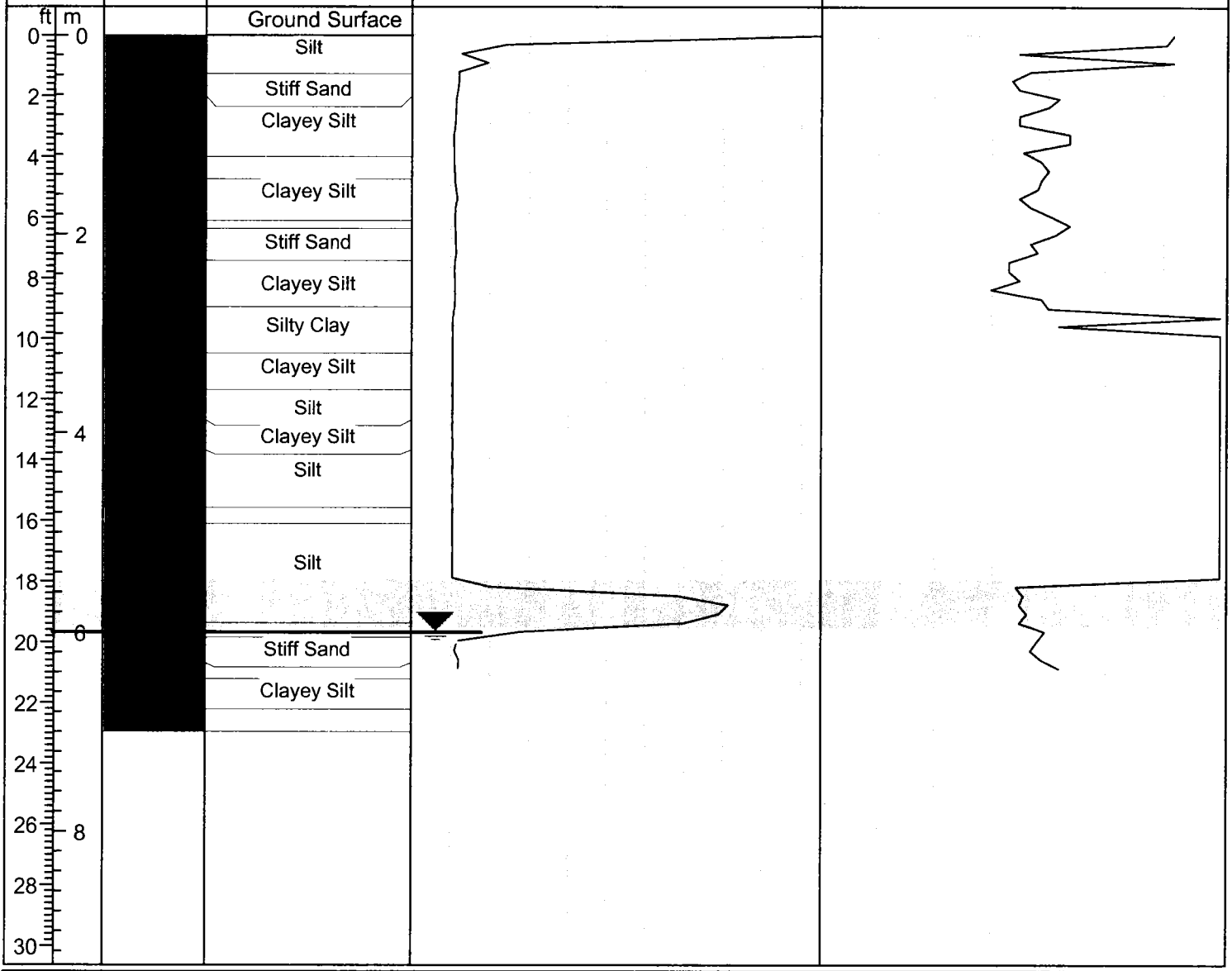
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 18-19.5' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 020

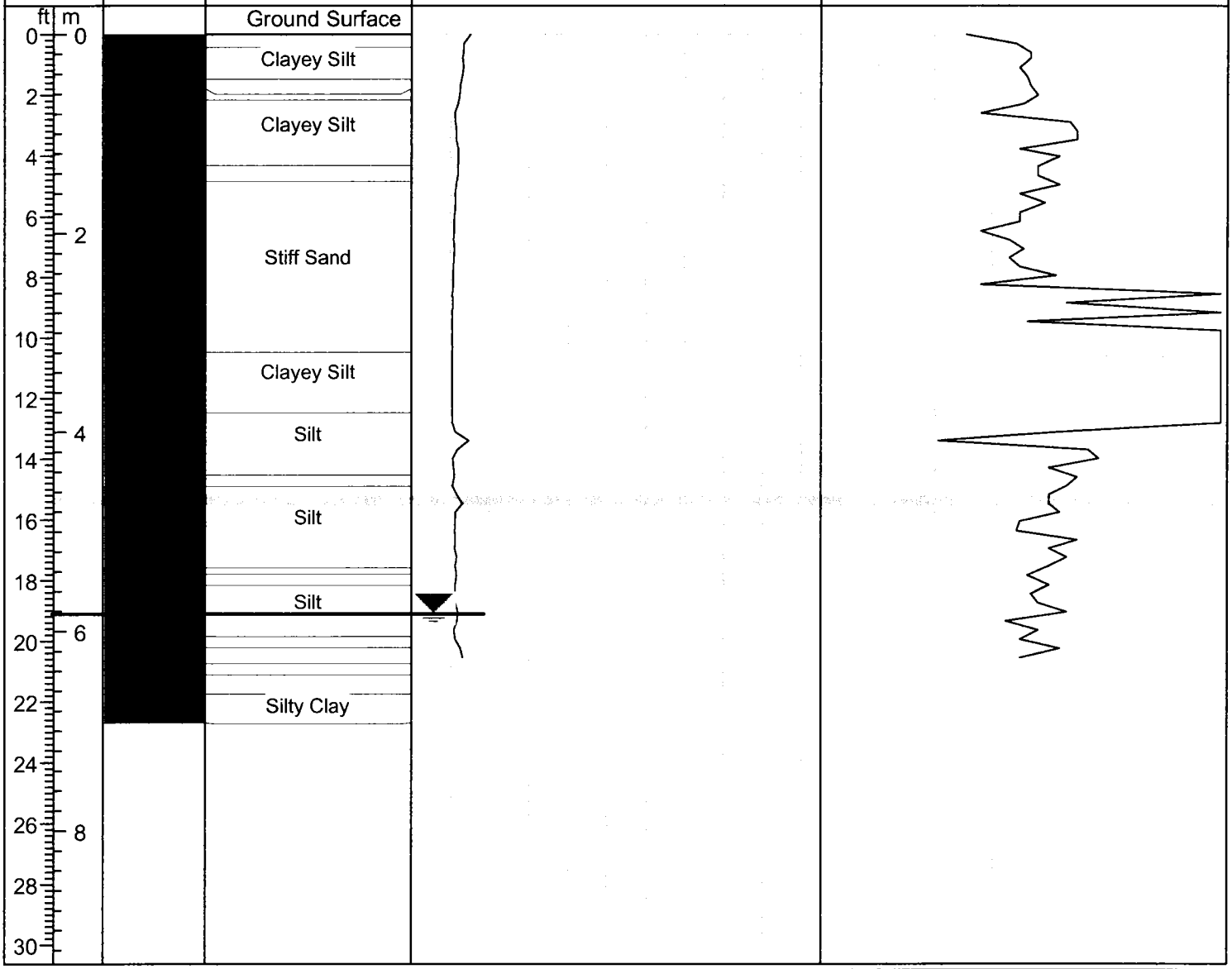
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 15.5' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 021

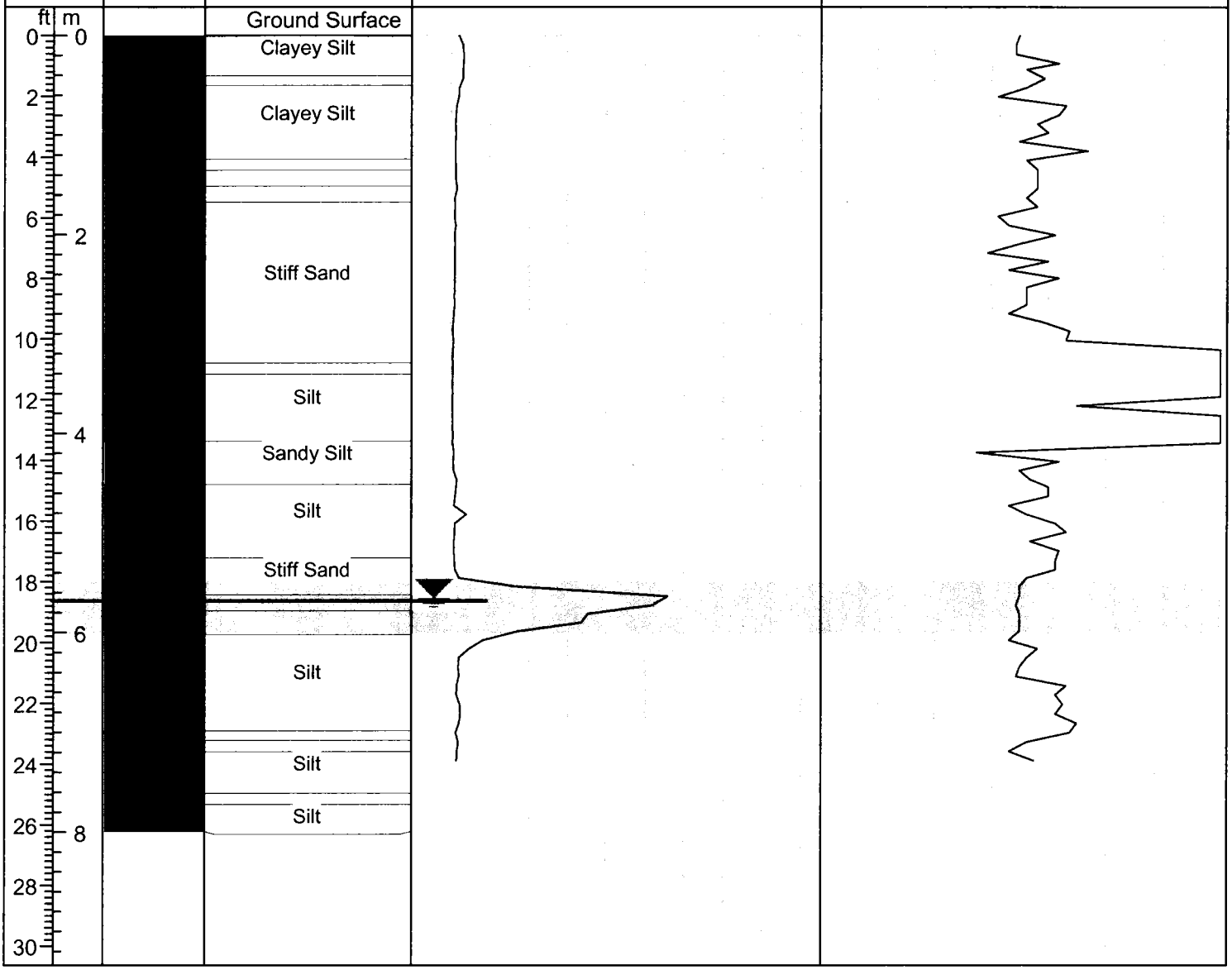
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 18-19.5' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 022

Project #: 02-002

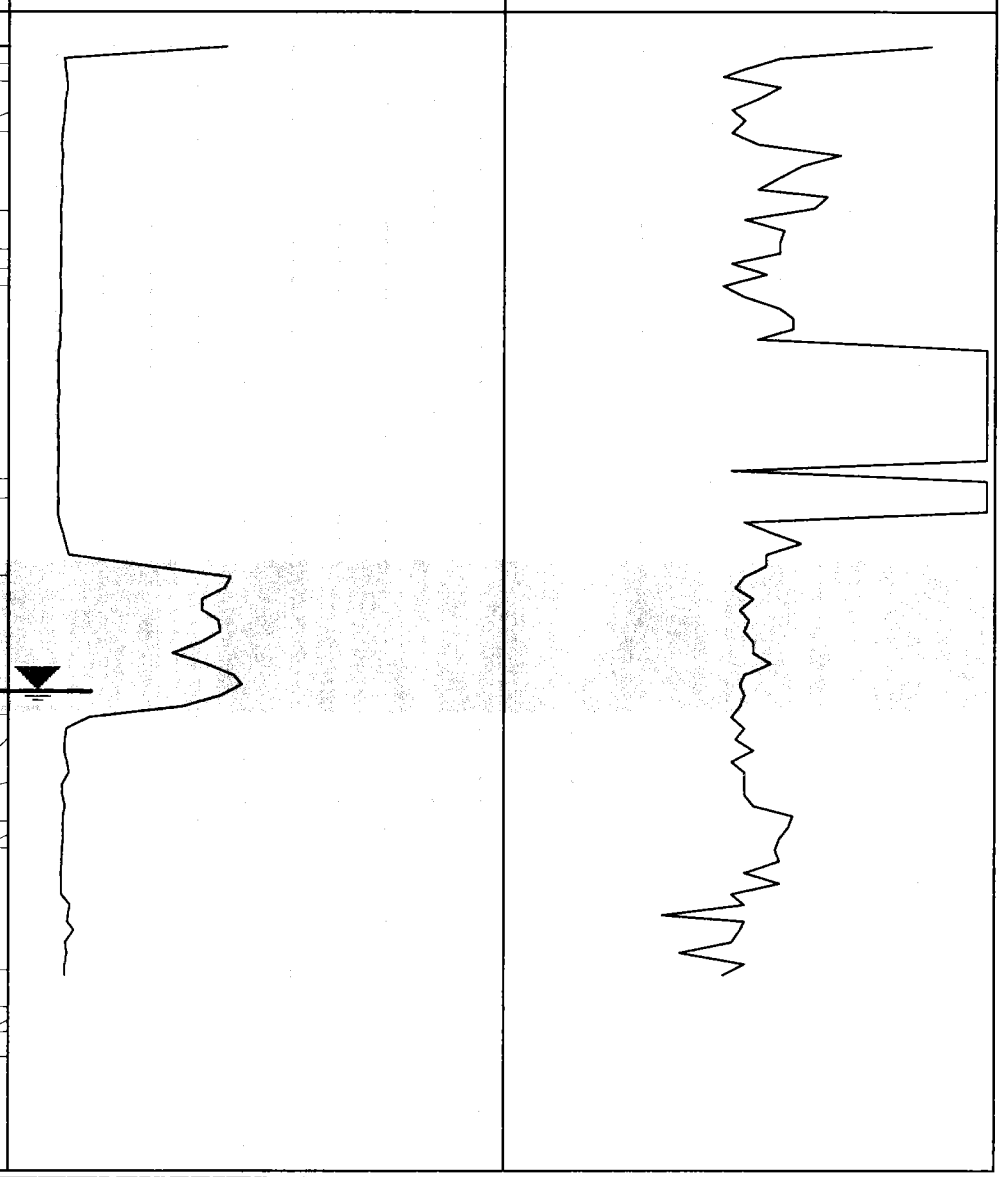
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Clayey Silt
2		Clayey Silt
4		Silty Clay
6		Stiff Sand
8		Stiff Sand
10		Stiff Sand
12		Sandy Silt
14		Clayey Silt
16		Clayey Silt
18		Silty Clay
20		Clay
22		Sandy Silt
24		Silt
26		Clayey Silt
28		
30		



Contamination Identified @ 14-18' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 023

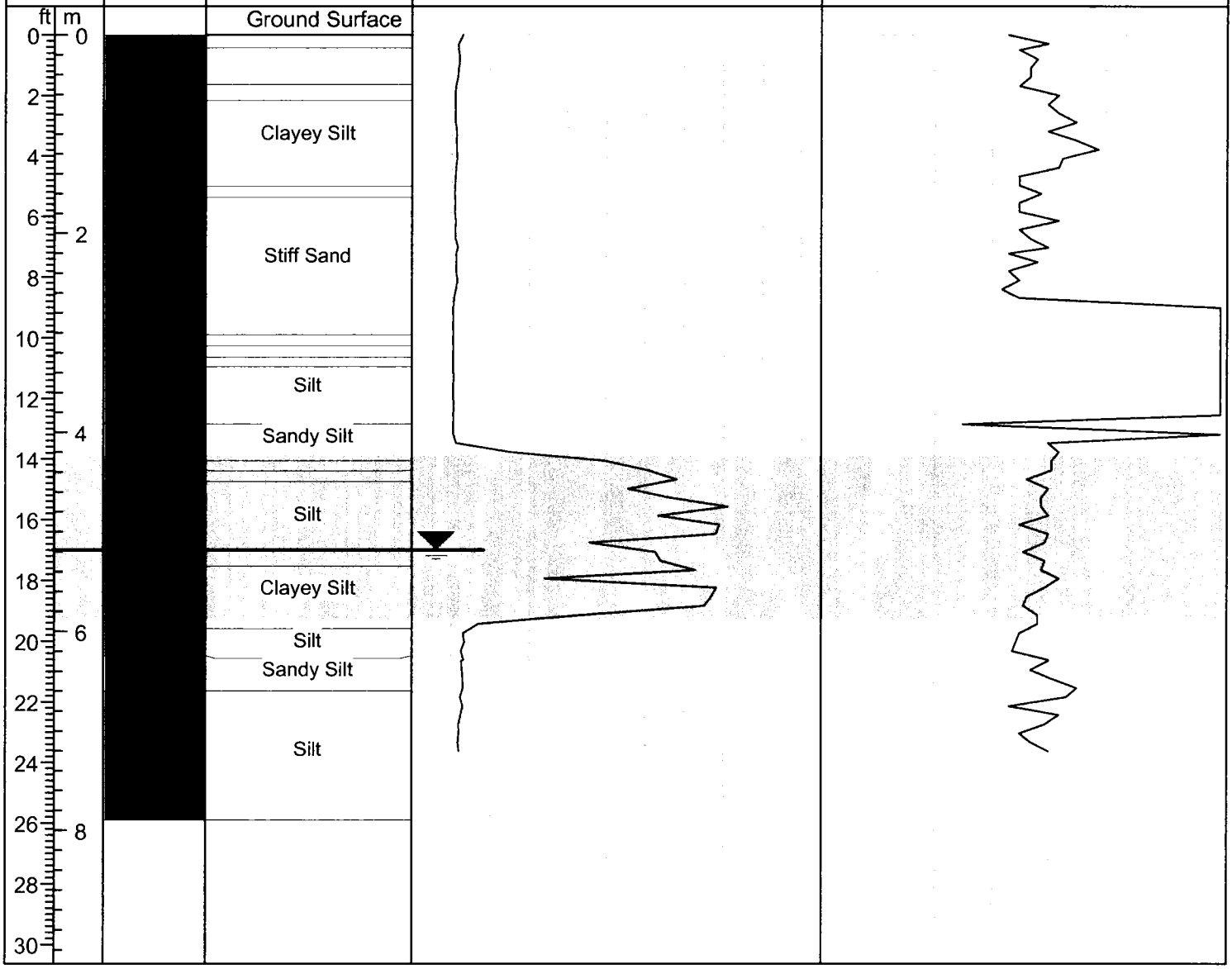
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 14-19' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 024

Project #: 02-002

Project Manager: GS

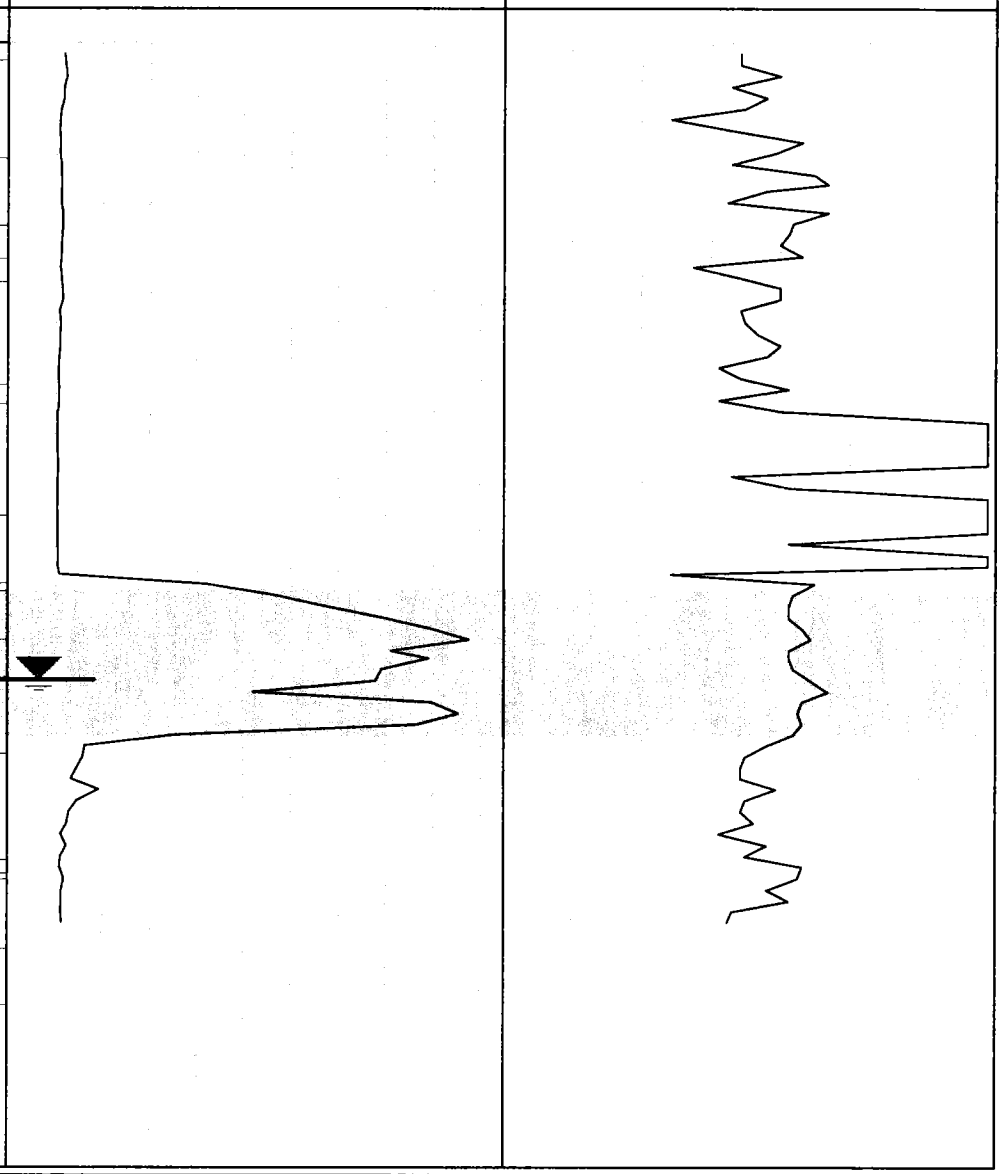
Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE

LIF RESULTS

Depth BGS	Symbol	Soil Class
ft / m		Ground Surface
0 / 0		Stiff Sand
2		Clayey Silt
4 / 2		Stiff Sand
6		Silty Sand
8 / 4		Clay
10		Silt
12		Silty Clay
14		Clay
16 / 6		Silt
18		Clayey Silt
20		Silt
22 / 8		
24		
26		
28		
30		



Contamination Identified @ 15-19' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 025

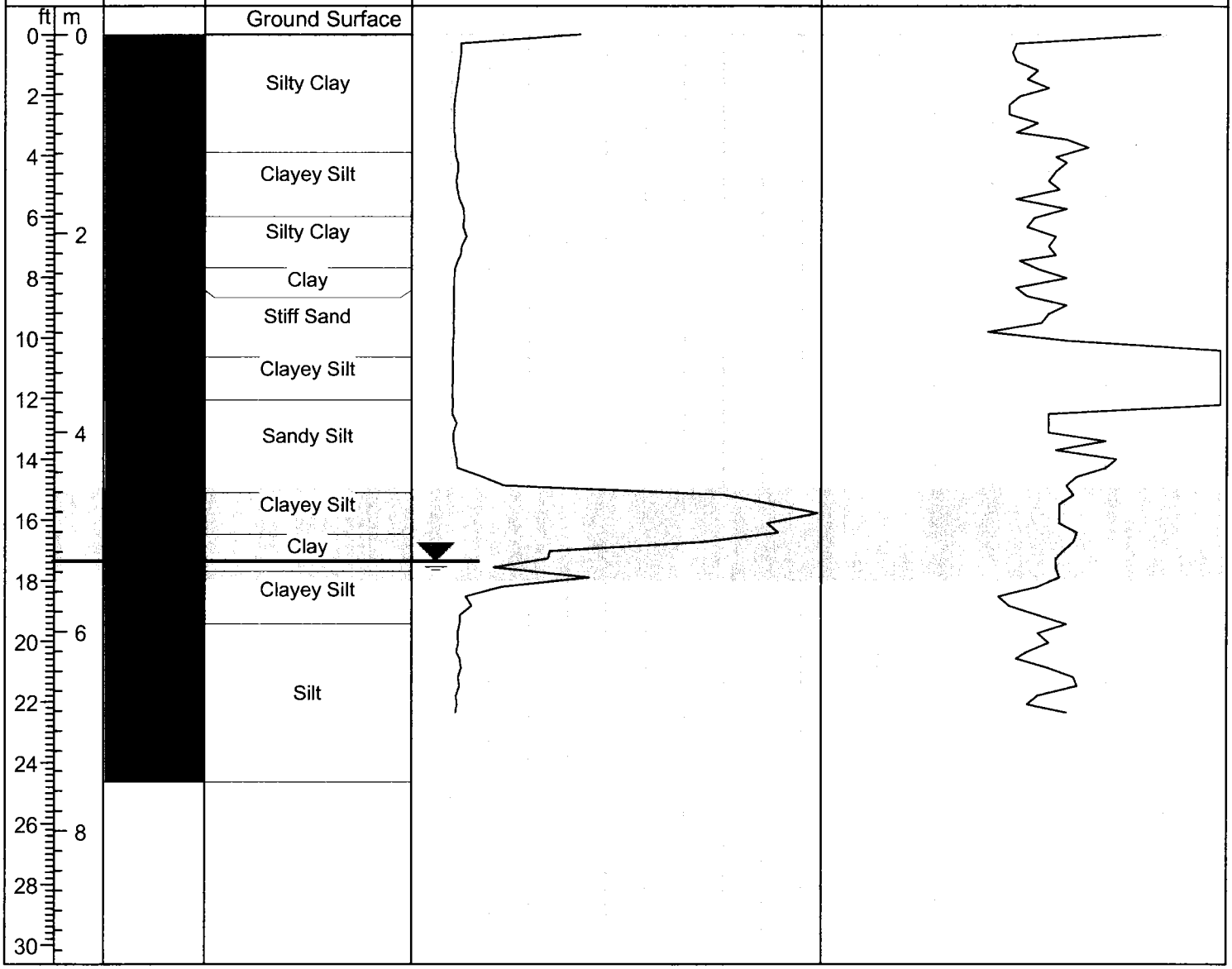
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 15-18' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

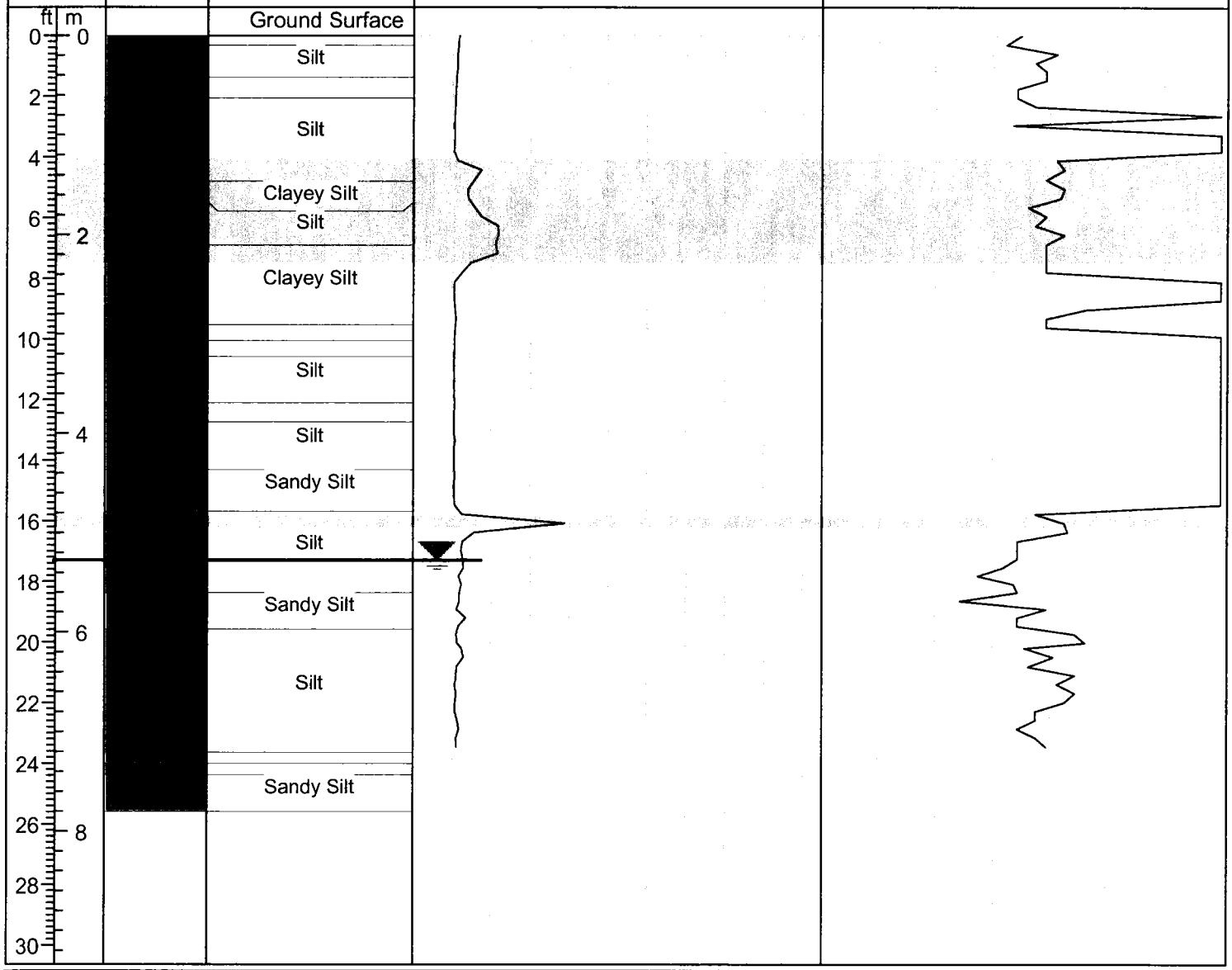
Push Location ID: 026

Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/10/01



Contamination Identified @ 4-7' BGS
Low Relative Intensity

Contamination Identified @ 16' BGS
Medium Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 027

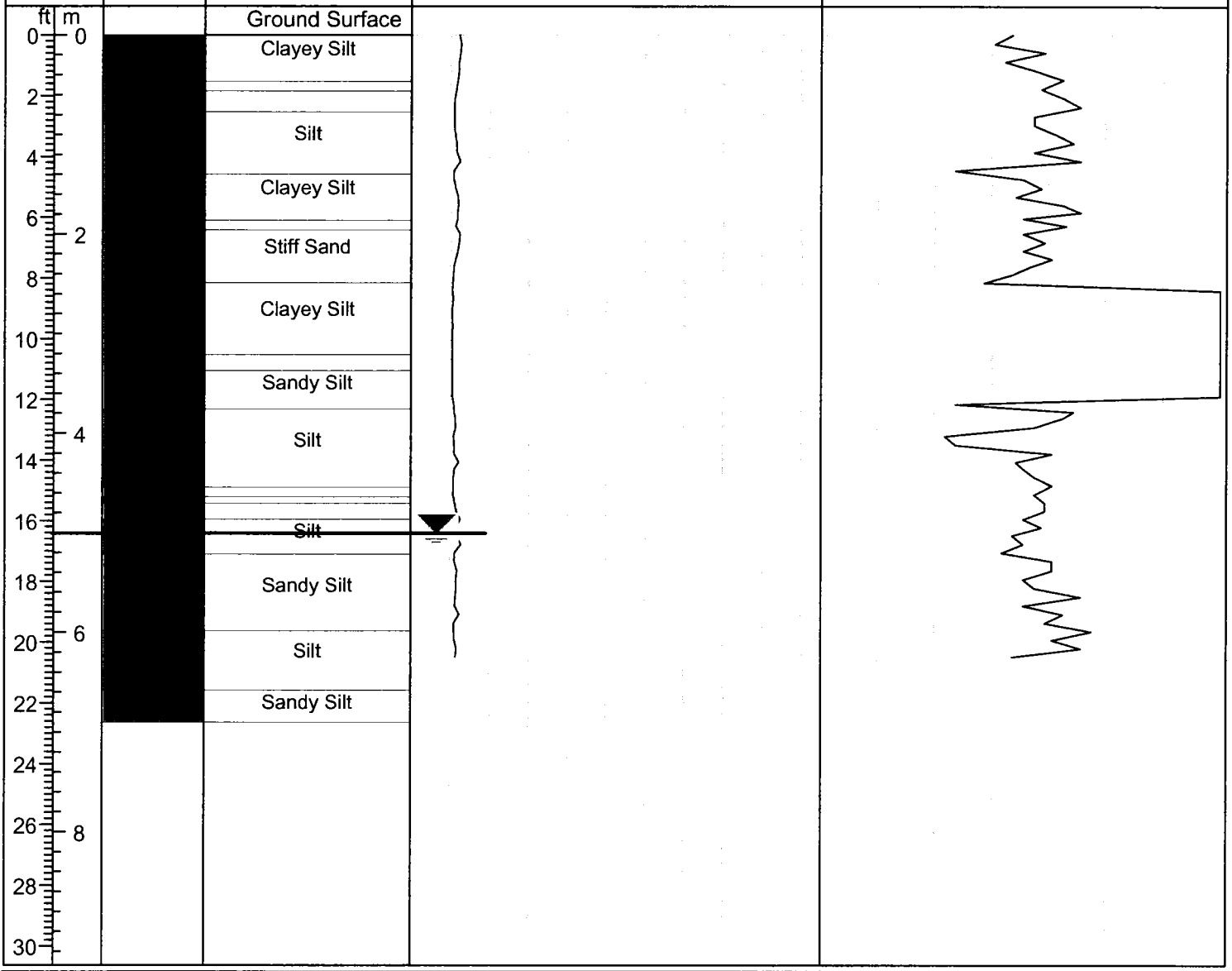
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/10/01

SUBSURFACE PROFILE | **LIF RESULTS**



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 028

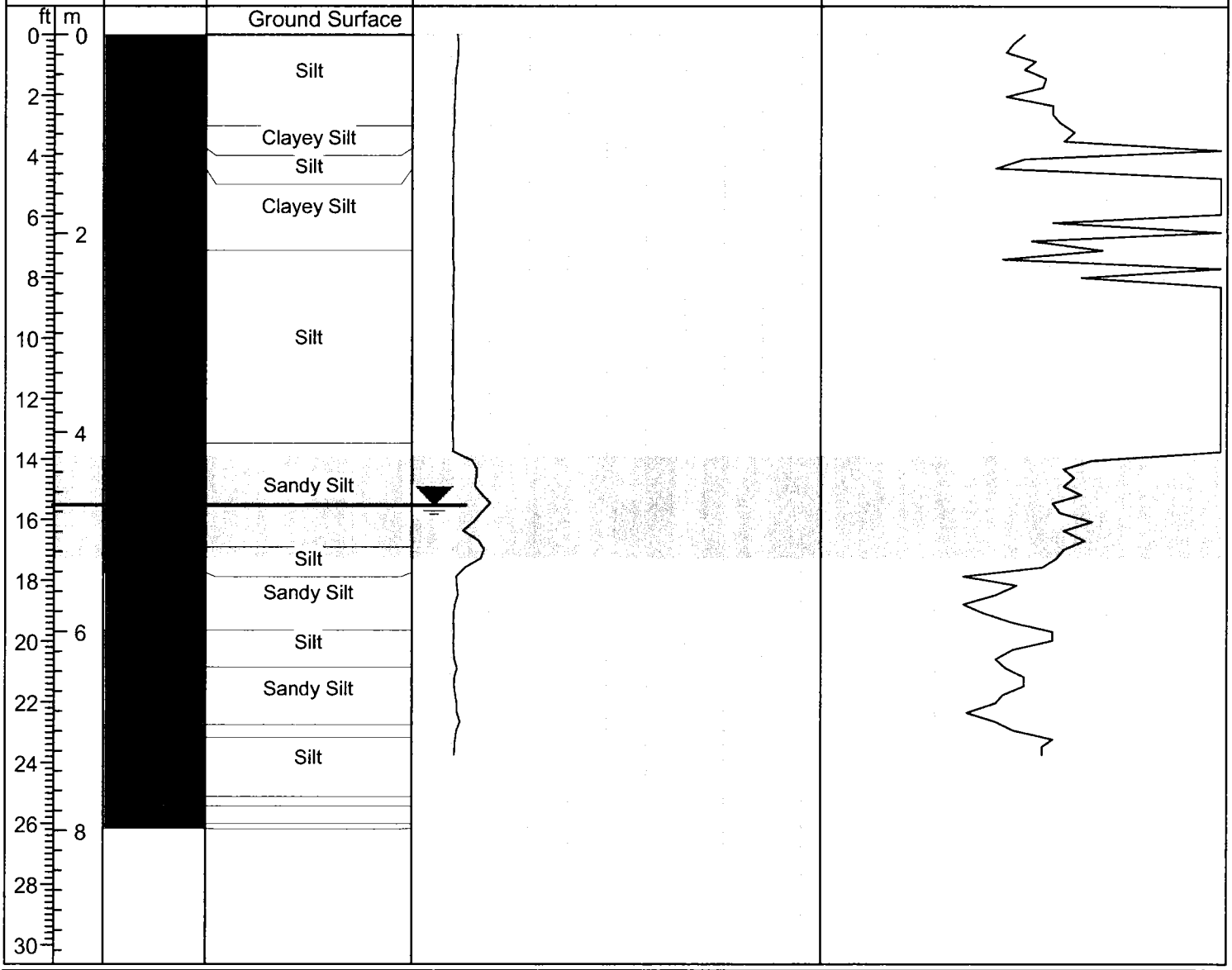
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/10/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 14-17' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 029

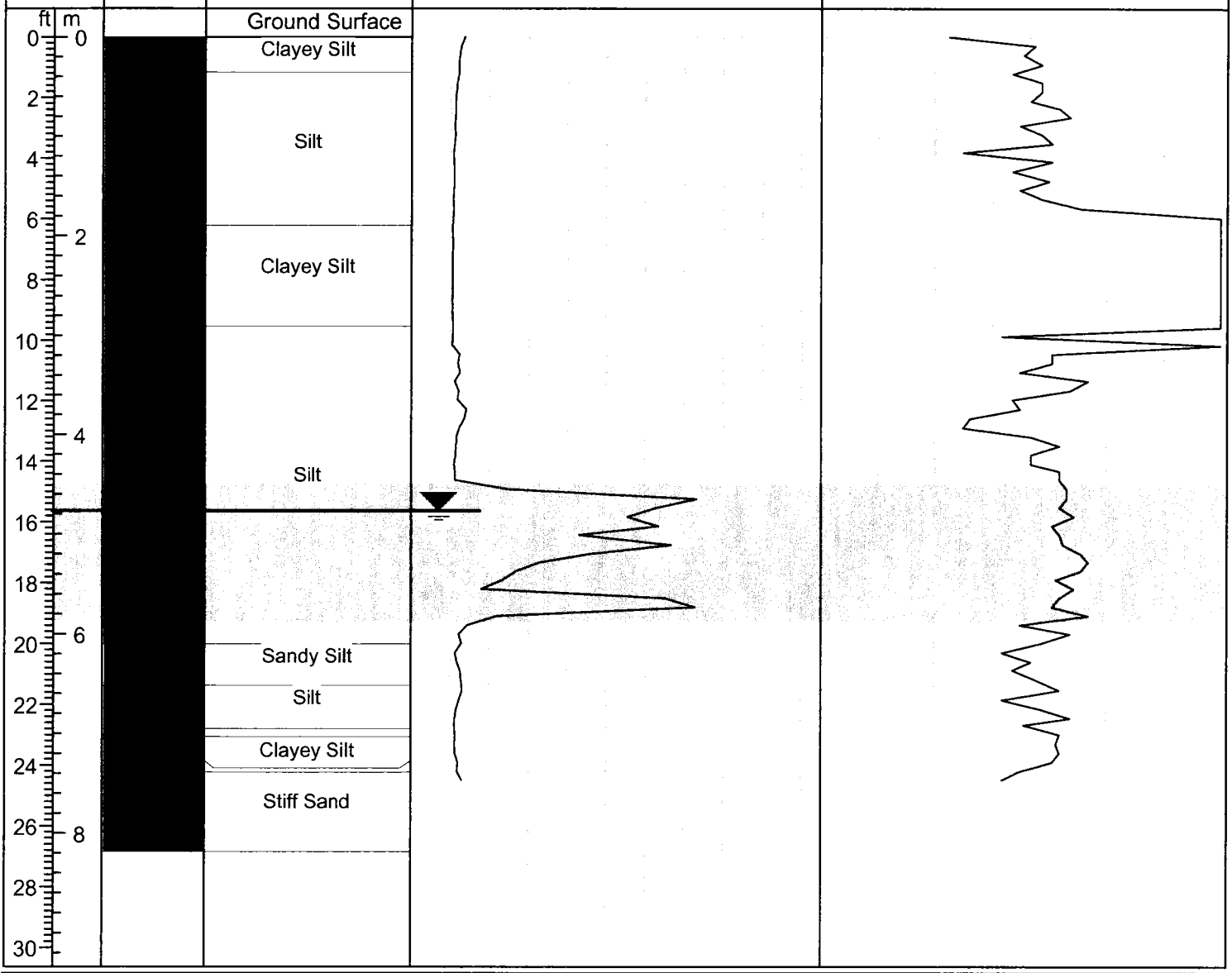
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/10/01

SUBSURFACE PROFILE			LIF RESULTS	
Depth BGS	Symbol	Soil Class	Peak Intensity (Counts X 1000)	Wavelength @ Peak (nm)



Contamination Identified @ 15-19' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 030

Project #: 02-002

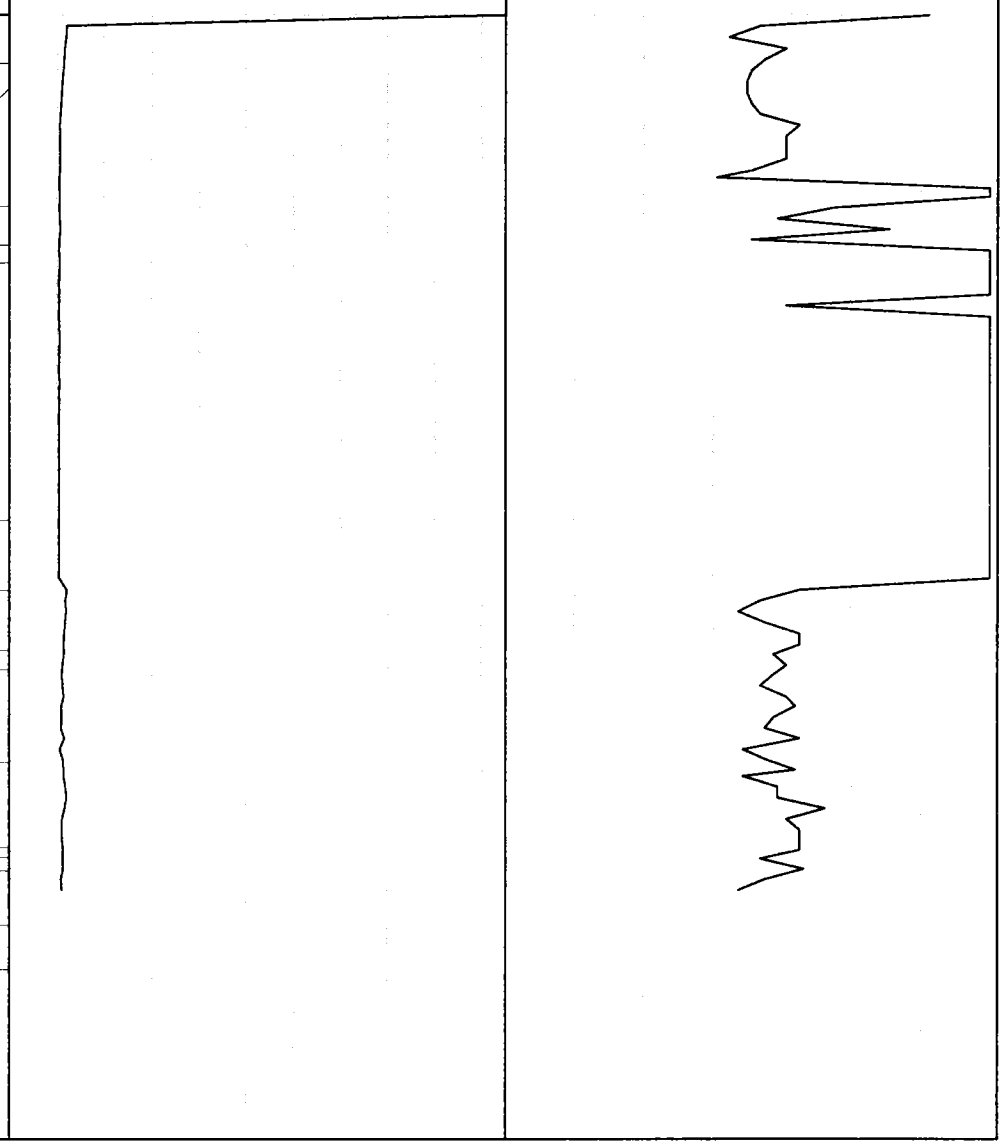
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/10/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Clayey Silt
2		Silt
4		Clayey Silt
6		Silt
2		
8		Silt
10		
12		
4		
14		Sandy Silt
16		Silt
18		Silt
6		
20		Sandy Silt
22		
24		Silt
26		Stiff Sand
8		
28		
30		



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 031

Project #: 02-002

Project Manager: GS

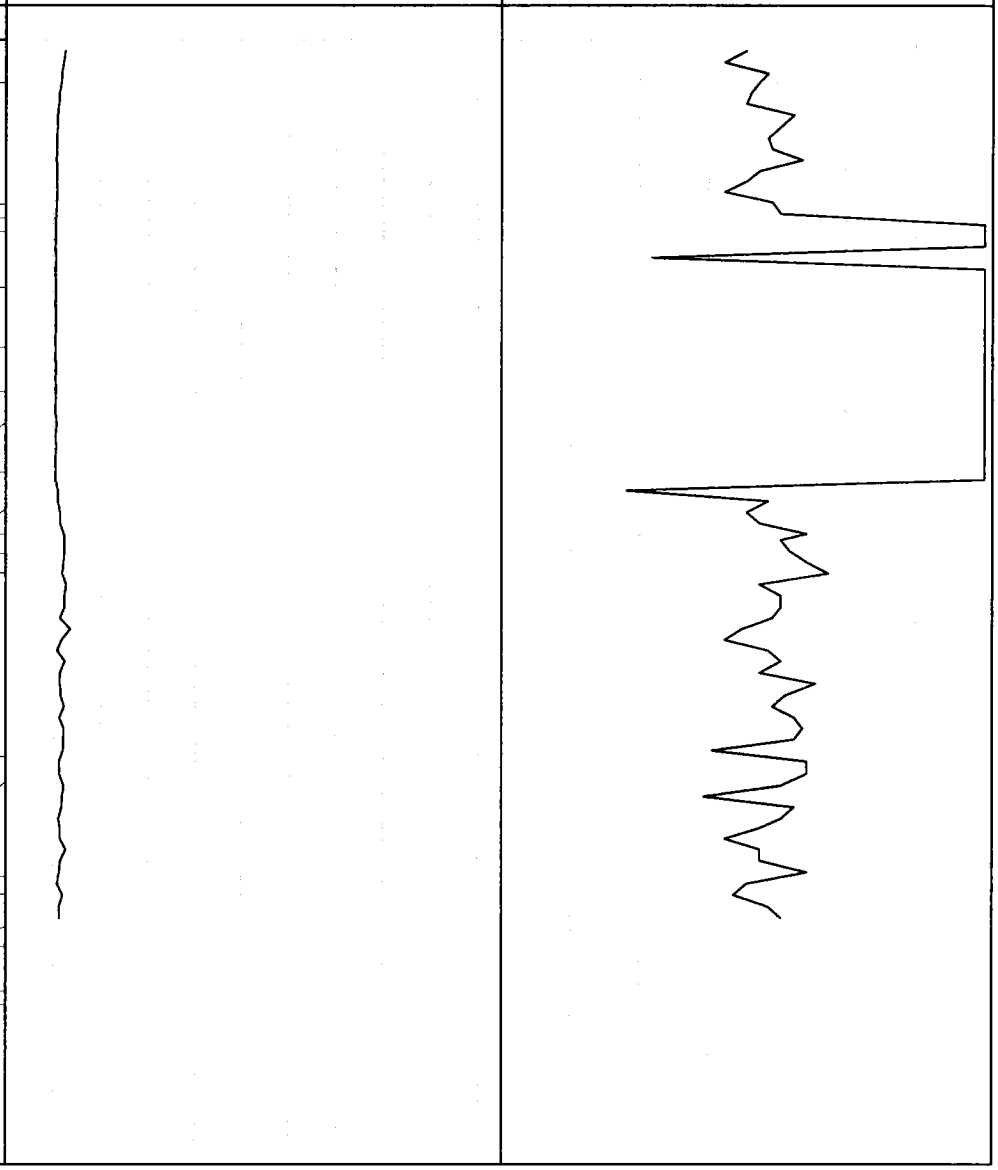
Client: CNRMA, Regional Env Group

Date: 12/10/01

SUBSURFACE PROFILE

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Clayey Silt
2		Silt
4		Silt
6		Stiff Sand
2		Clayey Silt
8		Silt
10		Clayey Silt
		Silt
12		Sandy Silt
4		Sandy Silt
14		Sandy Silt
16		Sandy Silt
18		Silt
20	6	Sandy Silt
22		Sandy Silt
24		Sandy Silt
26	8	Sandy Silt
28		
30		

LIF RESULTS



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 032

Project #: 02-002

Project Manager: GS

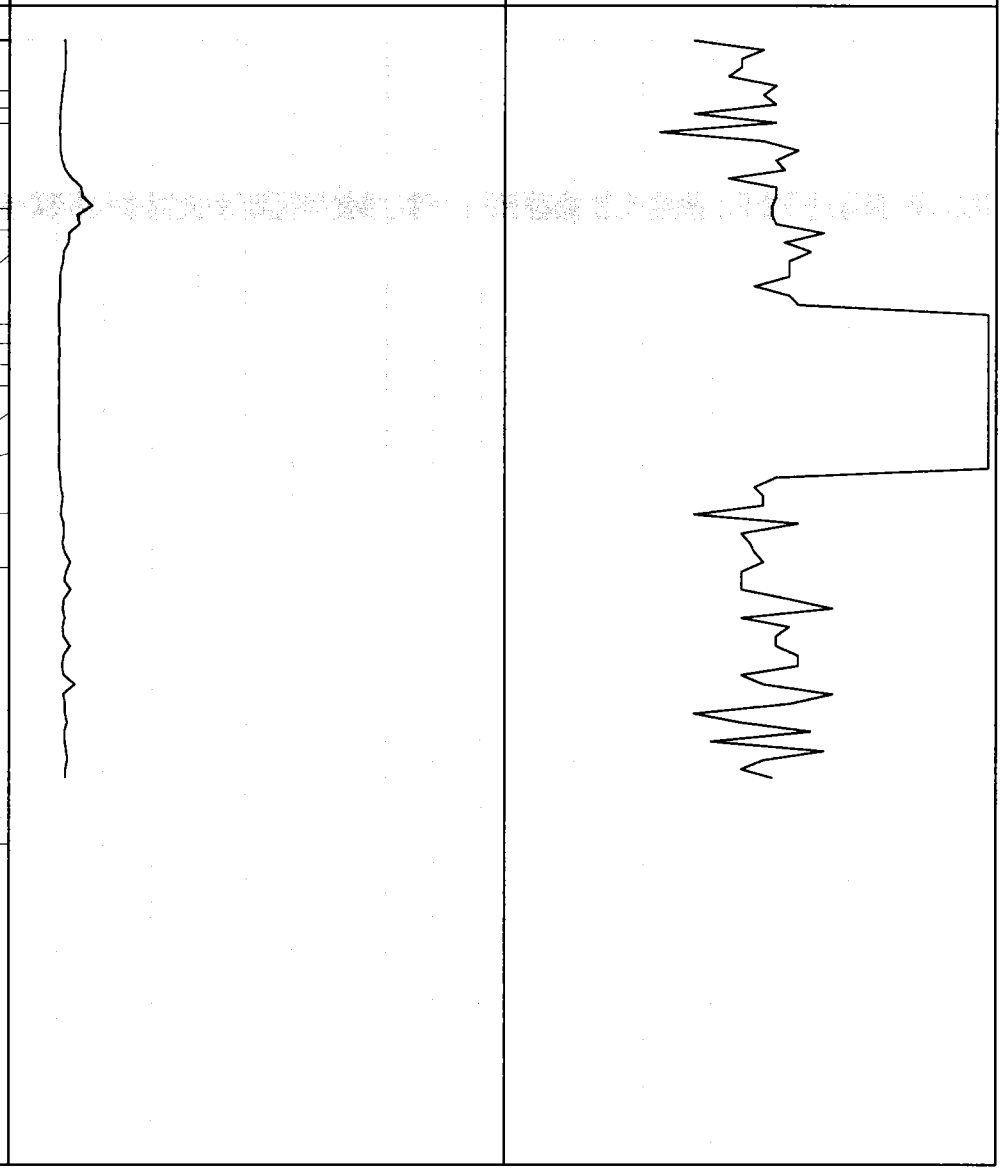
Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE

LIF RESULTS

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Clayey Silt
2		Silt
6		Silty Clay
2		Clayey Silt
8		Clayey Silt
10		Silt
12		Sandy Silt
4		Silt
14		Sandy Silt
16		Silt
18		Sandy Silt
6		Sandy Silt
20		Sandy Silt
22		Sandy Silt
24		Sandy Silt
26		Sandy Silt
8		Sandy Silt
28		Sandy Silt
30		Sandy Silt
32		Sandy Silt
10		Sandy Silt
34		Sandy Silt



Contamination Identified @ 5.5' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 033

Project #: 02-002

Project Manager: GS

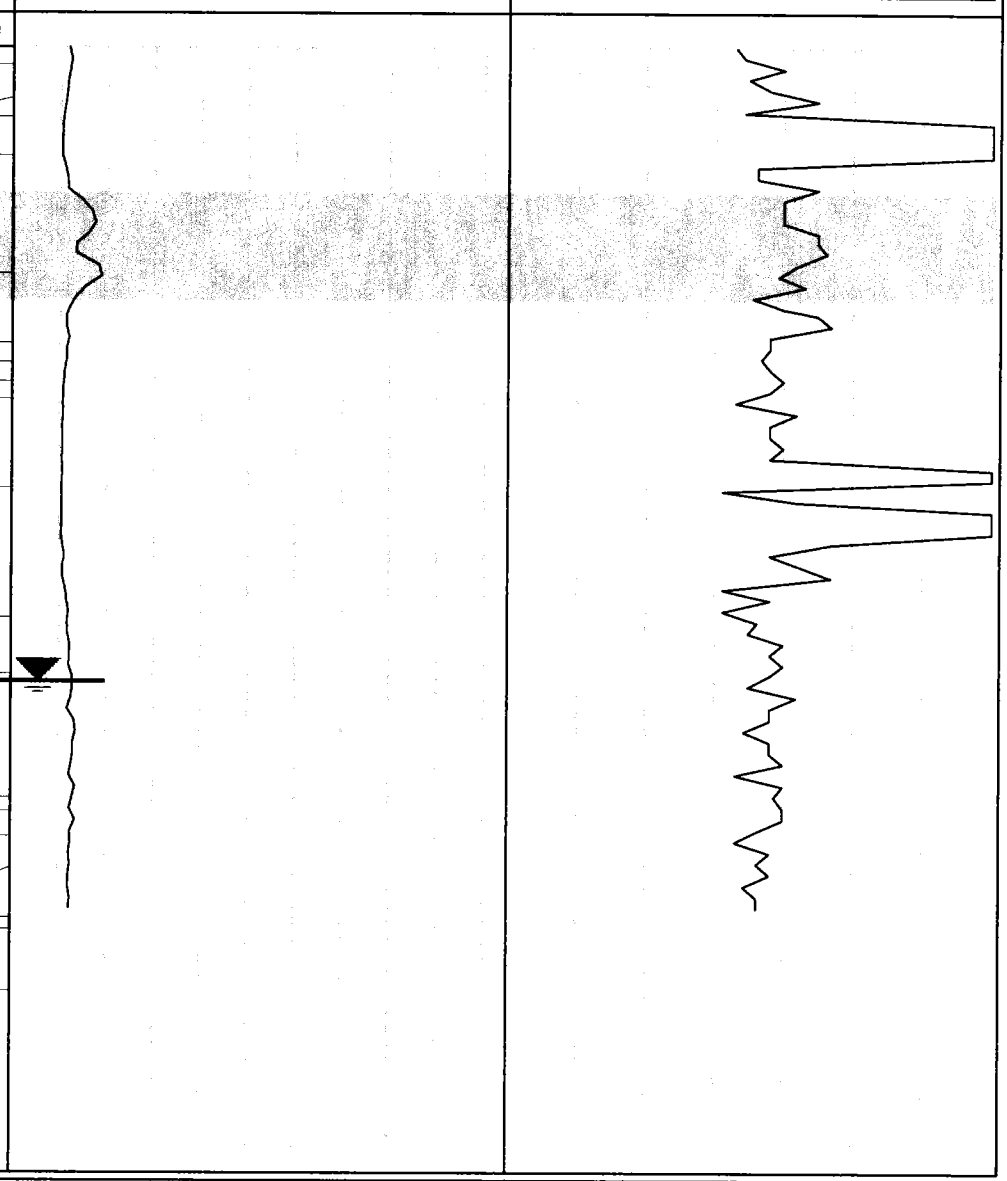
Client: CNRMA, Regional Env Group

Date: 12/7/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Silt
2		Silt
4		Clayey Silt
6		Silt
8		
10		Clayey Silt
12		Silt
14		
16		Clayey Silt
18		Silty Clay
20		
22		Sandy Silt
24		Silt
26		Silt
28		
30		

ft m: 0 0; 2; 4; 2; 6; 8; 10; 4; 12; 14; 16; 6; 18; 20; 22; 8; 24; 26; 28; 30



Contamination Identified @ 4-7' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 034

Project #: 02-002

Project Manager: GS

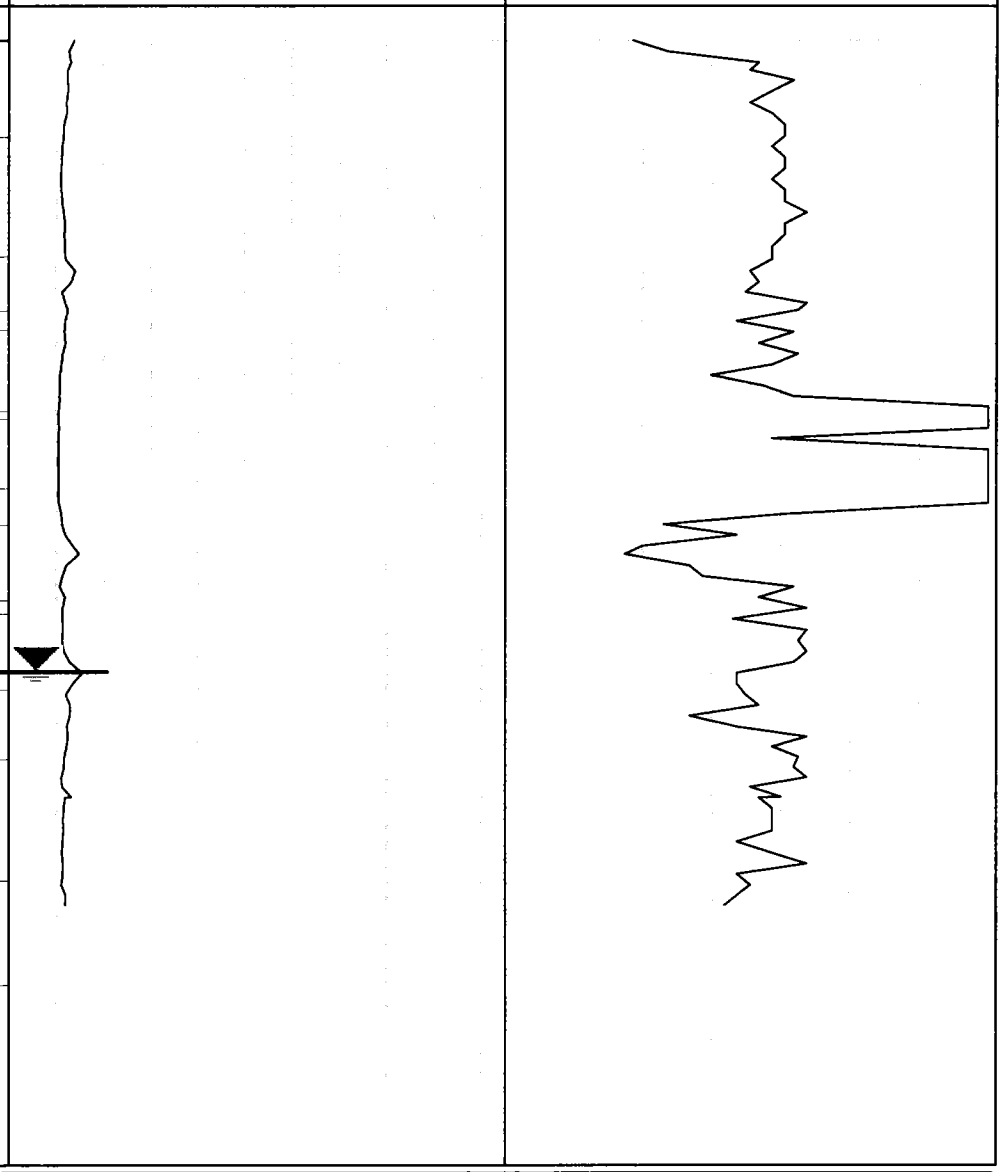
Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Silt
2		Clayey Silt
6		Silty Clay
8		Stiff Sand
10		Silt
12		Sandy Silt
14		Silt
16		Clayey Silt
18		Silt
20		Sandy Silt
22		Silt
24		
26		
28		
30		

ft / m: 0 = 0, 6 = 2, 12 = 4, 18 = 6, 26 = 8



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 035

Project #: 02-002

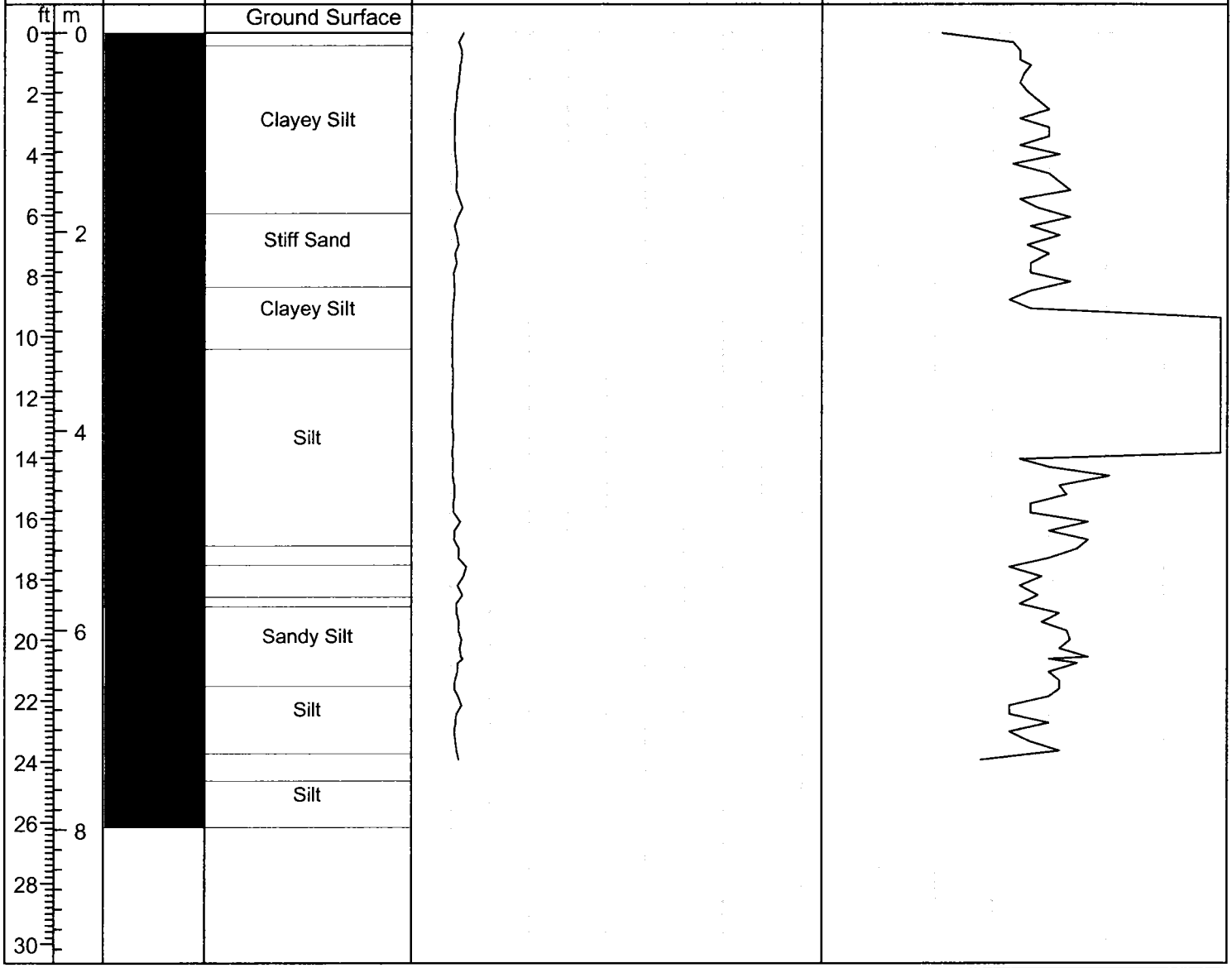
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0 – 2		Clayey Silt
2 – 3		Stiff Sand
3 – 4		Clayey Silt
4 – 6		Silt
6 – 7		Sandy Silt
7 – 8		Silt
8 – 8.5		Silt



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 036(A)

Project #: 02-002

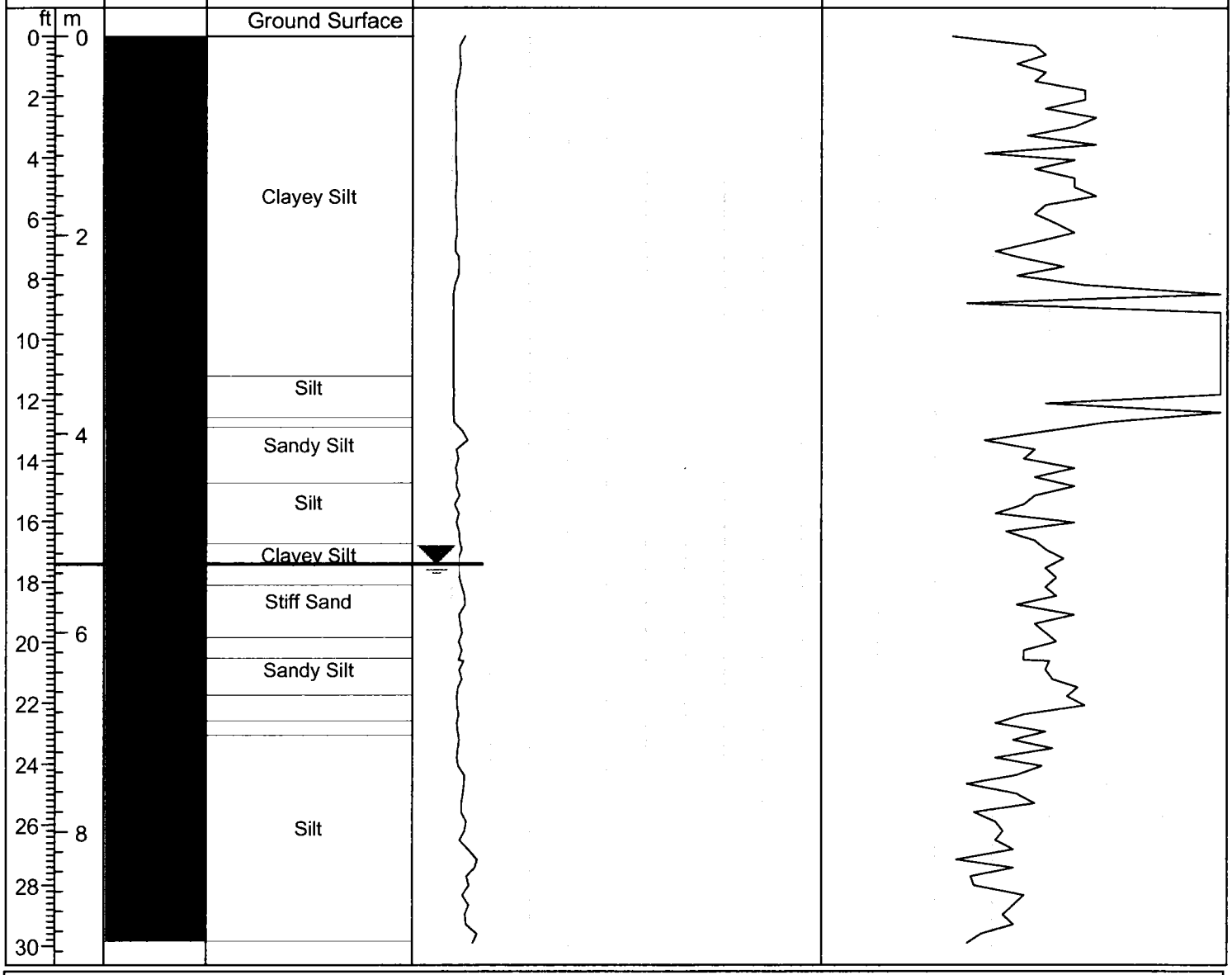
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0 – 2		Clayey Silt
2 – 4		Silt
4 – 6		Sandy Silt
6 – 8		Silt
8 – 10		Clayey Silt
10 – 12		Stiff Sand
12 – 14		Sandy Silt
14 – 16		Silt
16 – 18		Clayey Silt
18 – 20		Stiff Sand
20 – 22		Sandy Silt
22 – 24		Silt
24 – 26		Silt
26 – 28		Silt
28 – 30		Silt



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 037

Project #: 02-002

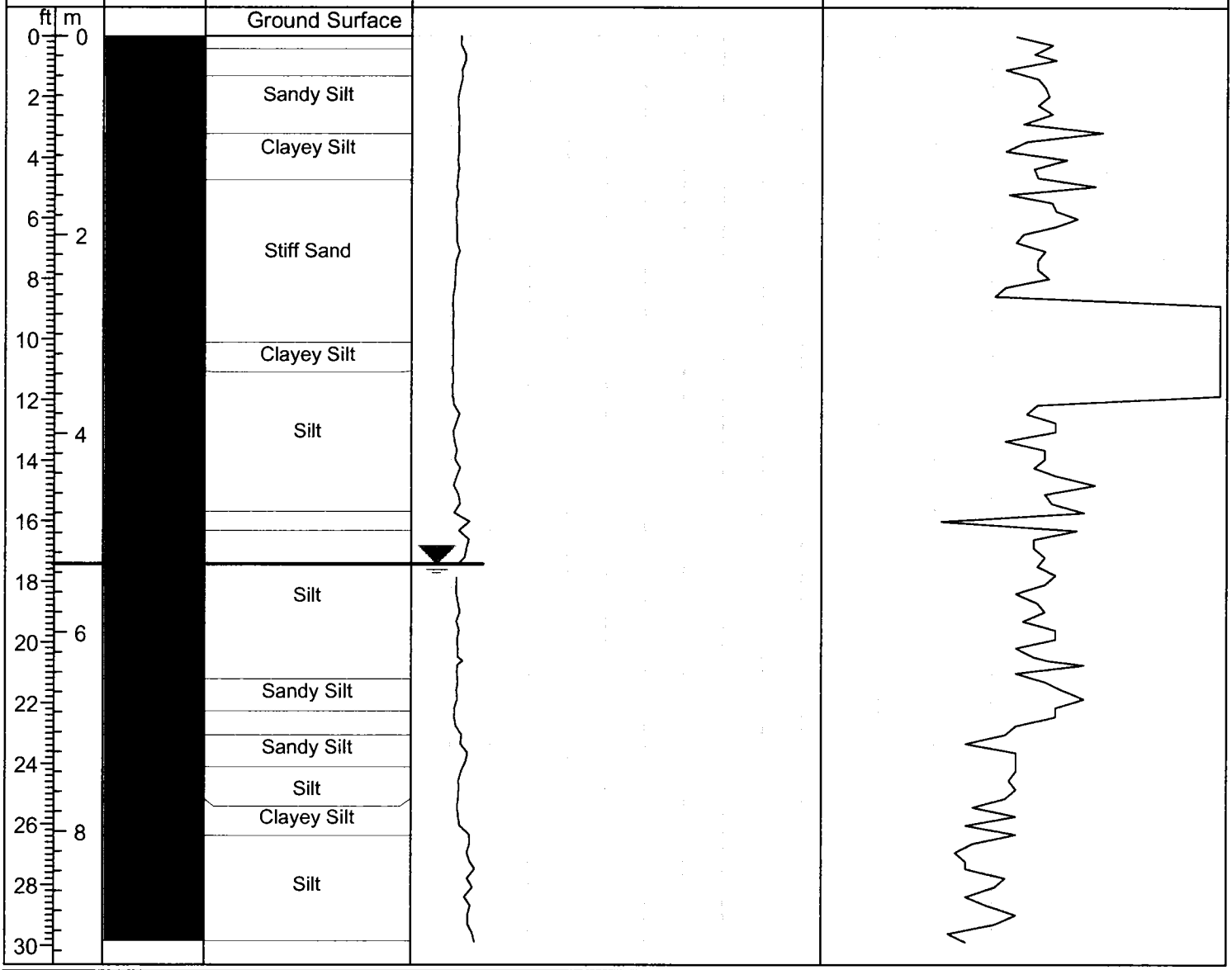
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
2		Sandy Silt
4		Clayey Silt
6		Stiff Sand
10		Clayey Silt
12		Silt
16		
18		Silt
20		
22		Sandy Silt
24		Sandy Silt
26		Silt
		Clayey Silt
28		Silt
30		



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 038

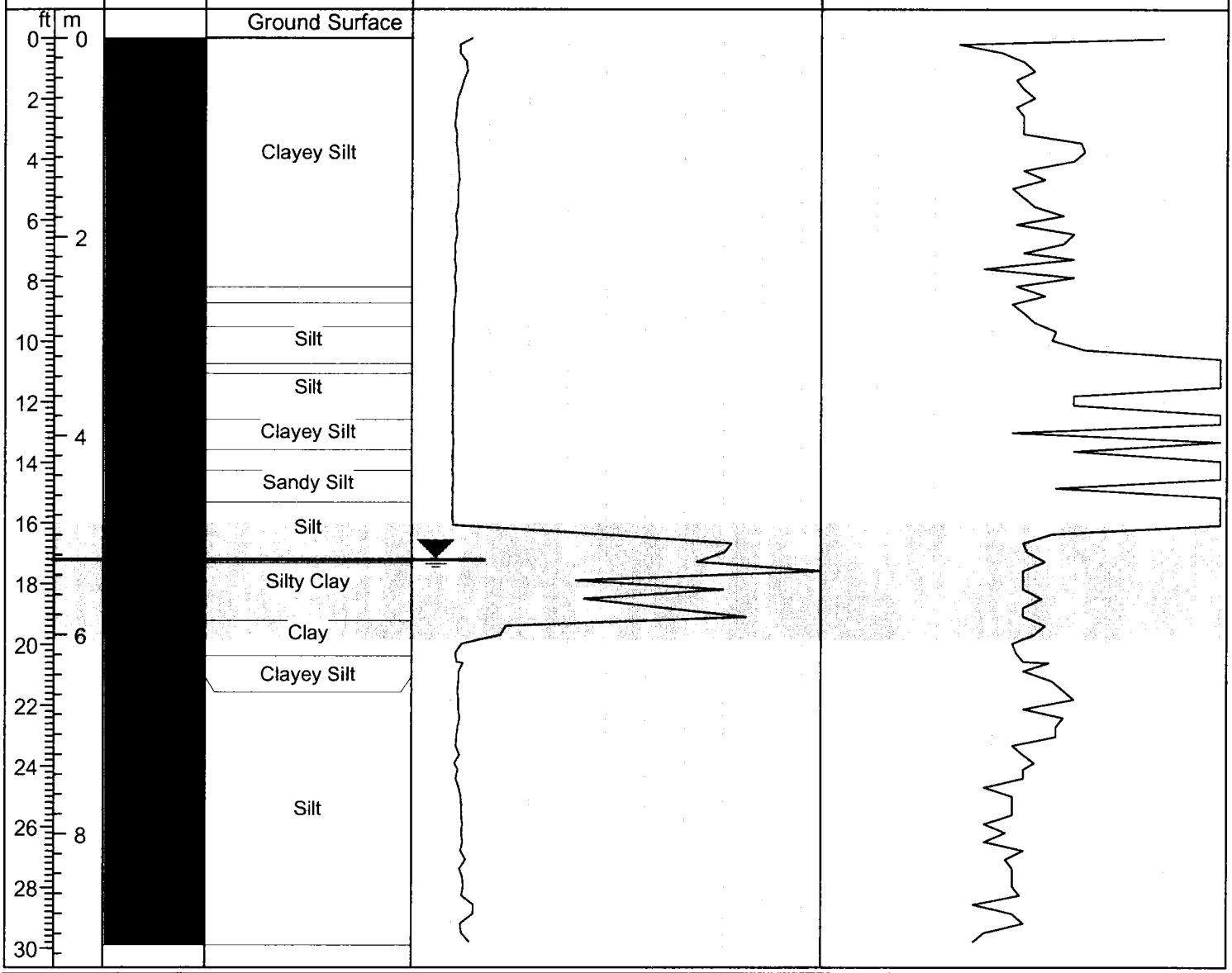
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 16-19.5' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 039

Project #: 02-002

Project Manager: GS

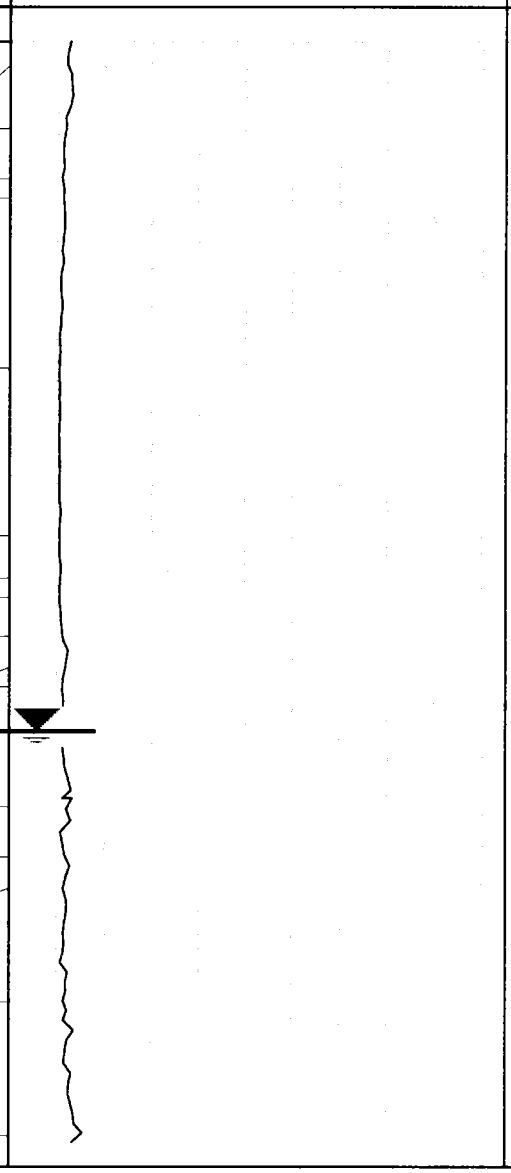
Client: CNRMA, Regional Env Group

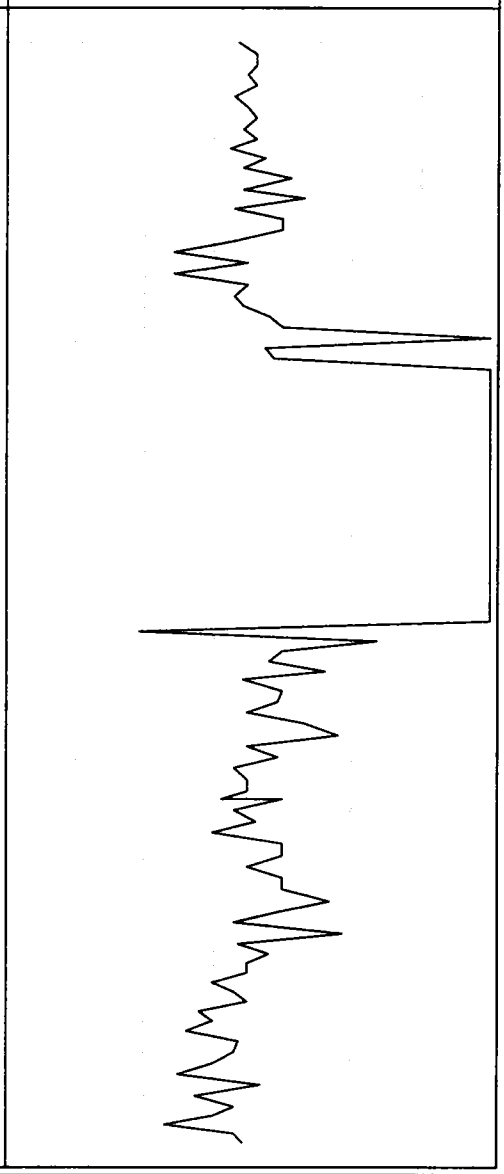
Date: 12/11/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Silt
2		Stiff Sand
4		Silty Clay
6		Stiff Sand
8		
10		Clayey Silt
12		
14		Silt
16		Stiff Sand
18		Clayey Silt
20		
22		Silt
24		Clayey Silt
26		Sandy Silt
28		Silt
30		

ft / m: 0 / 0, 2 / 2, 4 / 4, 6 / 2, 8 / 4, 10 / 6, 12 / 8, 14 / 10, 16 / 12, 18 / 14, 20 / 16, 22 / 18, 24 / 20, 26 / 22, 28 / 24, 30 / 26





No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 040

Project #: 02-002

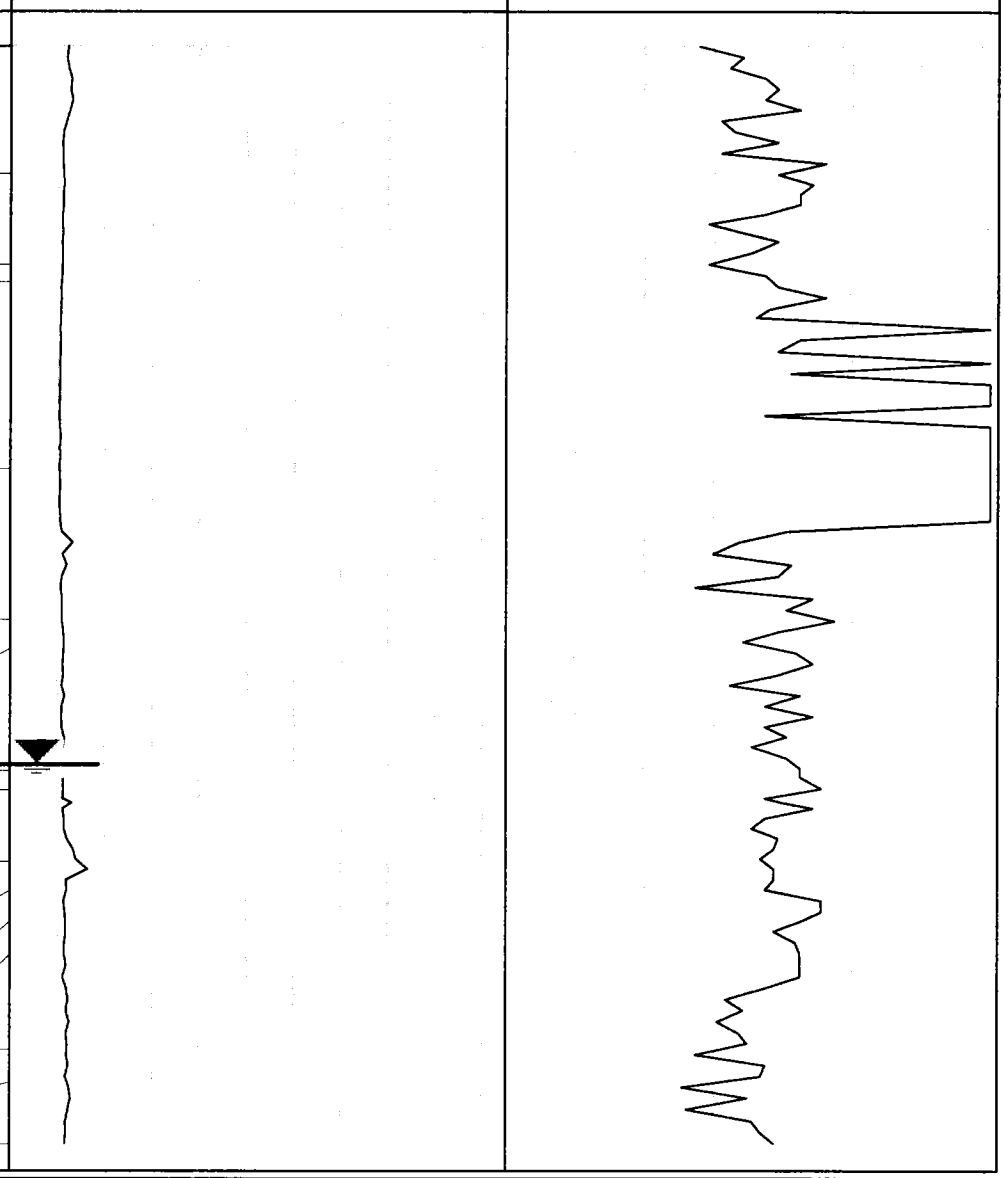
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/12/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Silt
4		Clayey Silt
2		Stiff Sand
8		Silt
4		Clayey Silt
16		Silt
6		Silt
20		Stiff Sand
22		Clayey Silt
24		Silt
8		Sandy Silt
26		Silt
28		Clayey Silt
30		



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 041

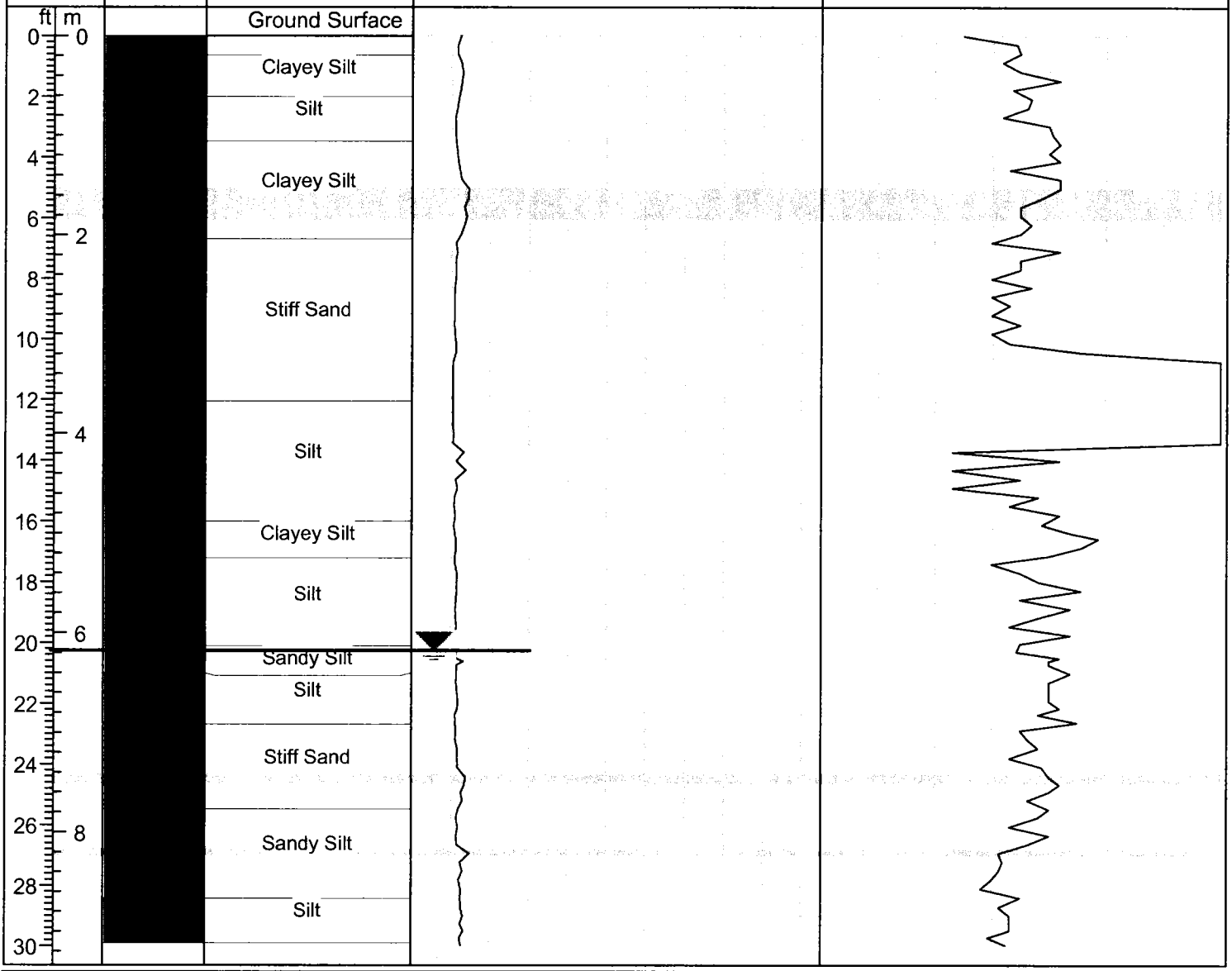
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/12/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 5-6', 24.5' and 27' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 042

Project #: 02-002

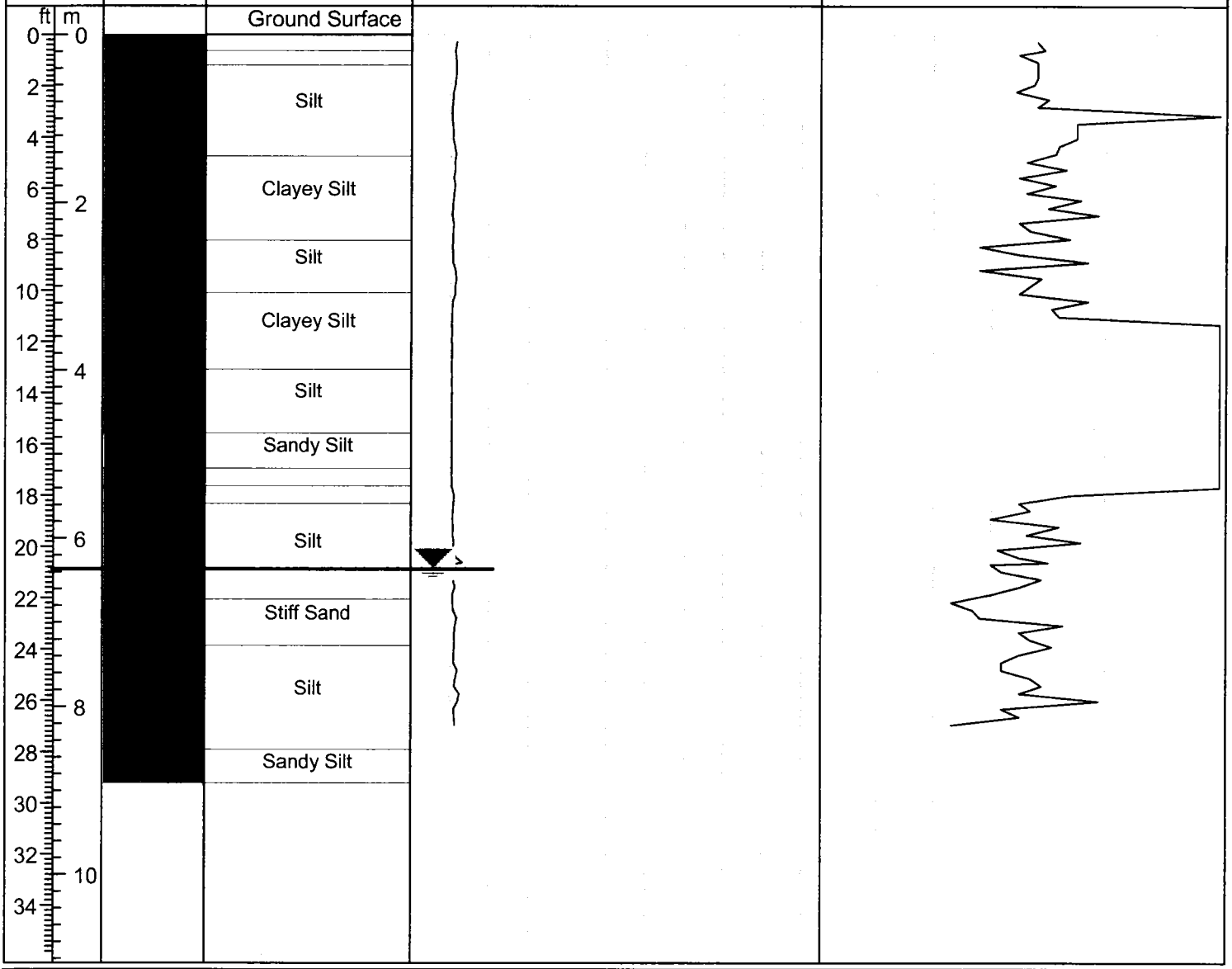
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/12/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0–2		Silt
2–6		Clayey Silt
6–8		Silt
8–12		Clayey Silt
12–14		Silt
14–16		Sandy Silt
16–20		Silt
20–22		Stiff Sand
22–28		Silt
28–30		Sandy Silt
30–34		



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 044

Project #: 02-002

Project Manager: GS

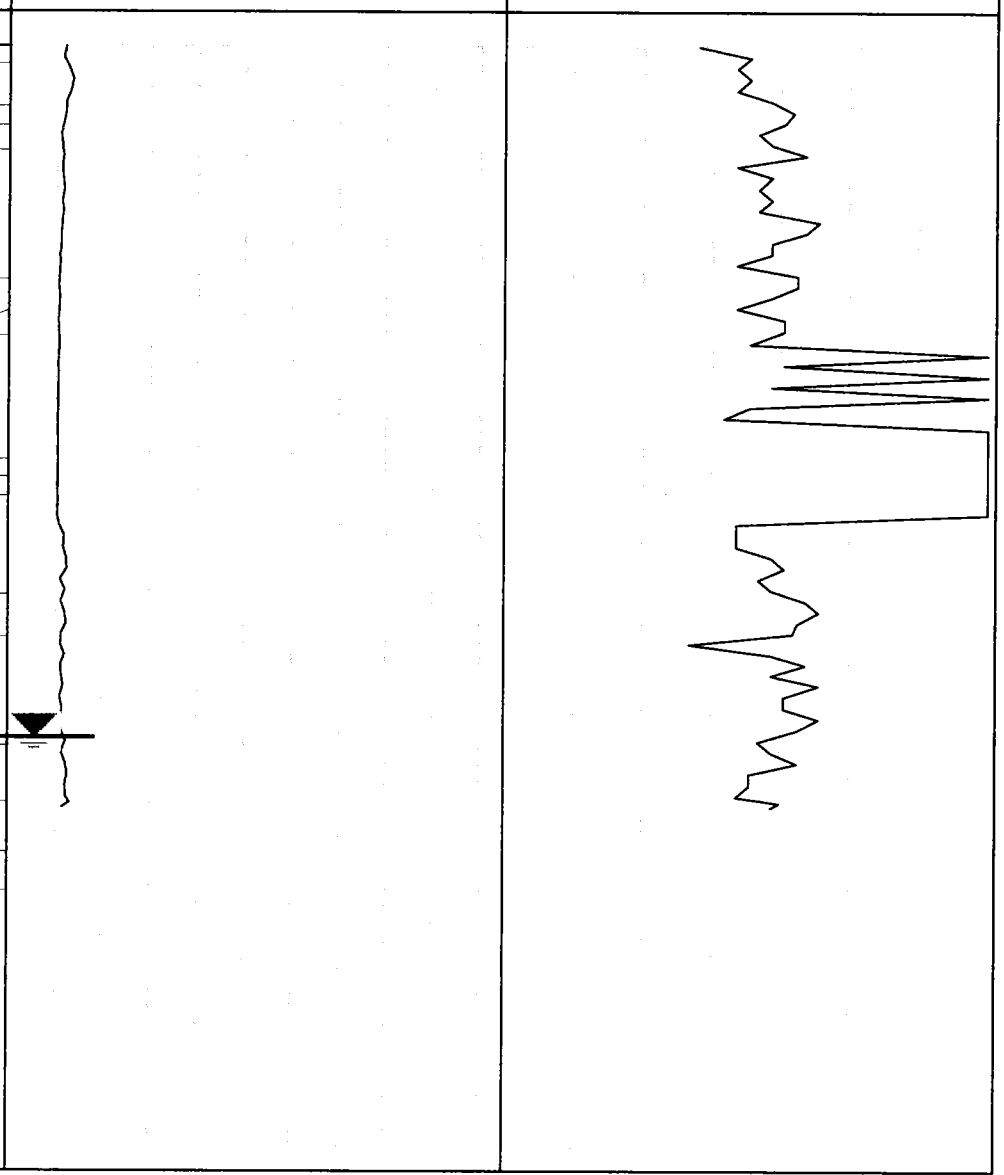
Client: CNRMA, Regional Env Group

Date: 12/12/01

SUBSURFACE PROFILE

LIF RESULTS

Depth BGS	Symbol	Soil Class
ft / m		Ground Surface
0 / 0		Stiff Sand
2		
4		Clayey Silt
6 / 2		Stiff Sand
8		Stiff Sand
10		
12		Sandy Silt
14 / 4		Stiff Sand
16		Silt
18		
20 / 6		Stiff Sand
22		Clayey Silt
24		Silt
26 / 8		
28		
30		



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

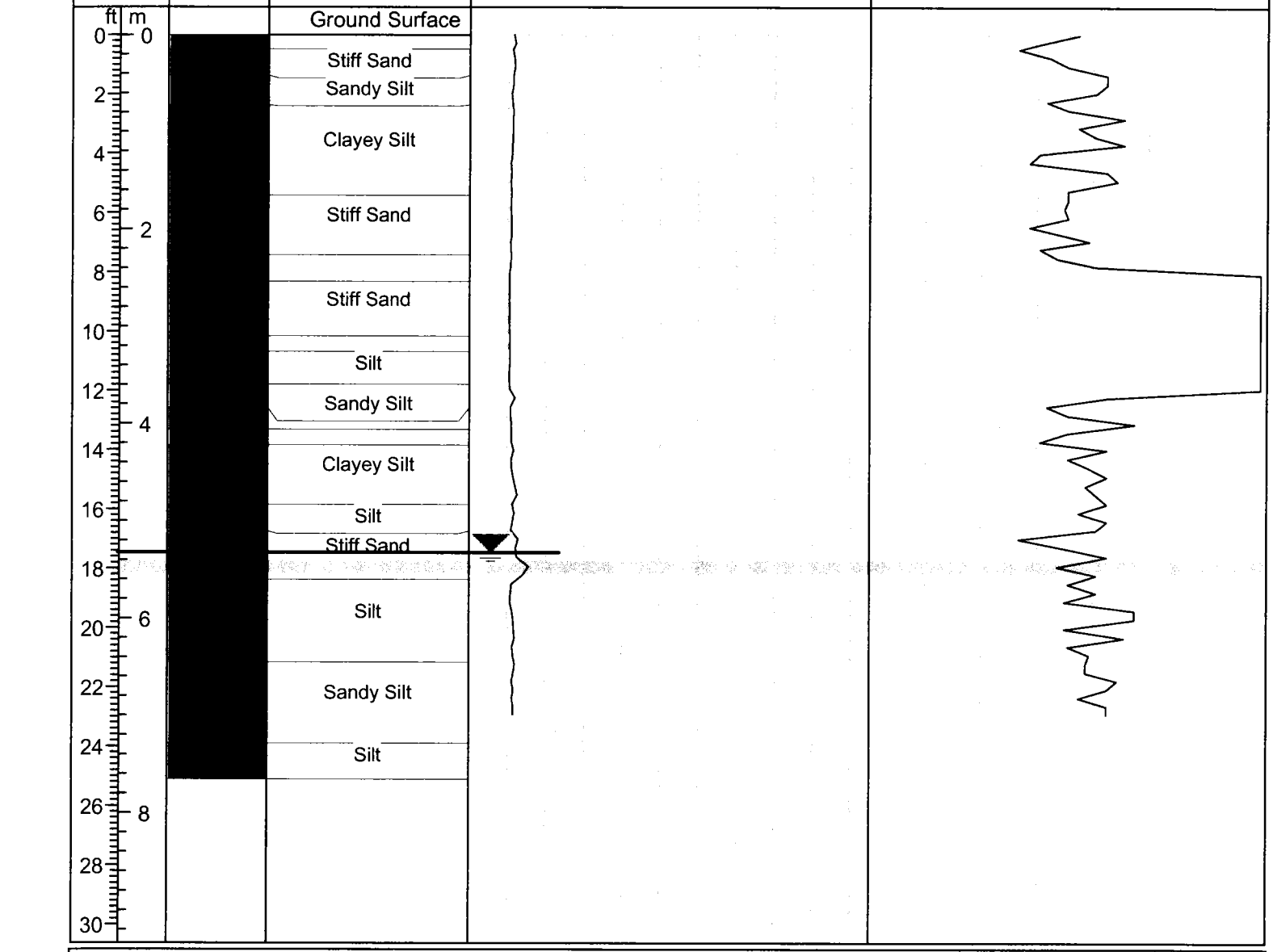
Push Location ID: 045

Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/12/01



Contamination Identified @ 18' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 046

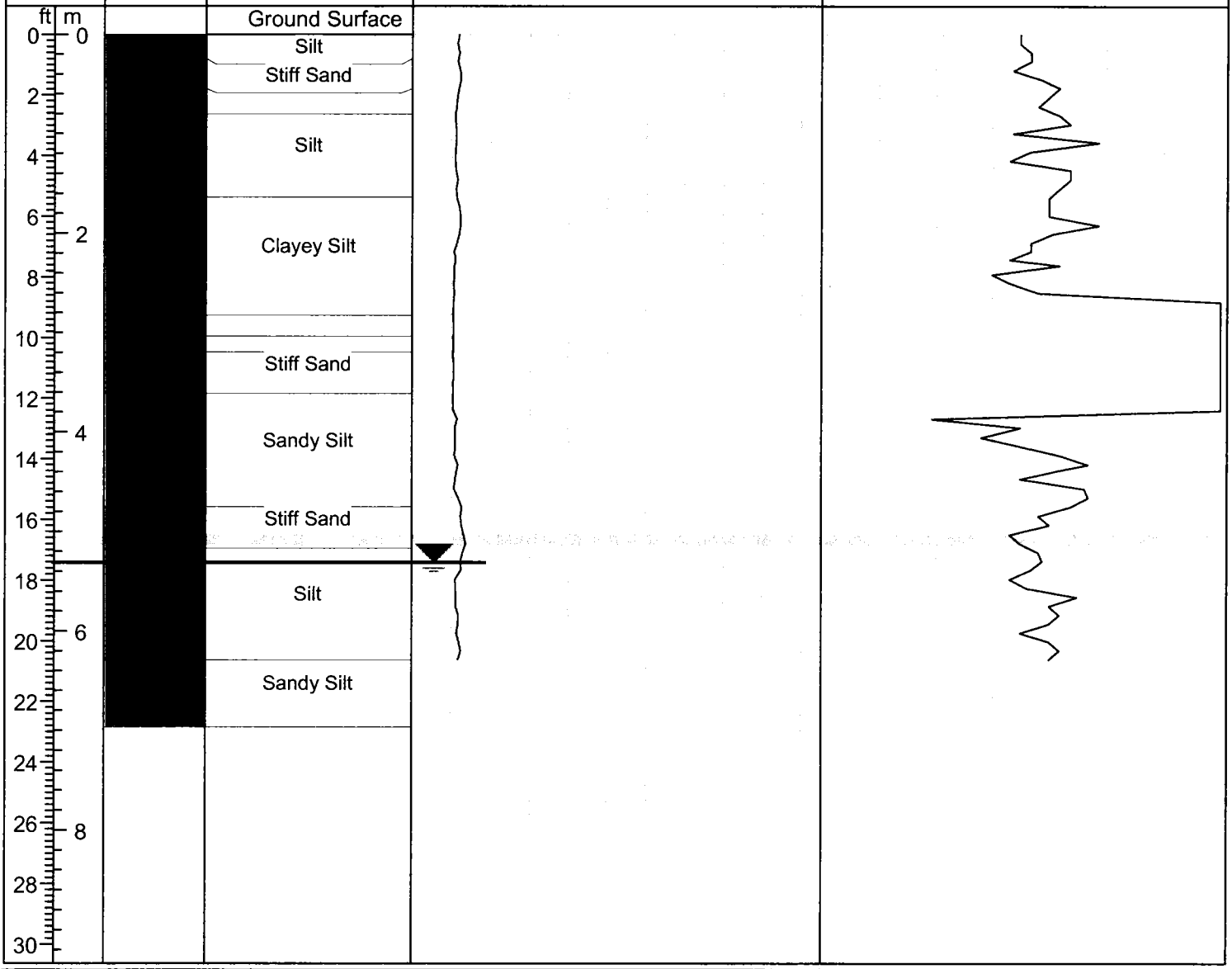
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 16.8' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 047

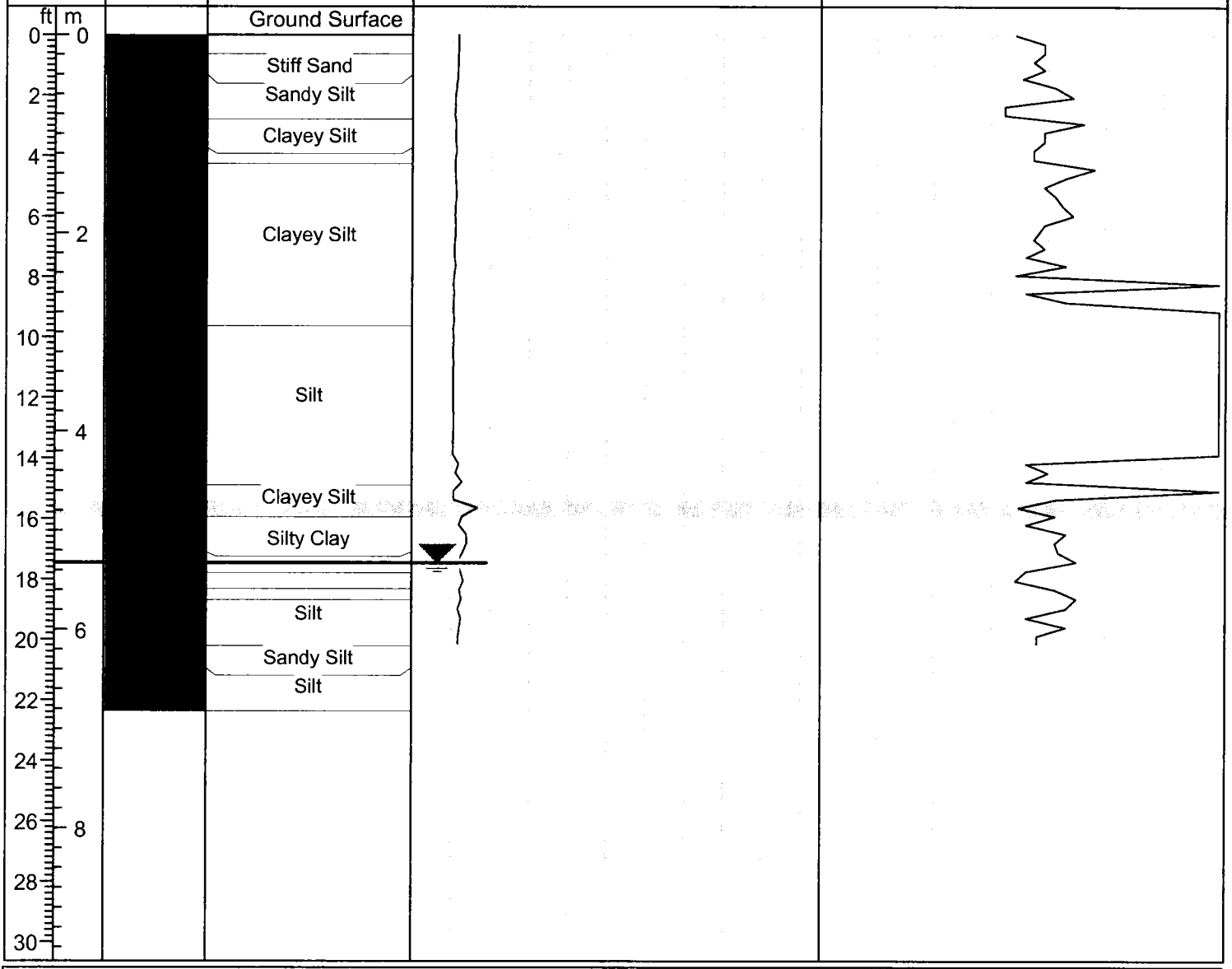
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**



Contamination Identified @ 15.6' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 048

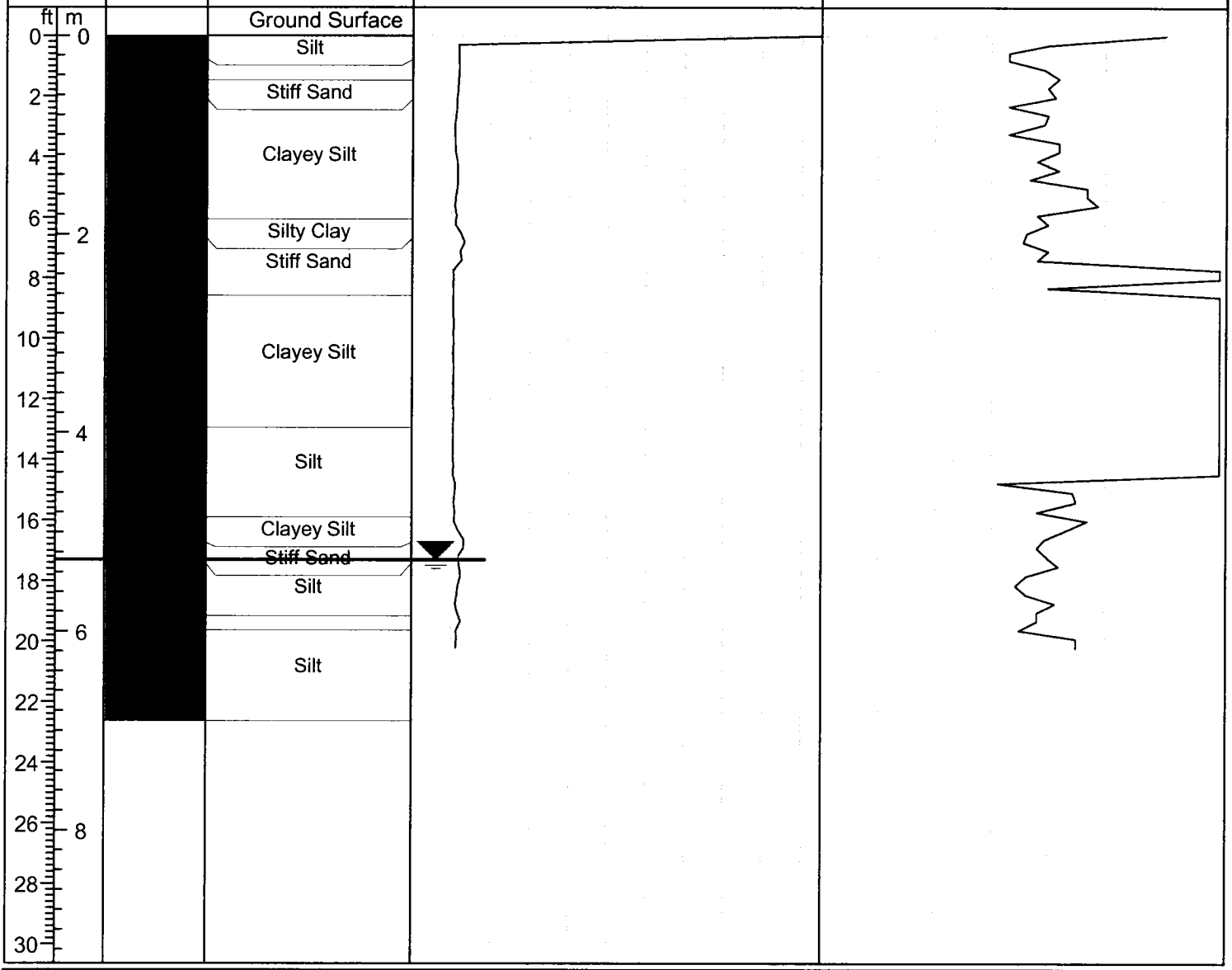
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 049

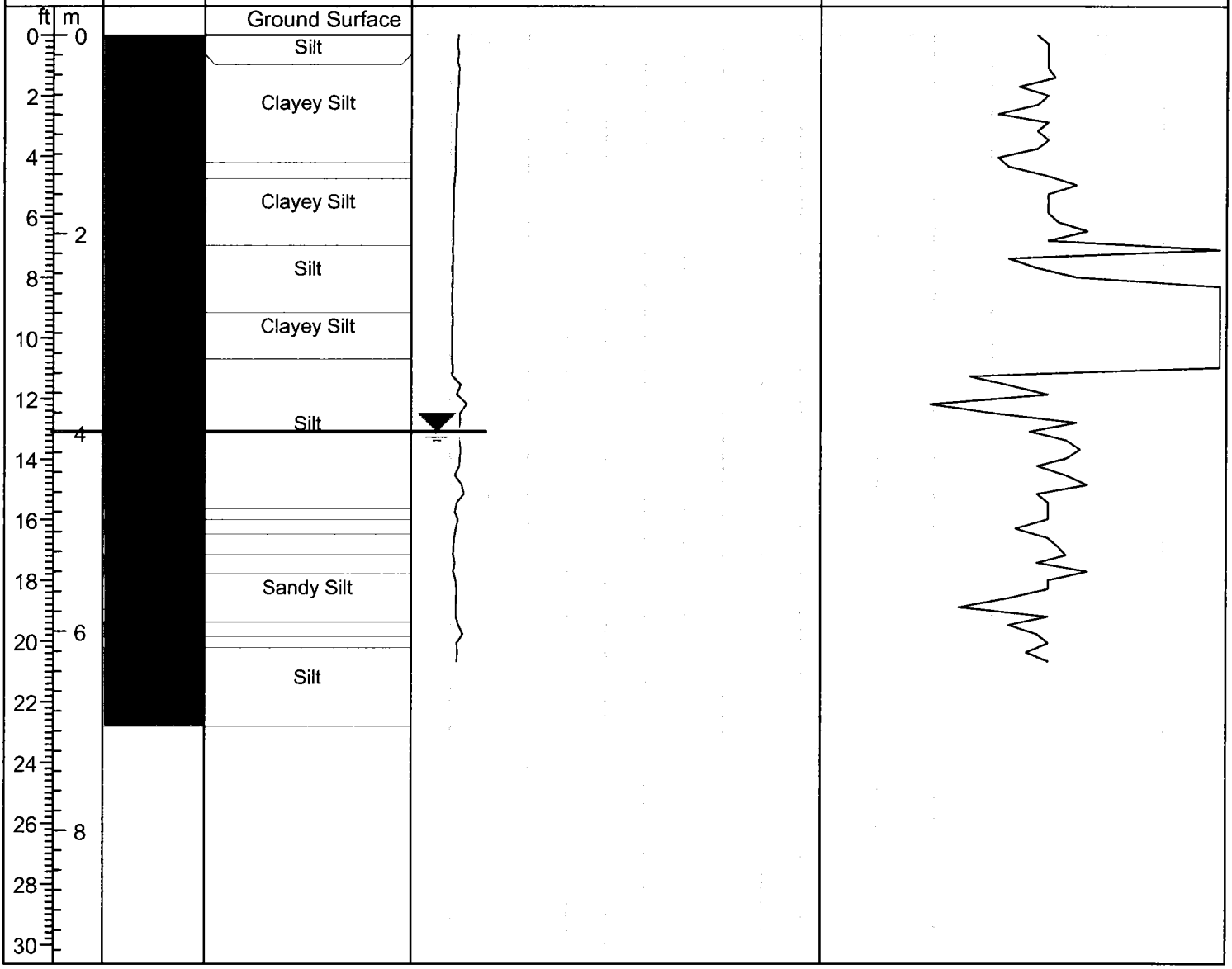
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 050 (Video)

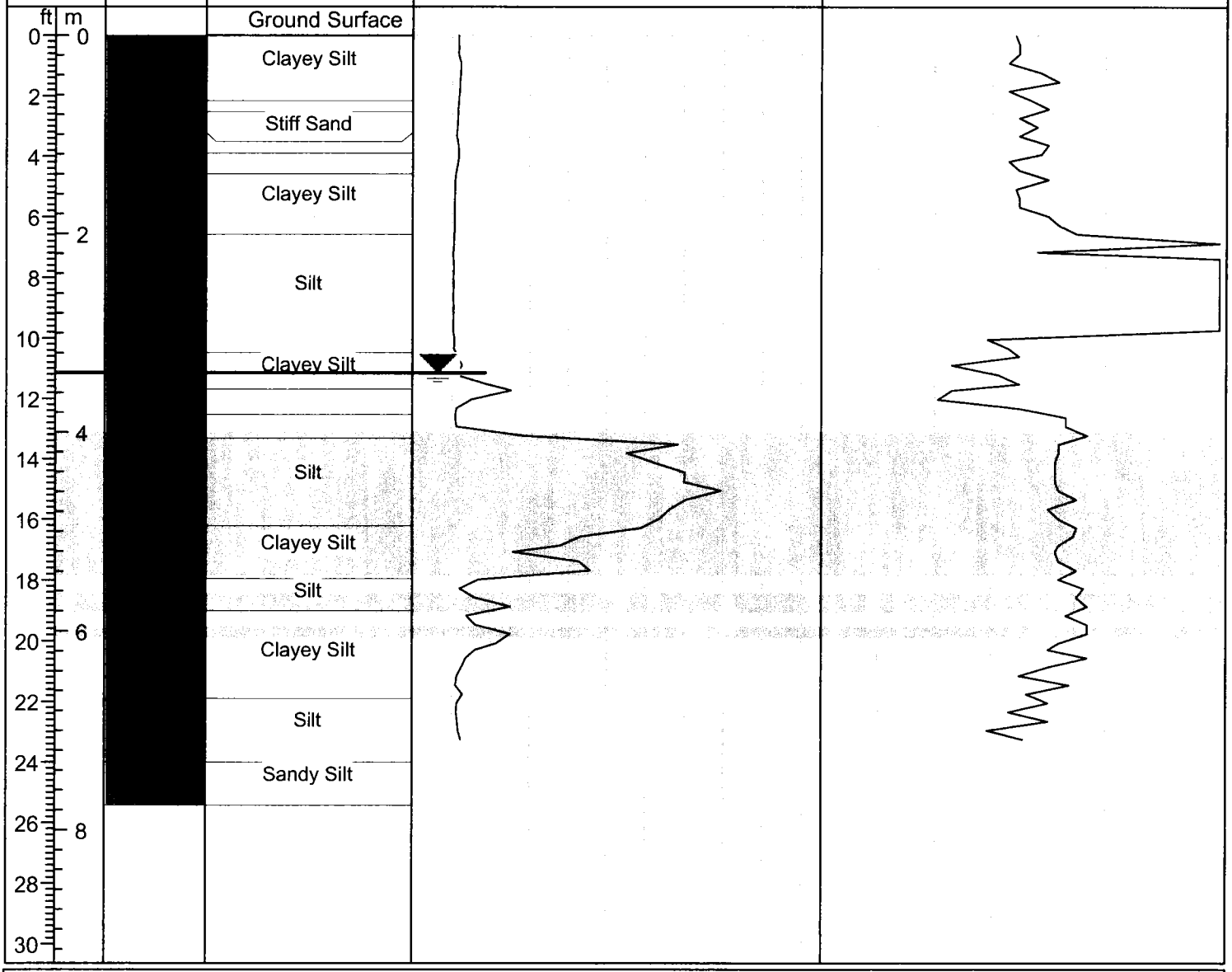
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/20/01

SUBSURFACE PROFILE | **LIF RESULTS**



Pushed @ 1-foot offset from Video Probe Push

Contamination Identified @ 13.5-18' BGS
High Relative Intensity
Contamination Identified @ 19' and 19.75' BGS
Low Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 051

Project #: 02-002

Project Manager: GS

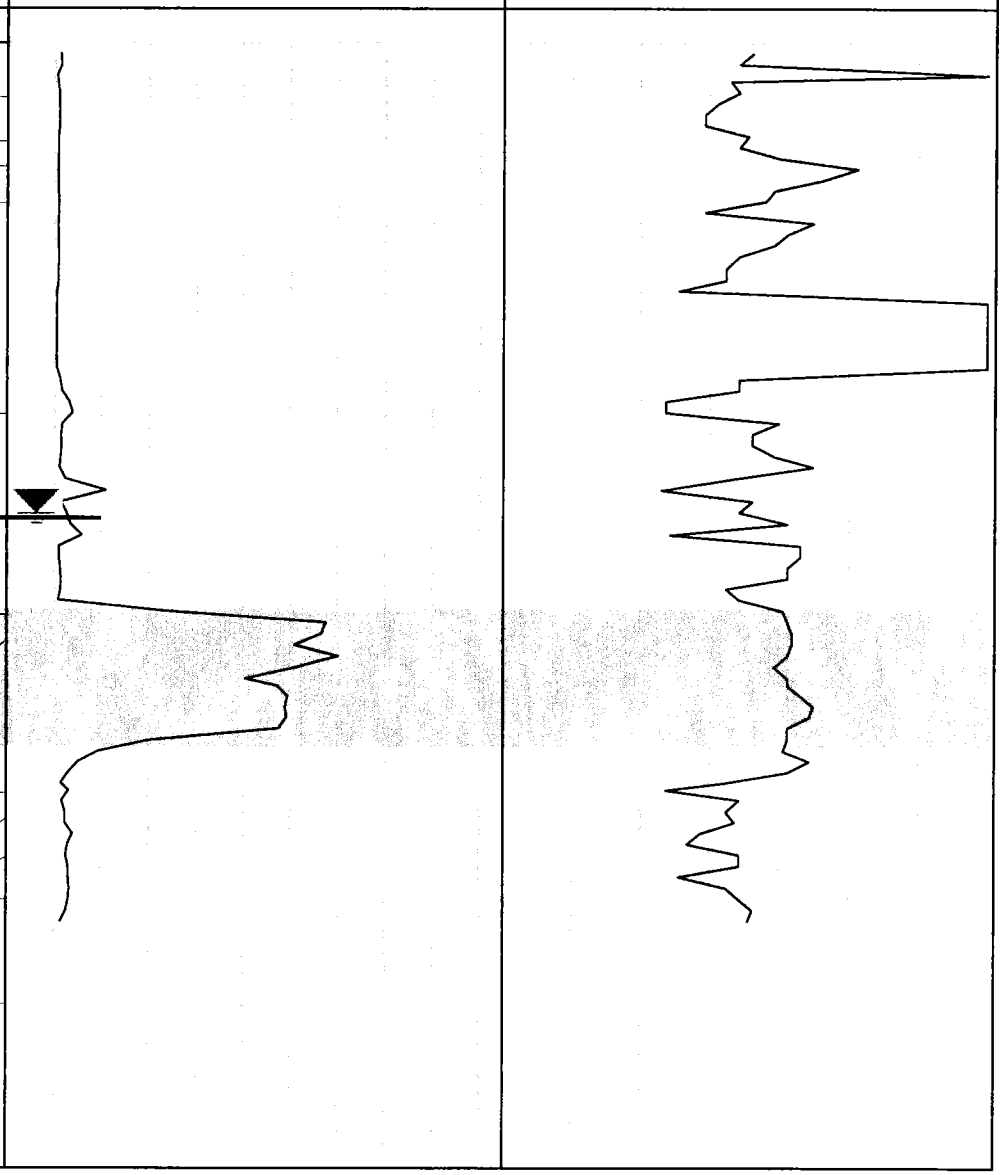
Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Stiff Sand
2		Clayey Sand
4		Stiff Sand
6		Clayey Silt
10		
12		Sandy Silt
14		
16		Silt
18		Clayey Silt
20		Silt
22		Sandy Silt
		Silt
24		Sandy Silt
26		
28		
30		

ft / m: 0 / 0, 2 / 2, 4 / 6, 8 / 10, 12 / 14, 16 / 18, 20 / 22, 24 / 26, 28 / 30



Contamination Identified @ 15.5-19' BGS
High Relative Intensity

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 052

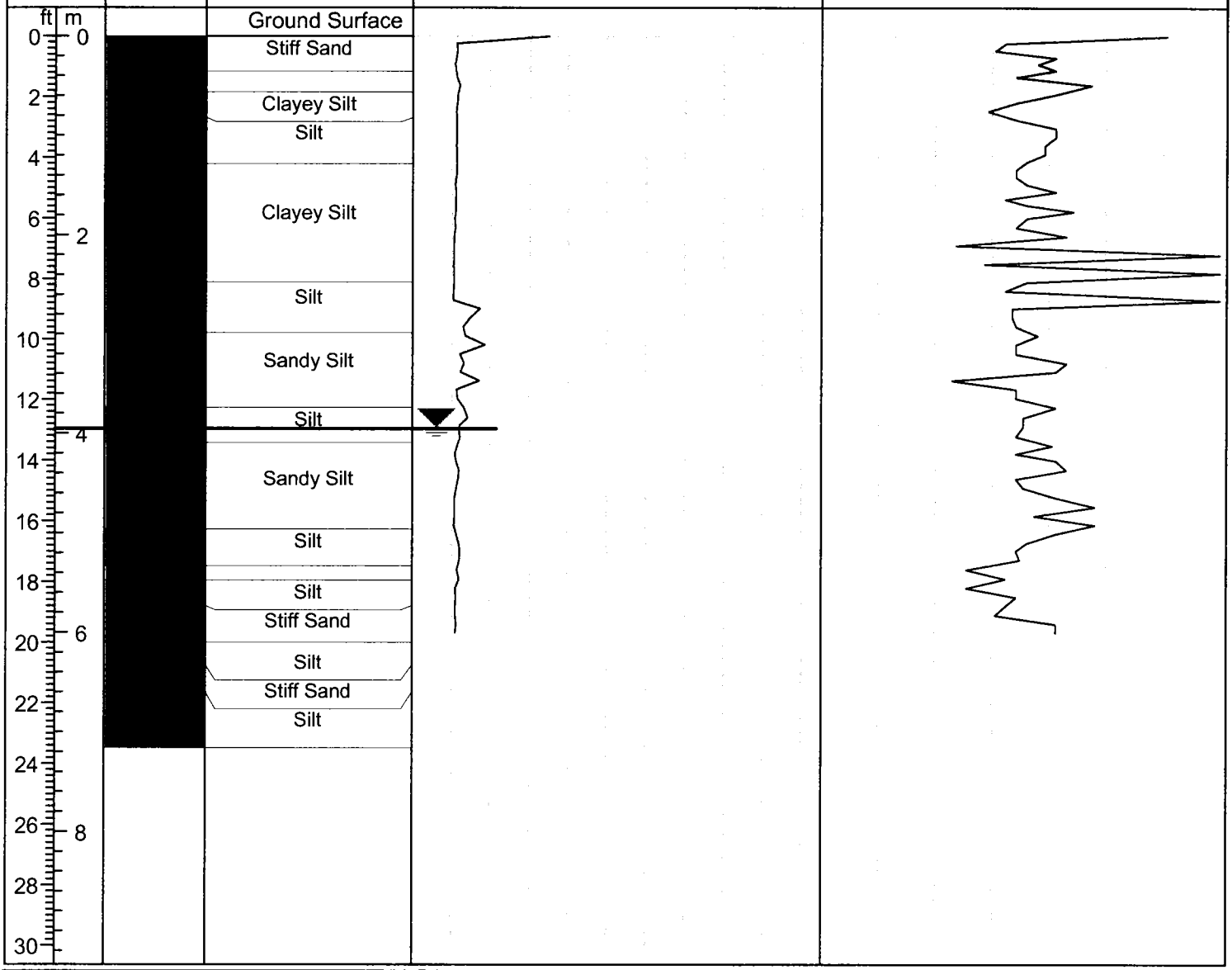
Project #: 02-002

Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**



No Contamination Detected

NAVY PWC NORFOLK
9742 Maryland Avenue
Norfolk, VA. 23511
Tel: (757) 445-4885 Fax: (757) 444-5822

Site: Yorktown Fuel Farm

Push Location ID: 053

Project #: 02-002

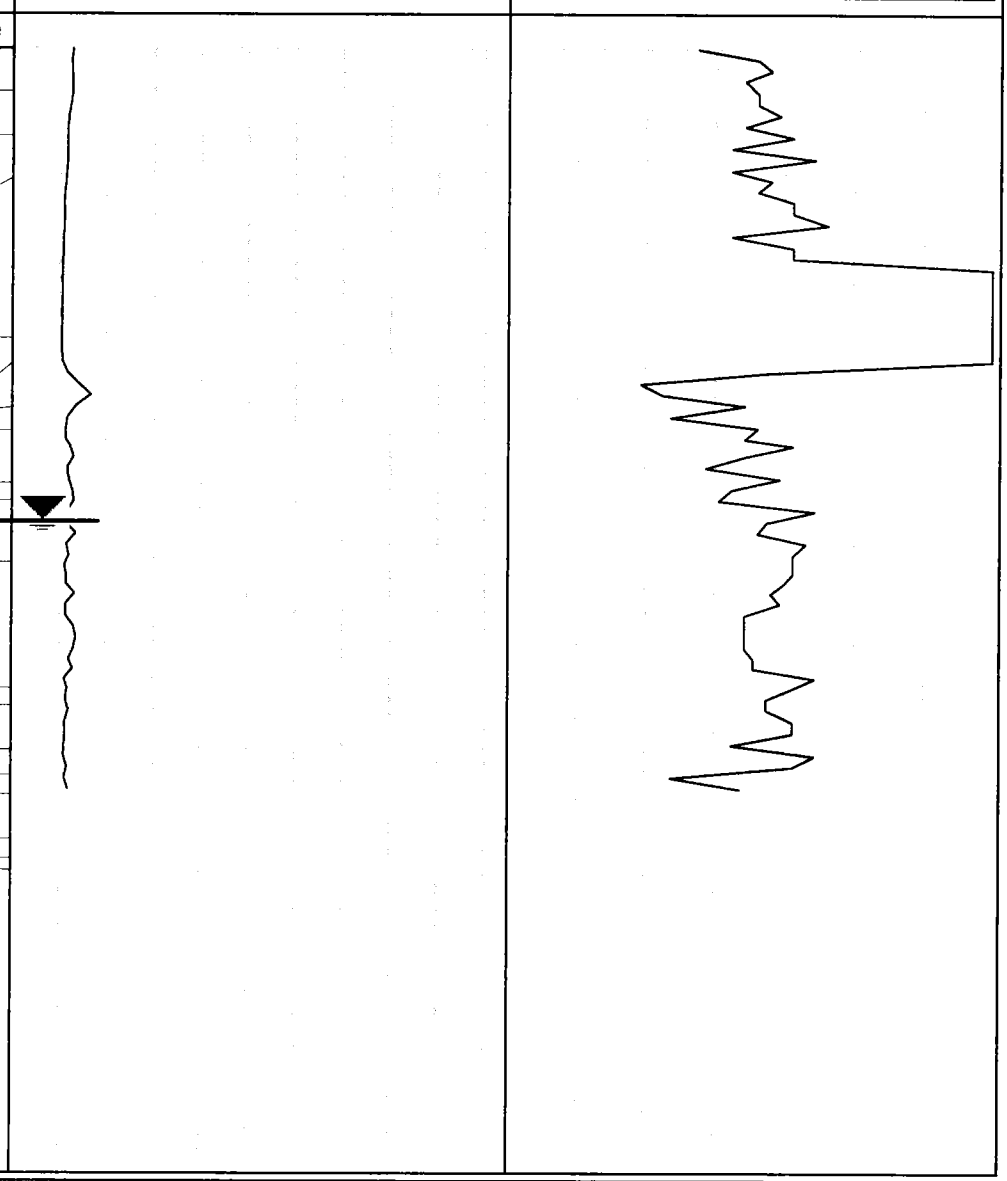
Project Manager: GS

Client: CNRMA, Regional Env Group

Date: 12/13/01

SUBSURFACE PROFILE | **LIF RESULTS**

Depth BGS	Symbol	Soil Class
0		Ground Surface
0		Clayey Silt
2		Stiff Sand
4		Silty Clay
6		Clayey Silt
2		
8		Silt
		Clayey Silt
10		Sandy Silt
12		Sandy Silt
4		
14		Silt
16		
18		Silt
6		
20		Silt
22		
24		
26		
8		
28		
30		



No Contamination Detected