FINAL CORRECTIVE ACTION PLAN UNDERGROUND STORAGE TANK SYSTEM AT BUILDING 81 NWS YORKTOWN VA

9/1/1993

ROY F. WESTON

FINAL

CORRECTIVE ACTION PLAN
UST SYSTEM AT BUILDING 81

NAVAL WEAPONS STATION
YORKTOWN, VIRGINIA

CONTRACT TASK ORDER 0198

PC No. 93-594

Prepared For:

NAVAL FACILITIES
ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA

Under:

Contract N62470-89-D-4814

Prepared By:

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3 SEPTEMBER 1993

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EXECUTIVE SUMMARY

Roy F. Weston, Inc. (WESTON®), as partners with Baker Environmental, Inc. (Baker) on the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, was contracted by the Atlantic Division (LANTDIV), Department of the Navy to prepare a Corrective Action Plan (CAP) to address previous petroleum releases from the underground storage tank (UST) system 81.1 at Building 81, Naval Weapons Station, Yorktown, Virginia. The CAP was prepared in accordance with the Commonwealth of Virginia's Department of Environmental Quality (DEQ) Underground Storage Tank (UST) Regulations, Code VR 680-13-02.

The Site Characterization Report (SCR) study was conducted by WESTON during January 1993 and confirmed the presence of subsurface petroleum hydrocarbon contamination in the vicinity of UST system 81.1. The extent of subsurface hydrocarbons is confined to the area surrounding of Building 81 and to a lesser extent downgradient of Building 81 in the ravine.

Detected concentrations of total petroleum hydrocarbons (TPH) in soil ranged from 22 to 3,800 parts per million (ppm). Dissolved concentrations of TPH in groundwater ranged from below the method detection limit to 26.86 ppm. TPH concentrations in groundwater diminish rapidly away from Building 81. Concentrations of several volatile and semi-volatile organic compounds, were also identified at the site.

With the exception of TPH, all concentrations of dissolved contaminants in groundwater were below state standards and federal maximum contaminant levels. Additionally, the risk assessment identified no risk to humans or the environment from the subsurface contaminants. The risk assessment included the use of fate-and-transport modeling to quantify potential concentrations of benzene at the nearest surface water body downgradient of the site.

This CAP addresses the removal of UST system 81.1, any visually contaminated soils in its immediate vicinity, and the adjacent concrete pad. Soils that are excavated will be remediated by thermal treatment. Proposed remedial endpoints are less than or equal to 0.01 feet liquid-phase hydrocarbons (LPH), 500 ppm TPH in soils, and 10 ppm TPH in groundwater. Site monitoring will include a 6-month maintenance and a 6-month post-operative monitoring period in accordance with the General CAP Permit requirements to ensure that remedial goals have been achieved. The total current estimated project costs are approximately $54,000.

1.0 INTRODUCTION

Roy F. Weston, Inc. (WESTON®), as partners with Baker Environmental, Inc. (Baker) on the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, was contracted by the Atlantic Division (LANTDIV), Department of the Navy to prepare a Corrective Action Plan (CAP) to address previous releases from the storage tank (UST) system 81.1 at Building 81, Naval Weapons Station (NWS) Yorktown, Virginia. Building 81 is a steam generation plant providing heat for the adjacent munitions storage and maintenance building at NWS Yorktown (see Figures 1-1 and 1-2). This CAP was prepared in accordance with the Commonwealth of Virginia's Underground Storage Tank (UST) Regulations, Part VI of Code VR 680-13-02 following the Department of Environmental Quality (DEQ) guidelines. The DEQ CAP checklist is provided as Appendix A.

1.1 PURPOSE AND OBJECTIVES

The purpose of this report is to describe and provide supporting documentation for the corrective action approach selected for remediation of the petroleum hydrocarbons in the vicinity of Building 81. The specific objectives of this report are to provide background characterization and assessment information; propose permanent corrective actions to mitigate the migration of petroleum hydrocarbons to the environment; propose remediation endpoints for the site; and outline a monitoring plan to evaluate the progress of the corrective action.

1.2 REPORT ORGANIZATION

This report is organized in three sections. Section 1 presents the purpose and objectives of this report. Section 2 presents the site background information, including a description of the site, site investigative history, a summary of the nature and extent of contamination, and a summary of the risk and remediation assessments conducted during the Site Characterization Study (SCS). Section 3 presents a description of the corrective action approach and includes the proposed remediation endpoints, an outline of proposed requirements for site remediation, a site monitoring plan, a CAP schedule, and an estimate of project cost.

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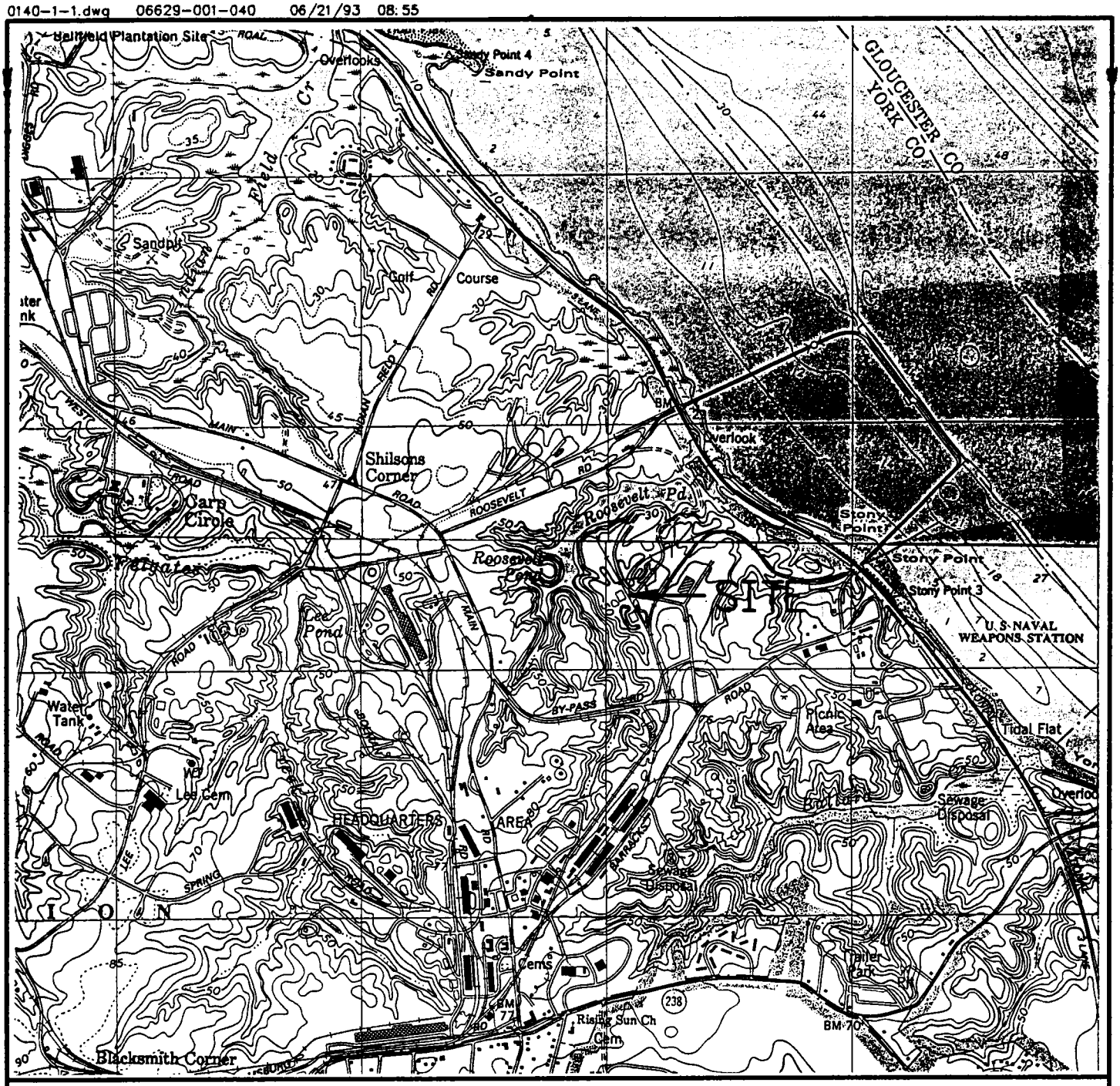

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0.5 0 1 KILOMETER

-N-

QUADRANGLE LOCATION

SOURCE: YORKTOWN, CLAY BANK, VA
7.5' QUADRANGLE
37076-C5-TF-024
37076-B5-TF-024
1984

PROJECT TITLE: CORRECTIVE ACTION PLAN UST SYSTEM - BUILDING 81 NAVAL WEAPONS STATION YORKTOWN, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	WESTON
DWG. TITLE: REGIONAL SITE LOCATION MAP	FIGURE NO.: 1-1	

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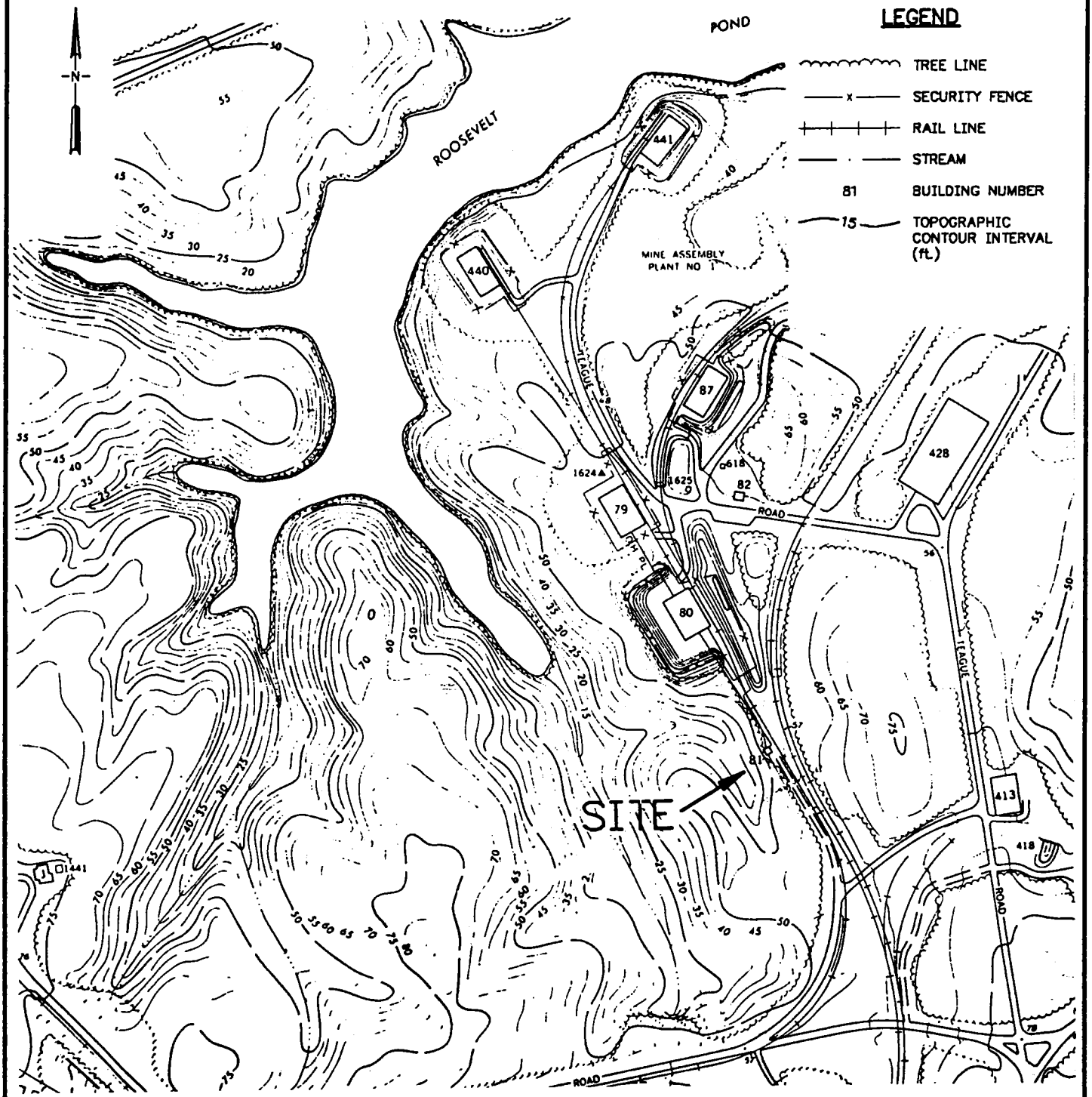

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SCALE 1"=400' FEET

SOURCE: LANTDIV DRAWING # 153068

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DWG. TITLE AREA MAP	FIGURE NO. 1-2	

2.0 SITE BACKGROUND

This section provides site background information that includes a site description, a review of investigative history, a summary of the nature and extent of contamination, and a summary of the risk and remediation assessments. The reader is referred to the Site Characterization Report (SCR) (WESTON, 1993) for additional site background information. Information in this section has been amended to include more detailed historical information for the site, and in some instances has been updated or revised from the SCR.

2.1 SITE LOCATION AND DESCRIPTION

Building 81 is located in a relatively remote area in the east-central portion of NWS Yorktown (see Figure 1-1). The building houses one boiler used for steam generation, providing a heating source to nearby Buildings 79 and 80. The site is bounded on the northeast by railroad tracks. The area immediately south and west of the site is a wooded and steeply sloped ravine. The UST system at Building 81 consists of two tanks, UST 81.1 and UST 81.2.

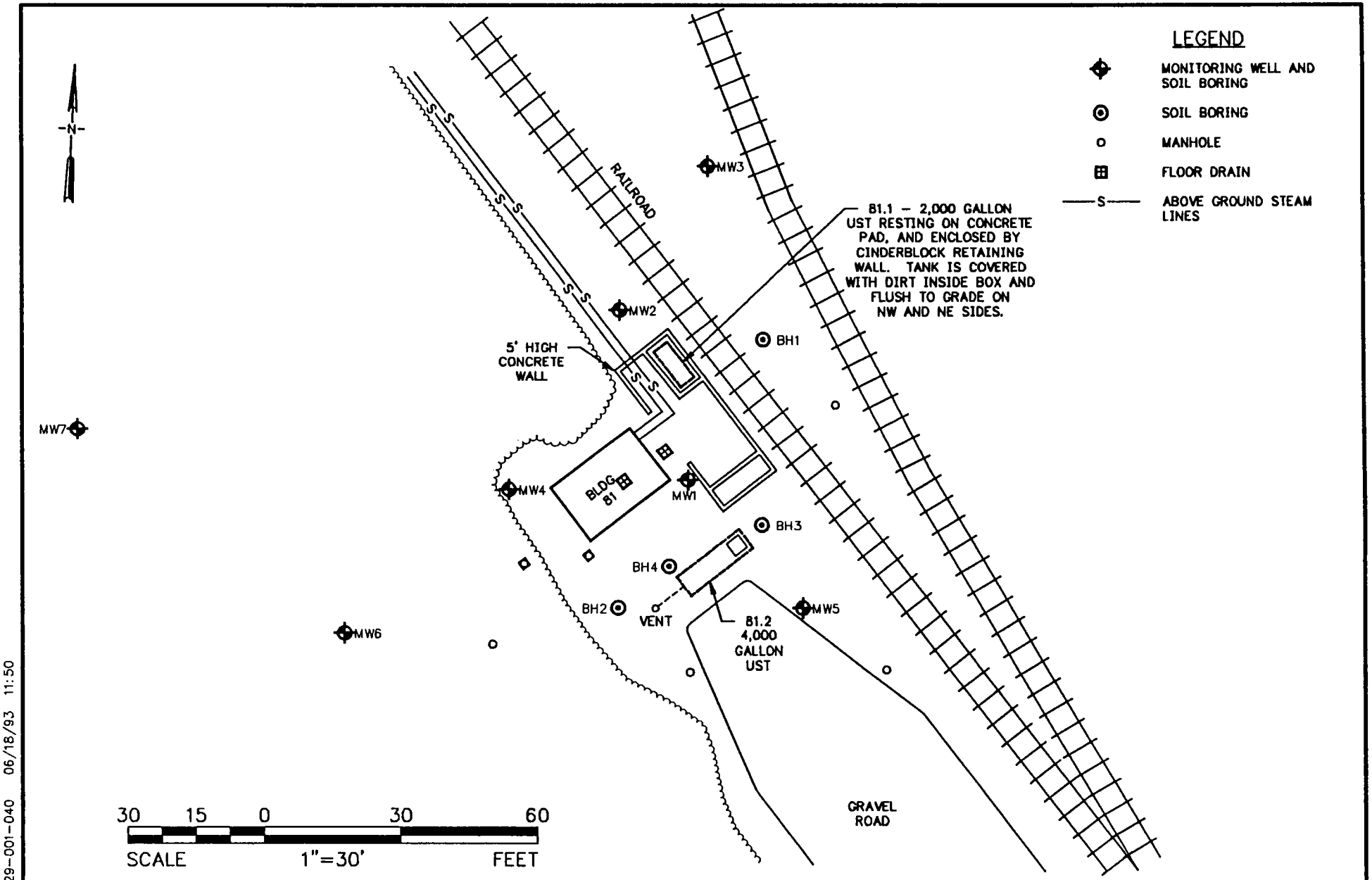
2.2 INVESTIGATIVE HISTORY

UST 81.1 is a 2,000-gallon, single-wall steel heating oil tank installed in 1942 to replace coal as a source of firing the boiler used to heat Buildings 79 and 80 (Figure 2-1). In March 1992, NWS Yorktown maintenance personnel observed oily soils around UST 81.1 and signs of spillage on the concrete pad. The UST has subsequently been removed from service. An Initial Abatement Measures Report was prepared by NWS Yorktown personnel presented to the DEQ on 19 October 1992. UST 81.2 currently supplies No. 2 fuel oil to the boiler in Building 81 via subsurface fuel lines. A 4,000-gallon capacity UST 81.2 is located approximately 20 feet to the southeast of Building 81. UST 81.2 was installed in 1946.

WESTON, as partners with Baker on the CLEAN Program, was contracted by LANTDIV to perform a SCS at Building 81. WESTON conducted the field portion of the SCS in January 1993. The specific objectives of the assessment were to investigate the site geologic and hydrogeologic conditions and to define the extent of subsurface contamination in the vicinity of the previously identified release. During the SCS, WESTON advanced 11 soil borings, screened and collected soil samples for analysis, converted seven of the borings into monitoring wells, collected groundwater samples for analysis, and conducted two hydraulic conductivity tests. Figure 2-1 illustrates the soil boring, and well locations. The SCR was finalized in March 1993 and forwarded to the DEQ.

2.3 GEOLOGY

Soil Samples were obtained from each of the 11 borings to characterize subsurface soil conditions. In general, the study area is underlain by 18 to 28 feet of mottled, rusty orange to light gray, fine-grained, sandy to silty clay interlayered with lenses of fine-grained, silty sand. The sandy to silty clay overlies a 4 to 16-foot layer of clayey



PROJECT TITLE: CORRECTIVE ACTION PLAN UST SYSTEM - BUILDING 81 NAVAL WEAPONS STATION YORKTOWN, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	WESTON
DWG. TITLE SITE MAP	FIGURE NO. 2-1	

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to silty sand with shells. The shell fraction generally increases with depth to where, in some cases, the soil is predominantly a slightly cemented shell hash with a silty sand matrix. The shelly silty sand overlies a tight, plastic, blue-gray, silty clay with shells. The silty clay was encountered in most soil borings at a depth of approximately 38 feet bgs. The dense blue-gray, silty clay with shells has thin laminations (less than 1/8-inch) of gray to black very fine-grained, silty sand and is characteristic of an upper sequence in the Yorktown Formation. Copies of the boring logs describing the soils encountered are provided in Appendix B.

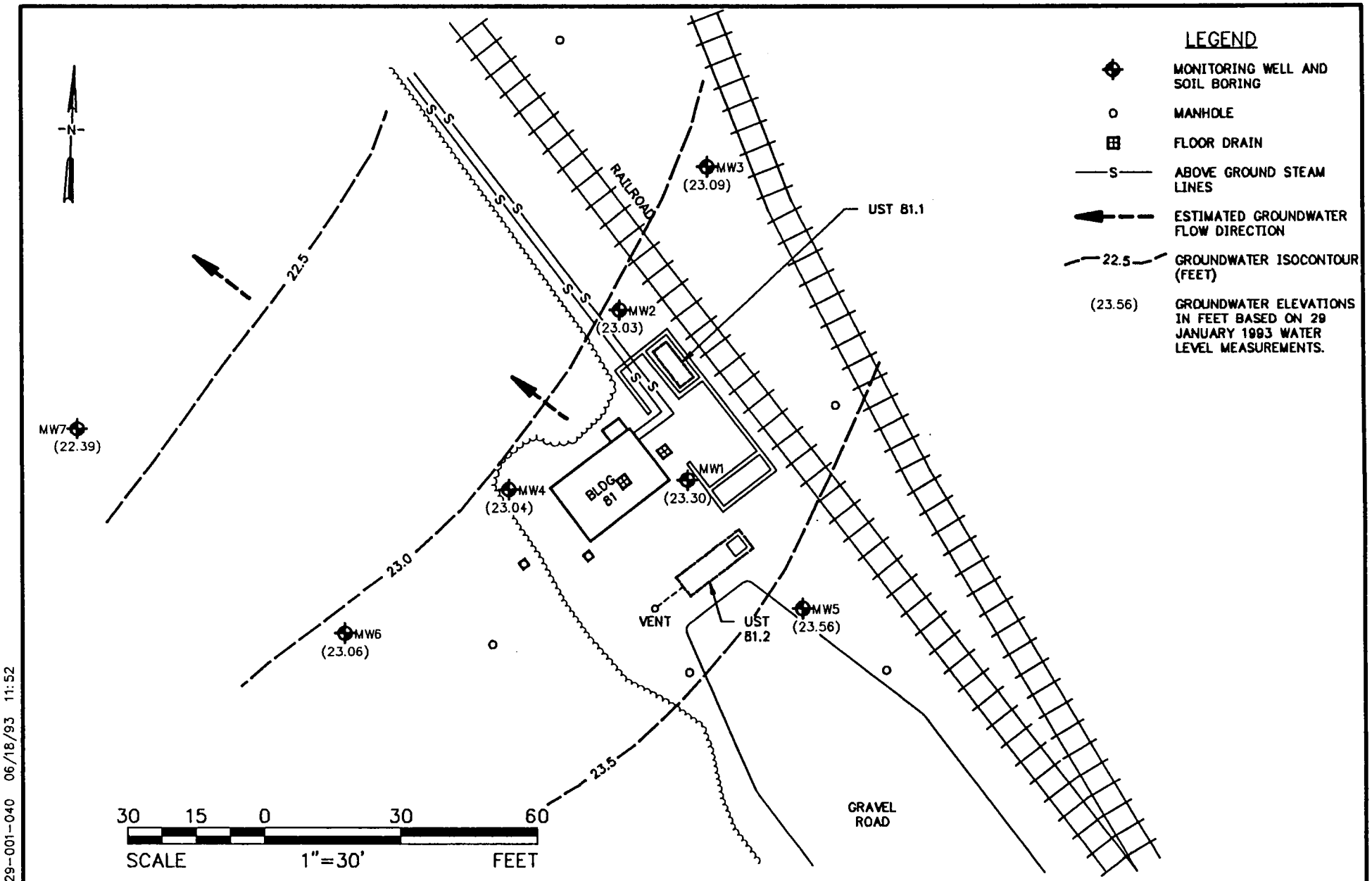
The surficial geologic units in the study area are believed to be the Pleistocene age sediments of the Shirley Formation to the Miocene-age shelly sands of the Yorktown Formation. The Shirley in this area is comprised of medium-to-thick bedded clayey and sandy silts and silty clays with abundant organics that are interbedded with small fine-grained silty sand lenses. The elevation of the Shirley ranges from 35 to 45 feet above MSL. The Chuckatuck Formation, while mapped in this area by Mixon (et al., 1989), was not present, based on the descriptions available for comparison. The sandy clays grade into a shelly silty sand characteristic of the upper Yorktown Formation. Together, these formations form the uppermost water table aquifer in this vicinity.

2.4 SITE HYDROGEOLOGY

Groundwater levels in the wells at the site were measured periodically during field activities (see Appendix C). Depth to groundwater at the site on 29 January 1993 ranged between approximately 12 and 35 feet bgs. Based on this data, groundwater appears to be flowing across the site in a northwesterly direction with a gradient of approximately 0.008 ft/ft as illustrated in Figure 2-2. Site-specific aquifer characteristics were determined by evaluating the rising-head test data from the 19 January 1993 slug tests in monitoring wells MW5 and MW7. The field data were evaluated using the Bouwer and Rice (1976) equation for a partially penetrated unconfined aquifer. Hydraulic conductivity was determined to be 0.2 and 5.9 ft/day for MW5 and MW7, respectively. Using this range of values calculated for K, a groundwater gradient of 0.008 ft/ft across the site, and an estimated effective porosity of 30% (Fetter, 1980), the range of groundwater flow velocities is calculated as 5.3×10^{-3} ft/day to 0.16 ft/day (2 to 57 ft/yr).

2.5 NATURE AND EXTENT OF CONTAMINATION

SCS results confirm that subsurface soils in the vicinity of the southern side of Building 81 are contaminated with petroleum compounds related to No. 2 fuel oil. Elevated levels of contamination in the form of adsorbed- and dissolve-phase hydrocarbons were identified. Based on field screening data, vapor-phase hydrocarbons do not appear to represent a contaminant concern at the site which is consistent with the low volatility of No. 2 fuel oil. No liquid-phase hydrocarbons were detected during the SCS. The nature and extent of the identified phases of subsurface hydrocarbons are provided in subsequent portions of this report.



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DWG. TITLE GROUNDWATER ISOCONTOUR MAP	FIGURE NO. 2-2	

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2.5.1 Adsorbed-Phase Hydrocarbons

A total of 23 soil samples were collected from the 11 soil borings at the study area for TPH analysis. Two samples collected from each boring were analyzed for TPH. For each soil boring, one sample was collected in the vadose zone and the second sample was collected at the interval just above the observed water table. Seven samples were collected from selected soil borings and analyzed for volatile organic compounds (VOCs) by EPA method 8240. The samples for VOCs were chosen based on field screening of the soils at discrete intervals to identify potentially contaminated soils. Two composite soil samples from MW1 were collected for grain size analysis. Laboratory results are summarized in Table 2-1. Laboratory results are provided in Appendix D.

Laboratory results indicate that TPH concentrations in soil samples ranged from below detection limits (BDL) in soil borings MW2, MW3, BH1, MW4, and MW5 to 3,800 ppm in soil boring MW6 (14 to 16 feet bgs). Of the 23 soil samples analyzed for TPH (two from each boring and one duplicate), six samples contained TPH concentrations that exceed the DEQ "action level" of 100 ppm. Soil borings that exhibited TPH concentrations greater than 100 ppm include MW1, BH4, and MW6. The analytical data indicate that the TPH detected from these soil samples appear to be representative of the mid-distillate group of fuels (such as diesel, fuel oil, or kerosene).

Results for VOC analysis revealed ethylbenzene was present in the soil samples from MW1, BH4, and MW6 (see Table 2-1). In addition, 1,1,1 trichloroethane (TCA) was also detected in both soil samples from MW1; 0.0376 ppm in the sample from the 4 to 6 feet interval, and 0.10 ppm in the sample was collected at the 29 to 31 feet interval.

Concentrations of TPH in soils in the vicinity of the Building 81 are depicted in Figure 2-3. The distribution pattern of TPH concentrations in soil indicates that the highest area of soil contamination is located in the vicinity of MW1, MW6, and BH4. The elevated concentrations of TPH are likely related to a release of petroleum hydrocarbons from UST 81.1 as a result of overfilling and possibly from leakage of the No. 2 fuel oil onto the concrete pad. The elevated concentrations of TPH, especially in the vicinity of MW6, may be in part due to the leakage of the fuel oil through the concrete pad floor drain. The spilled fuel may have entered the floor drain and passed partially to a discharge point (or points) and behind Building 81. Monitoring well MW6 is in close proximity to the floor drain outfall location (see Figure 2-3).

2.5.2 Dissolved-Phased Hydrocarbons

Groundwater samples were collected on 15, 18, and 19 January 1993 from the newly installed monitoring wells. The samples were analyzed for VOCs (EPA method 624), Base/Neutral-Acid Extractables (BNAs) by EPA method 625, TPH (EPA method 418.1), and total dissolved lead (EPA method 7421). Results of the laboratory analyses are presented in Tables 2-2 and 2-3.

TABLE 2-1

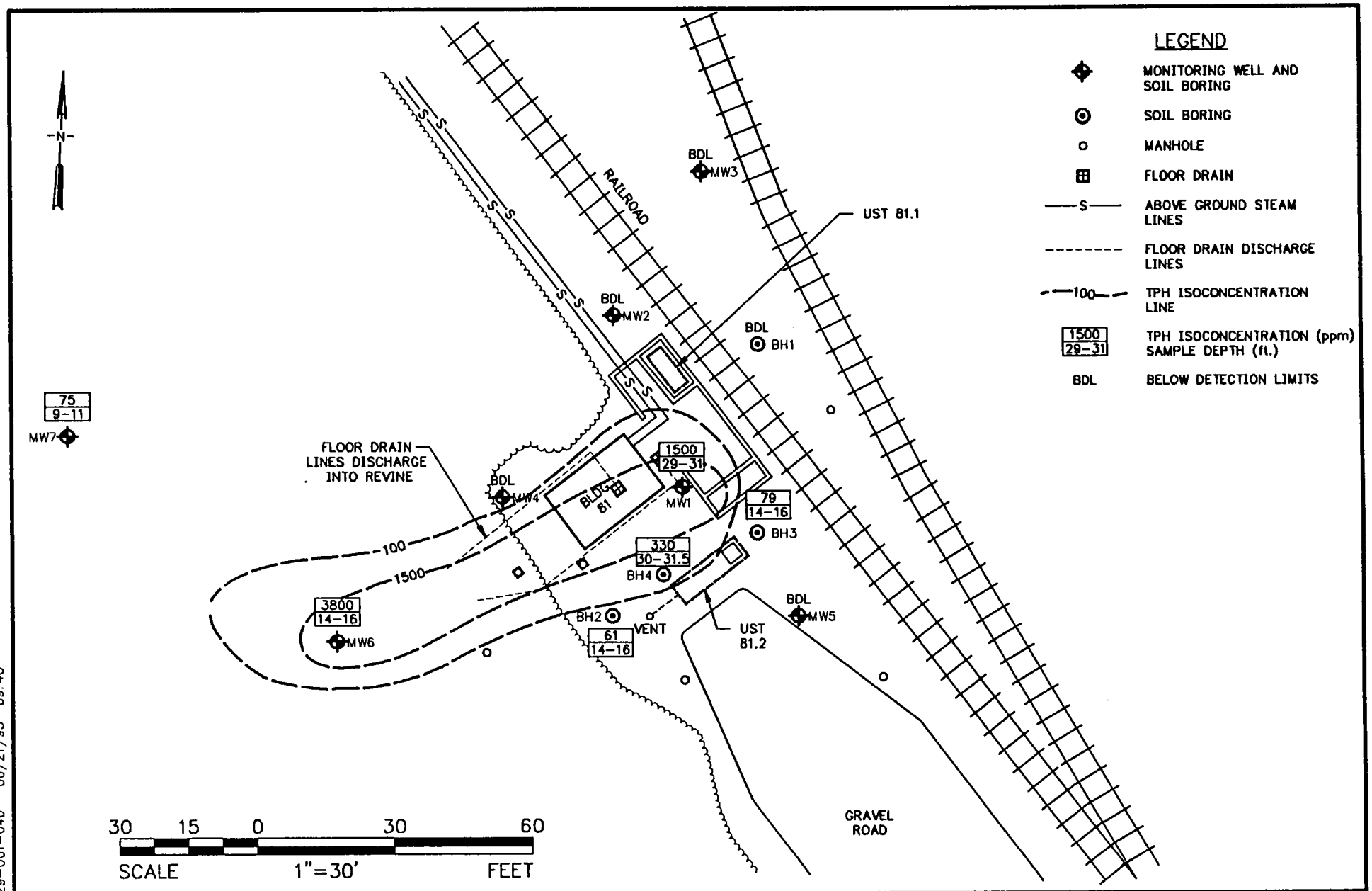
SUMMARY OF TPH AND VOCs IN SOIL SAMPLES (ppm)

Soil Boring Number	Field Sample Number	Sample Interval[a]	TPH[b]	Benzene[c]	Toluene[c]	Ethylbenzene[c]	Total Xylenes[c]	Total BTEX[c]	1,1,1 Trichlorethane[c]
MW1	MW1-001	4-6	610	BDL	BDL	BDL	DBL	BDL	0.0376
MW1	MW1-002	29-31	1500	BDL	BDL	0.630	BDL	0.630	0.100
MW2	MW2-001	29-31	BDL	--	--	--	--	--	--
MW2	MW2-002	34-36	BDL	--	--	--	--	--	--
MW3	MW3-001	29-30	BDL	--	--	--	--	--	--
MW3	MW3-002	30-31	BDL	--	--	--	--	--	--
BH1	BH1-001	29-31	BDL	--	--	--	--	--	--
BH1	BH1-002	32-33.3	BDL	--	--	--	--	--	--
MW4	MW4-001	19-21	BDL	--	--	--	--	--	--
MW4	MW4-002	29-30.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
MW4[(1)]	MW4-003	29-30.5	BDL	--	--	--	--	--	--
BH2	BH2-001	14-16	61	--	--	--	--	--	--
BH2	BH2-003	30-32	BDL	--	--	--	--	--	--
MW5	MW5-001	29-30.5	BDL	--	--	--	--	--	--
MW5	MW5-002	34-36	BDL	--	--	--	--	--	--
BH3	BH3-001	14-16	79	--	--	--	--	--	--
BH3	BH3-002	29-31	22	BDL	BDL	BDL	BDL	BDL	--
BH4	BH4-001	28-30	250	BDL	BDL	BDL	BDL	BDL	BDL
BH4	BH4-002	30-31.5	330	--	--	--	--	--	--
BH4[(1)]	BH4-003	28-30	--	BDL	BDL	0.288	BDL	0.288	BDL
MW6	MW6-001	9-11	110	--	--	--	--	--	--
MW6	MW6-002	14-16	3800	BDL	BDL	1.127	BDL	1.127	BDL
MW7	MW7-001	9-11	75	--	--	--	--	--	--
MW7	MW7-002	19-21	BDL	--	--	--	--	--	--

a - Feet below ground surface.
b - TPH analysis by EPA SW846 modified method 8015 with method 3550 extraction.
c - EPA method 8240 for Halogenated Hydrocarbons.

1 - Duplicate TPH sample.
-- - Not analyzed.
BDL - Below detection limits.
ppm - Parts per million.

ppm - Parts per million.



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DWG. TITLE TPH IN SOIL ISOCONCENTRATIONS	FIGURE NO. 2-3	

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TABLE 2-2

SUMMARY OF TPH AND TOTAL DISSOLVED LEAD IN GROUNDWATER SAMPLES (ppm)

Parameter	Well Number/Field Sample No. (ppm)									
	MW1 MW1-001	MW2 MW2-101	MW2 MW2-101[a]	MW2 MW2-201[b]	MW2 MW2-301[c]	MW3 MW3-301	MW4 MW4-001	MW5 MW5-001	MW6 MW6-001	MW7 MW7-001
Total Dissolved Lead[(1)]	BDL	BDL	BDL	BDL	--	BDL	BDL	BDL	BDL	BDL
TPH[(2)]	26.86	BDL	2.79	BDL	BDL	2.39	26.2	1.79	3.7	1.48

ppm - Parts per million.
BDL - Below detection limits (1.0 ppm for TPH; 0.005 ppm for total dissolved lead).
-- - Not sampled.
a - Duplicate sample.
b - Trip Blank.
c - Rinsate Blank.
(1) - Total Dissolved Lead analysis by EPA method 7421.
(2) - Total petroleum hydrocarbon analysis by EPA method 418.1.

TABLE 2-3

SUMMARY OF VOAs AND BNAs IN GROUNDWATER SAMPLES[a] (ppm)

Analyte	PQL	Well Number/Field Sample No.					
		MW1 MW1-001	MW2 MW2-001	MW2[b] MW2-101	MW2[c] MW2-301	MW4 MW4-001	MW6 MW6-001
Chloroform[d]	0.001	--	0.002	0.002	--	--	--
Benzene[d]	0.001	0.004	--	--	--	--	--
Ethylbenzene[d]	0.001	0.004	--	--	--	--	--
Fluorene[e]	0.005	0.010	--	--	--	--	--
Naphthalene[e]	0.005	0.016	--	--	--	--	--
Phenanthrene[e]	0.005	0.013	--	--	--	--	--

ppm - Parts per million.
PQL -Practical quantitation limits.
-- - Less than practical quantitation limits
a - Only analytes detected are summarized. Analytical results are provided in Appendix H.
b - Duplicate sample (101).
c - Rinsate sample (301).
d - Analyses by EPA method 624, volatile organic aromatics (VOAs).
e - Analyses by EPA method 625, Base/Neutral Acids (BNAs).

Total petroleum hydrocarbons dissolved in groundwater were detected in all wells (see Table 2-2). TPH concentrations ranged from 1.48 ppm in monitoring well MW7 to 26.86 ppm in monitoring well MW1. Groundwater sample MW2-001 showed < 1 ppm TPH, compared to the duplicate sample MW2-101 which revealed 2.79 ppm; therefore, the duplicate sample was utilized in evaluating the extent of the site contamination. TPH concentrations detected in groundwater in the vicinity of Building 81 are depicted in Figure 2-4. The contaminant distribution pattern for TPH appears to be in the immediate vicinity of Building 81. TPH concentrations rapidly diminish radially away from Building 81 as depicted in Figure 2-4.

While TPH was detected in all groundwater samples, it should be noted that 5 of 7 samples were below a concentration of 5 ppm TPH (Figure 2-4). Furthermore, several of the samples with low concentrations (<5ppm) were upgradient of UST 81.1. It is suggested that the organic nature of the subsurface soils may be the contributing factor to these low TPH concentrations. All samples were analyzed for TPH by EPA method 418.1; a method not capable of differentiating between organic compounds.

Groundwater samples from monitoring wells MW1, MW2, MW4, and MW6 were collected for VOC analysis. Benzene and ethylbenzene were detected in well MW1, each at a concentration of 0.004 ppm. Benzene concentrations in groundwater are indicated on Figure 2-5. Chloroform was detected in well MW2 in both sample MW2-001 and the duplicate sample MW2-101 at a concentration of 0.002 ppm. The source of the chloroform has not been determined, however, small concentrations of chloroform is a common laboratory contaminant.

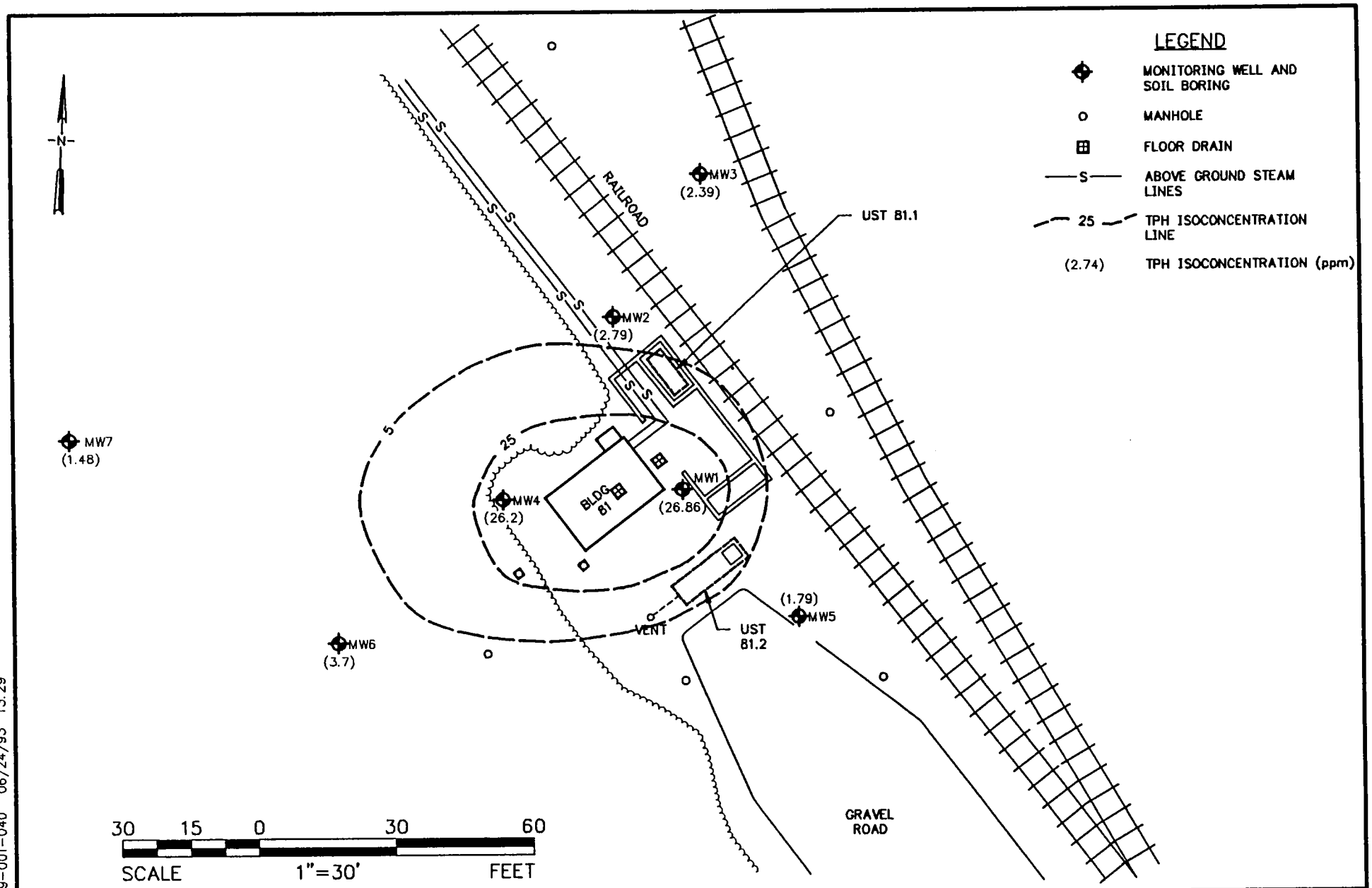
BNA analysis by EPA method 625 was performed on groundwater samples from the same four wells as above. The results of analysis revealed detectable concentrations of fluorene (0.010 ppm), naphthalene (0.016 ppm), and phenanthrene (0.013 ppm) in groundwater from monitoring well MW1. These compounds are polynuclear aromatic hydrocarbons (PAHs) and may be associated with the fuel oil or with storm-water runoff which can pick up oily residues from railroads, asphalt roads, parking lots, telephone poles, etc.

Groundwater samples were also analyzed for total dissolved lead. Concentration of total dissolved lead in all samples analyzed were below detection limits (0.005 ppm). Table 2-3 summarizes the EPA methods 624 and 625 laboratory analysis. Laboratory analytical results are provided in Appendix D.

2.6 SITE ASSESSMENT SUMMARY

The following is a summary based on the results of the Site Assessment:

- Soils in the area consist of 18 to 28 feet of fine-grained sandy to silty clay with lenses of fine-grained silty sand, underlain by a 4 to 16 foot interval of clayey to silty sand with shells. In places, the silty sand is predominantly an indurated shell hash. The shelly silty sand overlies a tight, plastic, silty clay with shells, encountered throughout the site at approximately 38 feet bgs.



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DWG. TITLE TPH IN GROUNDWATER ISOCONCENTRATIONS	FIGURE NO. 2-4	

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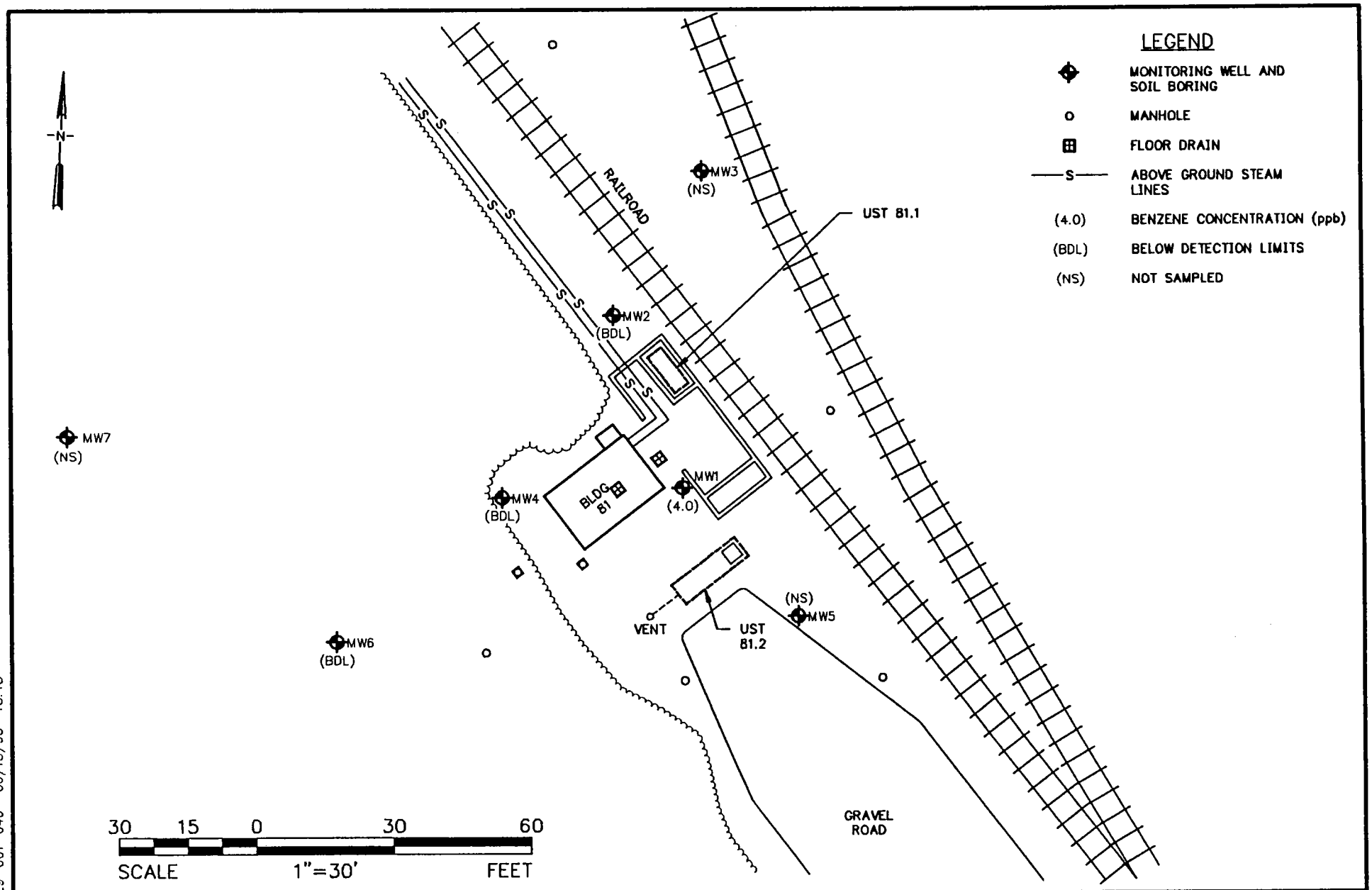

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DWG. TITLE BENZENE IN GROUNDWATER	FIGURE NO. 2-5	

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- Soils with elevated levels of TPH (> 100 ppm) were detected in the immediate vicinity of Building 81 (Figure 1-10), particularly south of the building and to the west near the floor drain outfall. The source of TPH in soils is likely due to a release resulting from overfilling of UST 81.1.

- Ethylbenzene was detected in three soil samples from borings MW1 and BH4. It is likely that this compound is present as a result of petroleum release from UST 81.1

- TPH dissolved in groundwater was detected in the immediate vicinity of Building 81 at concentrations up to 26.86 ppm (MW1). Five of seven wells showed low (<5ppm) concentrations of TPH. The contaminant distribution pattern for TPH shows concentrations rapidly diminishing radially away from Building 81.

- VOCs were detected in groundwater samples from two wells. Benzene and ethylbenzene were detected in MW1 and are likely present as a result of the petroleum release from UST 81.1. Concentrations for all detected VOC compounds were below state and federal water quality standards. Groundwater from MW2 contained chloroform. The source of the chloroform is undetermined, however, it is a common laboratory contaminant.

- Three BNA compounds were detected in samples collected from the site. PAH compounds fluorene, naphthalene, and phenanthrene were detected in groundwater samples from well MW1. Additionally, naphthalene was detected in well MW6. The presence of these compounds may be associated with No. 2 fuel oil or surface runoff from the railroad tracks and Building 81.

- No LPH was observed at the site during SCS.

- Groundwater in the study area generally flows in a northwesterly direction at a velocity ranging from 2 to 57 ft/year. The surficial geology is complex in this region, lithology and thus hydraulic conductivity can vary widely over short distances. The finer lithology found down-gradient may tend to confine and thus reduce the actual flow rate. Even at the maximum rate, groundwater transport is slow enough for natural degradation of contaminants before they would reach the surface water.

2.7 RISK ASSESSMENT SUMMARY

There are limited actual or potential human receptors in the study area. The possible exposure pathways of concern for human exposure may include: ingestion, inhalation (of volatile organics from groundwater and surface water, and particulates), and dermal contact of contaminated soil, groundwater, and surface waters. Contaminated surface waters and sediments would be the likely environmental exposure pathways to aquatic organisms. To date there

have been no reported impacts to sensitive receptors from the subsurface hydrocarbons at the site.

The petroleum hydrocarbon contamination identified at the site in the area occurs primarily below the ground surface and in the vicinity of UST 81.1. The UST rests on a concrete pad 20 feet north of Building 81, enclosed on all sides by a cinder block retaining wall and covered with soil. The surrounding surface area is either paved or grassed; therefore, there is little potential for dispersion due to fugitive dust except during intrusive activities such as construction. Although TPH was detected in all groundwater monitoring wells, no BTEX compounds were detected at levels above the Commonwealth of Virginia surface water standards or federal maximum contaminant levels (MCLs) (see Table 2-4). Present and future use of the groundwater is considered unlikely since drinking water is supplied to NWS Yorktown by municipal pipeline from off-site sources; therefore, no human receptors of contaminated groundwater are expected. There are no potable water supply wells within one-mile of the site.

Advection of dissolved TPH and/or BTEX constituents into a surface water receiver is a potential exposure pathway. The nearest surface water receiver is approximately 500 feet west-northwest of the site. The creek outfalls to Roosevelt Pond 650 feet northwest of the site. Considering the 500 foot distance to the creek, the slow migration rate of groundwater at the site, the slower migration rate of contaminants due to adsorption and degradation, the potential exposure via this pathway is minimal.

Potential concentrations of benzene in groundwater in the immediate vicinity of the nearest potential downgradient receptor were quantified using a three-dimensional computer model. The model used is entitled Analytical Transient One-, Two-, and Three-Dimensional Simulation of Waste Transport in the Aquifer System (AT123D) (Yeh, 1981).

The model was used to evaluate the potential level to which the elevated levels of benzene could impact the nearest potential sensitive receptor (the creek). Based on computer modeling results, impact on sensitive receptors appears unlikely. Using current information, the model predicts that benzene will not migrate a distance of 500 feet from the site. The model predicts that a benzene concentration of 1 parts per billion (ppb) (detectable levels) would not reach a distance of 500 feet even after 50 years. The model used a waste release rate equivalent to 10kg/hr, a very conservative (worst case) concentration, further supporting the conclusion that potential impact is unlikely.

In summary, no human or nonhuman receptors are anticipated to be affected by contamination at this site. Therefore, a quantitative risk evaluation was not performed. From a qualitative perspective, the contaminants identified do not represent or pose a public health risk as there are limited opportunities for exposure to contaminants.

TABLE 2-4

FREQUENCY SUMMARY FOR CHEMICAL COMPOUNDS DETECTED IN GROUNDWATER (ppm)
BUILDING 81

Parameter	State Standards[1]	Federal MCLs[2]	Minimum Detected Concentration	Maximum Detected Concentration	Number Of Samples	Frequency of Detected Values (%)	Number of Detects Greater Than Standards	
							State	Federal
Benzene	0.710	0.005	0.004	0.004	4	25	0	0
Ethylbenzene	29.000	0.700	0.004	0.004	4	25	0	0
Chloroform	4.7	0.1	0.002	0.002	4	25	0	0
Naphthalene	--	--	0.016	0.068	4	50	--	--
Fluorene	14	--	0.010	0.010	4	25	0	--
Phenanthrene	--	--	0.013	0.013	4	25	--	--
TPH	1,000	NA	1.48	26.86	4	100	100	NA

Note: 1) State standards are based on the DEQ surface water standards with general, statewide application.
2) Federal MCLs are based on the U.S. EPA federal Drinking Water Standard.
-- - No standards have been set.
ppm - Parts per million.
NA - Not applicable, no federal standards have been set for groundwater or surface waters other than public water supplies.

2.8 REMEDIATION ASSESSMENT SUMMARY

Results of the risk assessment conducted for this site determined that the subsurface hydrocarbons should not impact potential human or environmental receptors. The surficial contaminated soils, however, pose a potential risk during construction activities. Therefore, based on the results of the site and risk assessments and state guidelines, remediation is recommended to remove the out-of-service UST 81.1 system in accordance with DEQ guidelines and to excavate petroleum-contaminated soils encountered during the tank removal process. Visibly contaminated soils encountered during excavation of UST 81.1 should be removed to the maximum practical extent. Because of the apparent minimal risk to both human and environmental receptors, additional remediation is not recommended. With the removal of UST 81.1 and the soils in its immediate vicinity, natural processes such as degradation and dispersion, will in time reduce the concentration of the contaminants. Projected endpoints for soil and groundwater remediation at the site are the existing site conditions.

Table 2-5 presents demonstrated technologies for soil remediation. Table 2-5 also summarizes the evaluation of each technology based on applicability to the site, implementability, and costs. The soil remediation technologies that are applicable to the site for soils encountered during the excavation of UST 81.1 and for soils that may in the future be excavated are disposal as a solid waste or thermal treatment. Excavation and disposal as a solid waste is applicable because it is economical for small projects. However, disposal of the soils in a permitted landfill may not remove the Navy from future liabilities. Therefore, based on the reduced liability, thermal treatment should be conducted at an approval treatment facility or by using a mobile thermal treatment unit. Although transportation and backfill costs may be saved, permitting and overall costs should be reviewed prior to use of a mobile treatment unit. Additional on-site treatment costs may include post-treatment confirmation sampling. Also, the use of on-site treatment may not remove the Navy from future liabilities related to the treated soils. These options are appropriate for limited areas to reduce contaminants in the areas with the highest TPH concentrations, mainly around UST 81.1, and the floor drain outfall.

In conclusion, UST 81.1 should be taken out of service in accordance with DEQ guidelines. Existing floor drain lines should also be removed. Soils at the site should be directly remediated only in areas where excavation is necessary. Visibly contaminated soils encountered during excavation of UST 81.1 should be removed to the maximum practical extent. The recommended option for the remediation of contaminated soils that are excavated is either transport and treatment at an approved thermal treatment facility or on-site treatment with a mobile thermal treatment unit. Subsequent to soil removal activities, a site monitoring program including liquid-level measurements and groundwater sampling, should be conducted periodically to ensure existing contamination levels have stabilized or have shown reduction overtime.

TABLE 2-5

SOIL REMEDIATION OPTIONS

OPTION	PROCESS	ESTIMATED COSTS	PRACTICAL CONSTRAINTS	REMARKS	APPLICABLE TO SITE (Y/N)
Excavation and disposal as hazardous waste	Excavate and haul to Class I landfill; emplace and compact clean fill	$300/yd^3	Cradle-to-grave liability as waste generator	High cost	N
Excavation and disposal as solid waste (nonhazardous)	Excavate and haul to Class III landfill; backfill with clean fill	$30-80/ton + trans-portation	Location of a suitable landfill	Economical on small projects	Y
Excavation, aeration landfarming, and disposal off-site	Excavate and spread on-site; turn repeatedly to aerate; add nutrients; haul to clean fill disposal site; emplace and compact new clean fill	$50/yd^3	Emission considerations; space considerations	Technically feasible; permitting very difficult under current legislation; requires numerous analytical tests	N
Mechanically enhanced volatilization	Excavate; pass through crusher and aerator; and re-emplace	$250/yd^3	Requires dust control and vapor treatment	High cost, but suitable for specific locations	N
In situ venting (vacuum extraction)	Investigate extent of contamination and soil conditions; design and install venting system; permit system; operate system; reinvestigate to monitor effectiveness	$20-50/yd^3	Fine-grained soils and low volatility of hydrocarbons in soils limit the effectiveness of this method	Not a technically viable option for this site	N
Excavation and low-temperature thermal reduction (LTTR)	Contamination in soil reduced through volatilization by the application of heat	$50/ton + trans-portation	Emissions considerations	Moderate cost, suitable for small projects	Y
Excavation, LTTR and replacement	Excavate pass through mobile rotary kiln, enhancing volatilization by the application of heat ; re-emplace and compact	$30-50/ton	Emission considerations; space considerations; leaves excavation open during treatment	Technically feasible, economical on small projects, permitting required; requires analytical tests	Y
In situ bioremediation or chemical degradation	Investigate extent of contamination and soil and groundwater conditions; conduct feasibility study; design and install pumping and injection system; permit system; operate system; reinvestigate to monitor effectiveness	$75/yd^3	Fine-grained soils limit ability to inject and pump fluids through soils. System could be engineered to be installed and operated around existing facilities; requires ongoing operation and maintenance (O&M) and monitoring. Requires periodic soil sampling and final investigation	Overall effectiveness cannot be assured, pending results of pilot study; requires on-site monitoring	N

Source: Modified from Testa, Stephen M. and Duane L. Winegardner. Restoration of Petroleum-Contaminated Aquifers. Lewis Publishers, inc., Chelsea, MI. 1991.

3.0 CORRECTIVE ACTION APPROACH

The CAP presents a discussion of the corrective action approach selected for remediation at Building 81. The following subsections contain the proposed remediation endpoints, the proposed remedial approach, permitting requirements, site monitoring and reporting, the CAP project schedule, and an estimate of the CAP project costs.

3.1 REMEDIATION ENDPOINTS

Inherent in the CAP are two primary objectives: 1) reduce or eliminate the risk to health and the environment from the on-site contamination; and 2) comply with the DEQ regulations governing USTs, groundwater quality, and site remediation. Selection of the proposed remedial approach has been based not only on the extent of the contamination, technologies available, time and cost considerations, and physical characteristics of the site, but also on the risk evaluation. The proposed remedial approach addresses the contamination source (UST 81.1 and the floor drain lines) to reduce other phases of contamination, thereby reducing the potential threat to the public and the environment in consideration of the current and potential future use of the site.

Because of the apparent minimal risk to both human and environmental receptors, active soil and groundwater remediation is not proposed. Once the source of subsurface contamination is removed, processes including degradation and dispersion, will in time reduce the contaminant concentrations in soil and groundwater. EPA guidelines (1990) include in-place passive remediation as a corrective action option. Therefore, the proposed remedial endpoints for soil (adsorbed-phase) and groundwater (dissolved-phase) at the site are the existing site conditions. However, in order to accurately assess achievement and maintenance of these remedial goals and remediation of the site, numerical remedial endpoints are proposed.

Because No. 2 fuel oil has a low percentage of volatile compounds present, therefore, remediation or monitoring of the vapor- phase is not warranted or appropriate. Remediation endpoints proposed for the site include the following:

- liquid-phase hydrocarbons to less than or equal to 0.01 feet, as measured with an interface probe and observed/confirmed with a bailer;

- adsorbed-phase hydrocarbons to less than or equal to 500 ppm TPH, as quantified with a select soil sample analyzed by modified EPA method 8015; and

- dissolved-phase hydrocarbons to less than or equal to 10 ppm TPH, as quantified with select groundwater samples analyzed by modified EPA method 8015.

3.2 PROPOSED REMEDIAL APPROACH

The proposed remedial approach for the UST system at Building 81 includes several tasks: removal of UST 81.1 and associated piping; removal of any visually contaminated soils in the immediate vicinity of the UST system encountered during excavation activities; and in-place passive remediation of any soils and groundwater remaining which may be contaminated. Figure 3-1 illustrates the limit of excavation in the vicinity of UST 81.1. The visually contaminated soils that are excavated will be treated on-site with a mobile thermal treatment unit. Soils will be cleaned to less than 50 ppm TPH and in accordance with the DEQ Solid Waste Division's guidelines. Treated soils will then be used as clean backfill material for the UST excavation area.

This remedial approach has been selected because no additional backfill material is needed, transportation of the soils will not be required, there is reduced potential liability when compared to landfilling, there are reduced analytical requirements, and the overall project costs are reduced when compared to either landfilling or off-site thermal treatment. Comparing on-site with off-site thermal treatment, the closest competitively priced remedial option, on-site thermal treatment results in a cost savings of approximately $3,500. Cost savings are realized primarily in no transportation or backfill costs.

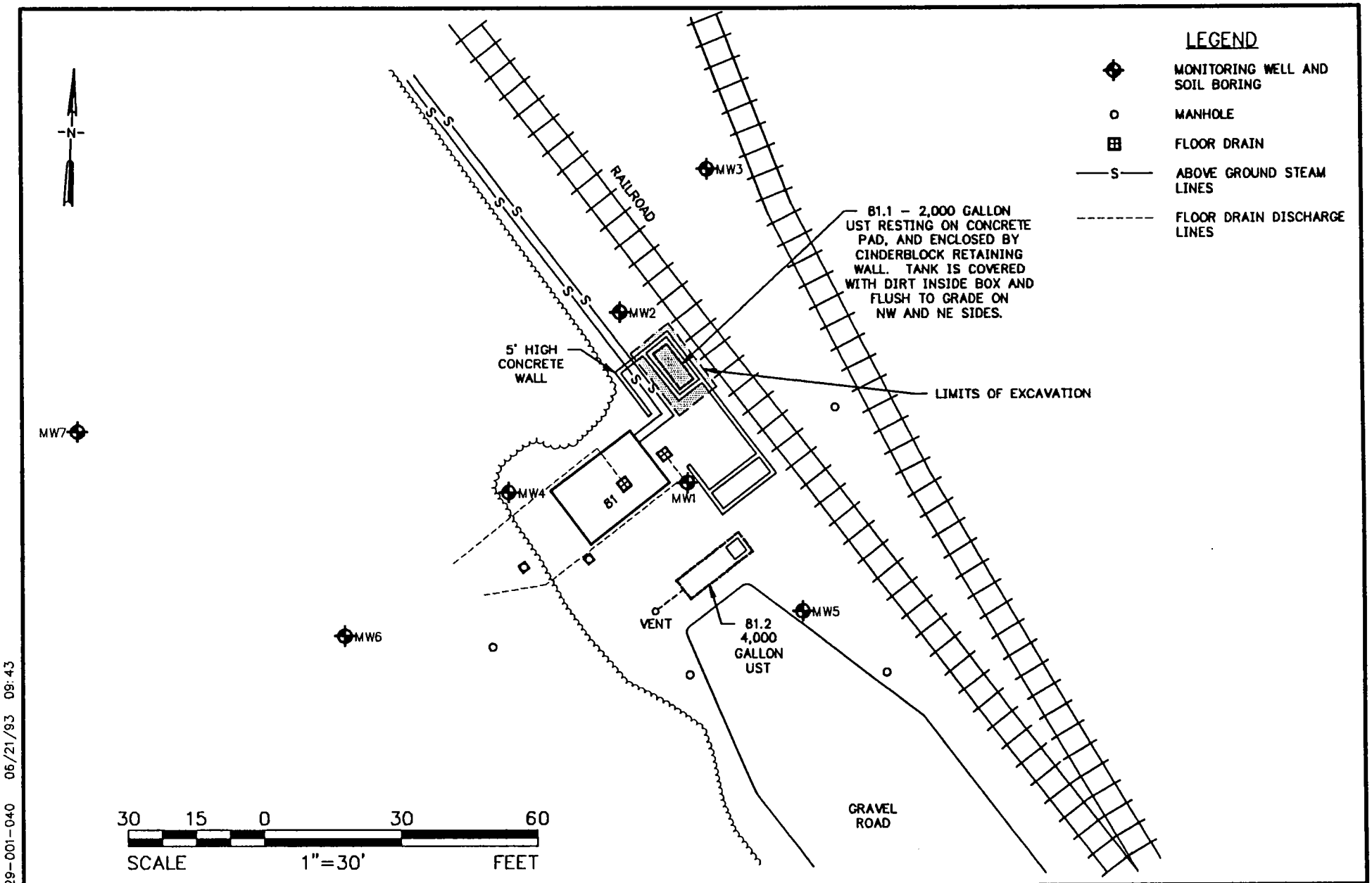
3.3 CAP PERMITTING

3.3.1 General CAP Permit

Remediation systems with a wastestream that includes discharge of treated groundwater to a surface water body require issuance of both a CAP permit and a Virginia Pollution Discharge Elimination System (VPDES) permit. However, the DEQ has recently implemented a General CAP Permit program in order to streamline the remediation process for UST sites. The General CAP Permit not only accords both approval and authorization to proceed with the CAP, but also authorizes an effluent discharge under specific limitations. The permit is site-specific regarding effluent limitations and monitoring requirements according to the type of petroleum product release and the discharge location. Because this CAP does not include the generation of a point-source discharge, effluent monitoring would not be required. Site monitoring requirements for this CAP are similar to those outlined for a diesel release in the General CAP permit.

3.3.2 Activity Construction Permit

As a federal facility NWS Yorktown is exempt from certain municipal permits; however, contractors will be required to coordinate and obtain a final inspection of all construction activities from the activity's utilities construction and inspection division. Any permits for UST removal and excavation activities required from NWS Yorktown will be secured before work commences.



PROJECT TITLE: CORRECTIVE ACTION PLAN UST SYSTEM – BUILDING 81 NAVAL WEAPONS STATION YORKTOWN, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	WESTON
DWG. TITLE LIMIT OF PROPOSED EXCAVATION	FIGURE NO. 3-1	

0140-3-1.dwg 06629-001-040 06/21/93 09:43

3.3.3 Air Discharge Permit

A site-specific air discharge permit will not be required for on-site treatment of the contaminated soils. The mobile thermal treatment unit to be used at the site is permitted to operate in Virginia by the DEQ Air Quality Division. The unit operating permit will be reviewed prior to on-site mobilization to ensure compliance with all applicable DEQ regulations.

3.3.4 Public Notification and Local Government Ordinance Form

For each confirmed release that requires a CAP, the owner/operator is required to notify those members of the public directly affected by the release or the corrective actions. Public notification, often in the form of newspaper notification, is generally exercised by the DEQ when necessary and appropriate. Included within the public notification is the requirement by the DEQ for completion of the Local Government Ordinance Form. The CAP may be considered incomplete without this form. The form is to be signed by an official of responsibility within the local government and confirms that the municipality has been informed of the release and the intent of the operator to implement a CAP.

3.4 CAP IMPLEMENTATION

Implementation of the CAP will commence subsequent to the DEQ approval of the CAP, obtaining all necessary permits, and confirmation of the final CAP approach. Excavation activities will be preceded by several site preparation activities and preparation of a Site Health and Safety Plan (HASP). These tasks are outlined in subsequent portions of this report.

3.4.1 Site Health And Safety Plan

A HASP will be prepared and followed to ensure the health and safety of excavation workers and other personnel in the area. The plan will include an outline of the tasks to be conducted at the site; the associated physical and health hazards of these tasks; the risks to employees's health and safety; the physical and chemical properties of the contaminants at the site; measures to detect their presence; and the standard operating procedures for protection against hazards. Contingency plans for accidents are also provided. The site HASP should be reviewed by all personnel who visit the site and be updated regularly, if needed. Only individuals with appropriate health and safety training and conforming to appropriate health and safety monitoring programs will be allowed in the work area.

3.4.2 Site Preparation

Site preparation activities for removal of the UST system and visually contaminated soils in the immediate vicinity of the UST will include:

- Final System Design and Contractor procurement. It is anticipated that finalizing the system design, procurement of the prime contractor, and procurement of the construction soil disposal contractors will take approximately 6 months.

- All necessary site access requirements will be arranged with the NWS Yorktown.

- All necessary permits will be obtained prior to system installation.

- The location of all potential underground utilities (i.e., water, gas, electric, steam, storm drain, and all subsurface fuel supply lines) will be identified. NWS Yorktown personnel or an approved subcontractor will provide utilities clearance of the excavation areas prior to the initiation of construction activities.

- Restricting access to the work area. Unauthorized access to the area is not a concern; therefore, fencing should not be required. Emergency barriers such as temporary fencing will be used, however, to cordon off the excavation to ensure worker safety.

- The contractor will provide for temporary shoring for Building 81, if necessary. Based on the limited extent of excavation and the location of overhead steam transfer lines, it is not anticipated that shoring will be needed.

3.4.3 Source Removal

Once site preparation activities have been completed, UST 81.1 and its associated piping will be excavated. Along with the UST system, a certain portion of the concrete retaining wall and floor that enclosed the UST will also be demolished. Soils in the immediate vicinity of the UST with visible signs of contamination will be excavated and temporarily stockpiled for treatment in accordance with the DEQ Solid Waste Division's guidelines.

Implementing the corrective action will result in the generation of three items that will require treatment and/or disposal. These include the excavated UST 81.1 and associated piping, concrete rubble, and the contaminated soils. The UST system will be cleaned of any oily residues prior to off-site disposal. The excavated concrete/pavement will be transported off-site to a commercial landfill permitted to accept construction rubble/debris, or if appropriate,

used as general fill material by the Navy. The excavated visually contaminated soils will be treated on-site with the mobile thermal treatment unit. It is estimated that approximately 150 tons of soils may require treatment.

Following soil treatment activities, a composite soil sample will be collected. The soil sample(s) will be submitted to a laboratory for analysis of TPH by modified EPA method 8015. If the composite soil sample(s) results are less than 50 ppm TPH, treated soils will be used as clean backfill for the excavation.

3.5 SITE MONITORING PLAN

The monitoring plan will be in accordance with the monitoring requirements for a General CAP Permit and will include well gauging, soil sampling, and groundwater sampling to ensure that subsurface contaminant concentrations have stabilized or decreased over time. The monitoring plan includes sampling frequency, sample locations, parameters to be analyzed, and a field QA/QC plan. The site schedule includes 6 months of maintenance monitoring and 6 months of post-operative site monitoring. The tasks associated with the monitoring program are outlined below.

3.5.1 Well Gauging

Once excavation activities were completed, all monitoring wells at the site will be gauged with an oil/water interface probe. Product thickness (if any) and water levels will be documented in the field log book. The presence/absence of LPH will be visually confirmed with a bailer. To date, LPH has not been observed at the site and it is not anticipated to be present. Well gauging will be conducted on as quarterly basis for both maintenance and post-operative monitoring.

3.5.2 Groundwater Samples

Groundwater samples will be collected once excavation activities have been completed and then performed on a quarterly basis for both maintenance and post-operative monitoring to document groundwater quality. Groundwater samples will be collected from all monitoring wells at the site and analyzed for TPH by modified EPA method 8015. During the last quarterly groundwater sampling event, one water sample will also be collected from monitoring well MW1 and analyzed for VOAs and BNAs by EPA methods 624 and 625, respectively.

3.5.3 Soil Samples

Confirmation soil samples will be collected once excavation activities are completed. The confirmation soil samples will be collected on all four sides of the excavated area by the grab method at or just above the water table. The

3.6 PROJECT REPORTING

Once excavation and backfilling activities have been completed, a summary report will be forwarded to the DEQ and will include a request for case closure. A summary report will be prepared on a quarterly basis for submittal to the DEQ. The report will be forwarded to the DEQ within one month of receipt of analytical results. Included in the quarterly progress report will be well gauging data and groundwater analytical results.

Maintenance of site remediation endpoints will be evaluated quarterly comparing site monitoring data with previous information. Additional remedial activities will be proposed, as necessary, if site conditions warrant it.

3.7 SITE RESTORATION PLAN

WESTON anticipates site closure to be initiated upon completion of soil excavation activities. Soil sample data collected at the end of excavation activities will be used to illustrate that the soil remedial endpoint has been achieved. Once this remediation goal has been achieved, a 6 months maintenance monitoring program will commence to ensure that remedial goals have been achieved. After 6 months, the Navy will petition the DEQ for closure. Once closure has been granted, a 6-month post-operative monitoring program will commence. The site post-operative monitoring program will include well gauging and groundwater sampling.

Subsequent to completion of the post-operative monitoring program and receipt of case closure notification from DEQ, site restoration will be completed by abandoning all wells in accordance with DEQ guidelines.

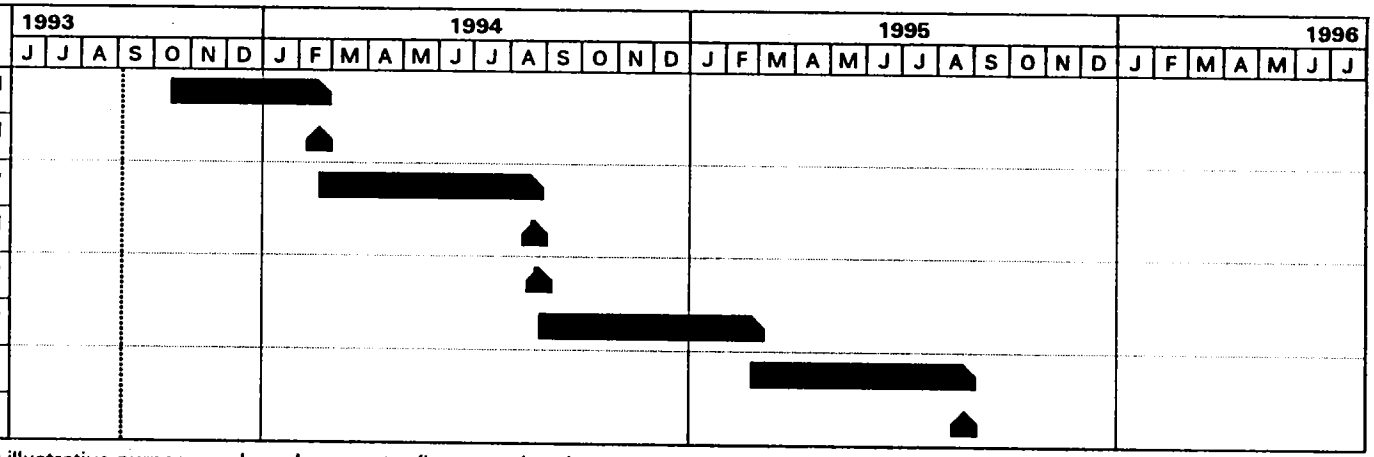
3.8 REMEDIATION SCHEDULE

The project remediation schedule associated with this CAP is presented on Table 3-1. As shown on this table, it is estimated that approximately 3 months will be required to complete the activities associated with obtaining all necessary permits. In addition, approximately 6 months will be needed to finalize CAP design and specifications, and to select and procure the prime contractor. Subsequent to CAP permitting, site preparation, contractor selection and procurement, UST system removal and excavation activities will commence. It is estimated that removal of the UST system and any visually contaminated soils encountered in its immediate vicinity will take approximately two weeks. Subsequent to soil excavation and backfilling activities, a 6-month maintenance monitoring program will commence. After six months, the Navy will petition the DEQ for case closure. A 6-month post-operational monitoring program will be implemented in order to document that remedial goals have been achieved. It should be noted that this project lifetime estimate is a first-order approximation.

TABLE 3-1

ANTICIPATED CAP SCHEDULE

ID	Name	Duration
1	CAP Approval	90d
2	CAP Authorization	1d
3	Final Design & Contractor Procu	26w
4	UST & Soil Excavation	2d
5	Soil Treatment & Backfill	1w
6	Maintenance Monitoring	26w
7	Post-operative Monitoring	26w
8	Site Closure	1d



Note: Project startup date selected for illustrative purposes only and may not reflect actual project startup date.

3.9 ESTIMATED PROJECT COSTS

Confirmation of final CAP approach, contractor procurement, preparation of bid specification drawings, and project oversight is estimated to be approximately $15,000. Removal of the UST system, floor drain lines, and excavation and backfilling of the contaminated soils is estimated to be $10,000 and includes equipment rental, labor, and disposal of the UST, piping, and rubble. The estimated cost for on-site thermal treatment of the soils is $6,000.

Site monitoring and project reporting is estimated to be approximately $20,000. Site restoration is estimated to be $3,000. The total current estimated project costs are approximately $54,000, including UST closure, soil treatment, and one year of post-operational monitoring. The current estimated project costs are summarized as follows:

Design, Bid, and Construction Oversite	$15,000
UST Removal, Excavation, Backfilling	10,000
On-Site Soil Thermal Treatment	6,000
Site Monitoring and Reporting	20,000
Site Restoration	3,000
Current Estimated Project Cost	$ 54,000

3.10 CAP SUMMARY

This CAP addresses the removal of UST system 81.1 and any visually contaminated soils in its immediate vicinity and the adjacent concrete pad. Soils that are excavated will be treated on-site with a mobile thermal treatment unit prior to replacement as clean backfill. Proposed remedial endpoints are less than or equal to 0.01 feet LPH, 500 ppm TPH in soils, and 10 ppm TPH in groundwater. Subsequent to completion of excavation activities, a 6-month maintenance and a 6-month post-operative monitoring program will be conducted in accordance with the General CAP Permit requirements to ensure that remedial goals have been achieved. The total current estimated project costs are approximately $54,000. The DEQ CAP summary worksheet is provided in Table 3-2.

TABLE 3-2 CAP SUMMARY WORKSHEET

PHASE OF CONTAMINATION	PROPOSED CLEANUP ENDPOINTS	PROPOSED MONITORING TO ACHIEVE ENDPOINTS					SYSTEM SHUTDOWN	PROPOSED POST OPER. MONITORING		CLOSE SITE OR REACTIVATE SYSTEM
		SAMPLING LOCATION	SAMPLING FREQUENCY & TYPE	METHOD OF ANALYSIS	SCHEDULE TO ACHIEVE ENDPOINTS	SCHEDULE TO MAINTAIN ENDPOINTS		SAMPLING FREQUENCY & TYPE	POST OPER. MONITORING SCHEDULE	
FREE PRODUCT	≤0.01 feet	MW-2 through MW-7 and PMW-1	Quarterly, I. Probe and bailer	Interface Probe and Bailer	N/A	6 months		Quarterly, I. Probe and bailer	6 month	
DISSOLVED PRODUCT IN GW TPH	≤10 ppm	MW-2 through MW-7 and PMW-1	Quarterly, Grab	TPH by modified EPA method 8015	N/A	6 months		Quarterly, Grab	6 month	
RESIDUAL PRODUCT IN SOILS TPH	≤1,000 ppm	Four (4) samples in Grass Area Adjacent to side of Excavation	Once, Grab	TPH by modified EPA method 8015	N/A	6 months		N/A	N/A	
VAPOR PRODUCT EXTRACTED FROM SOILS	Not Applicable N/A	N/A								

For SWCB Use: Comments:

APPENDIX A

CORRECTIVE ACTION PLAN CHECKLIST

CORRECTIVE ACTION PLAN CHECKLIST

Site: Building 81 PC# 93-594 Region TRO

The following checklist must be filled out by the Responsible Party and/or his Consultant and included in the Corrective Action Plan. **Indicated on the checklist the page and section number where each item is addressed in the attached plan.** Also indicate on the checklist the section and page number where justification is given for items omitted from the attached plan. The contents of the report should reflect and be commensurate with the nature of the release, degree of contamination and complexity of the site investigation.

A copy of the Initial Abatement Measures Report and Site Characterization Report must be attached to or included in the Corrective Action Plan.

Items marked with an * are required as part of the CAP Permit Application.

1. CORRECTIVE ACTION PLAN

PAGE / SECTION

N/A /___ Cleanup measures conducted under Interim Authorization

23 /3.2 * Block diagram, conceptual design, and narrative description of all proposed remediation systems (sketches, locations, design calculations, etc.)

- NA /NA * Maximum hours / day of operation
- NA /NA * Average hours / day of operation
- NA /NA * Days / week of operation

21 /3.1 Numerical remediation endpoints for all applicable phases (eg. TPH, BTEX, lead and other appropriate pollutants)

- 21 /3.1 Free product
- 21 /3.1 Dissolved
- 21 /3.1 Residual
- NA /3.1 Vapor
- NA /NA System effluent

NA /NA Operational monitoring schedule

- NA /NA Parameters
- NA /NA Frequency
- NA /NA Locations
- NA /NA Methods (media, detection limits, units of measure)

21 /3.10 Achievement of endpoints as evidenced by maintenance of values (numerical endpoints) over time

- 32 /3.10 Parameters
- 32 /3.10 Duration (period of time)
- 32 /3.10 Locations
- 32 /3.10 Methods (media, detection limits, units of measure)

NA /NA Proposed system shutdown schedule

Site: Building 81

26 /3.5 Post-operational monitoring schedule
- 26 /3.5 Parameters
- 26 /3.5 Frequency
- 26 /3.5 Locations
- 26 /3.5 Methods (media, detection limits, units of measure)

28 /3.6 Resumption of cleanup/site closure (CAP modification if necessary)

28 /3.6 Reporting schedule (compliance monitoring and annual reports)

25 /3.4.3 * Disposal/treatment of contaminated material (soils, free product, filter media, etc.)

NA /NA Submittal schedule for free product removal reports

24 /3.3.4 * Proposed actions to notify persons affected by CAP

22 /3.3 * Proposed actions to obtain all applicable Federal, State, and local permits or approvals (DWM, VAPCB, VDH, EPA, UIC etc.)

FOR OFFICE USE ONLY

COMMENTS: _____

DEFICIENCIES: _____

REVIEWED BY: _____ DATE: _____

APPENDIX B

WESTON BOREHOLE LOGS

Borehole Log

ROY F. WESTON, Inc.

CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	34.00
SITE NAME :	CTO-161 / BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	BH-1	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID RIG
EASTING :	0.0000 estimated	DATE STARTED :	01/06/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/06/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Interval Not Sampled						
-2	2									
-4	4		100	Silt, ML	YELLOW RED	STF	DMP	7 7 10 10	OVM 0.0	Finer sand above w/less silt & more clay. Top 0-6" is RR gravel. Bottom more sandy w/less clay.
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Lean clay, CL	LT GRAY	STF	DMP	8 9 11 13	OVM 0.5	Mottling throughout reddish brown mostly in upper half & more red and grey in lower. No odor.
-12	12			Interval Not Sampled						
-14	14		100	Silt, ML	LT GREY	FRM	DMP	7 7 9 11	OVM 0.0	Interbedded silty clay and clayey silt, silty portions are soft and nonplastic.
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML	YELLOW RED	FRM	MST	5 5 7 7		
-22	22			Interval Not Sampled						
-24	24		100	Silty sand, SM		SFT	MST	8 9 10 10	OVM 0.0	
-26	26			Interval Not Sampled						
-28	28									
-30	30		100	Silty sand with gravel, SM	LT GREY	LSE	WET	5 7 10 9	OVM 0.0	Shells are white.
				Interval Not Sampled						
-32	32		100	Sandy silt, ML	REDDISH YELLOW	SFT	WET	7 8 10 7	OVM 0.0	Saturated below 33.3' in shelly silt with very little quartz sand. Boring terminated -34'.
-34	34									
-36	36									
-38	38									
-40	40									

Borehole Log

ROY F. WESTON, Inc.

CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	32.00
SITE NAME :	BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	BH-2	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID
EASTING :	0.0000 estimated	DATE STARTED :	01/08/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/08/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Interval Not Sampled						0-2' - fill material.
-2	2									
-4	4			Silt, ML	RED YELLOW	SFT	MST	7 14 13 10	OVM 0.0	
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Lean clay, CL	LT GREY	STF	DMP	8 12 15 15	OVM 18.0	Slight petroleum odor. Yellow brown and red mottling.
-12	12			Interval Not Sampled						
-14	14		100	Lean clay, CL	LT BROWN RED	FRM	MST	5 6 9 10	OVM 66.0	Becomes more silty below 15.6' and odor increases.
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML		SFT	WET	5 6 5 6	OVM 35.0	Sticky and gooey like mud partly due to rain.
-22	22			Interval Not Sampled						
-24	24			Silt, ML		SFT	MST	2 3 4	OVM 25.0	Iron stained silty deposits in lenses.
-26	26			Silty sand, SM	GREENISH GREY	LSE	MST	4	OVM 5.0	Very slight odor.
				Interval Not Sampled						
-28	28									
-30	30		100	Silty sand with gravel, SM	STRONG BROWN	LSE	WET	6 3 4 4	OVM 9.0	Saturated at 31.6'. Boring terminated 32'.
-32	32									
-34	34									
-36	36									
-38	38									
-40	40									

Borehole Log

ROY F. WESTON, Inc.

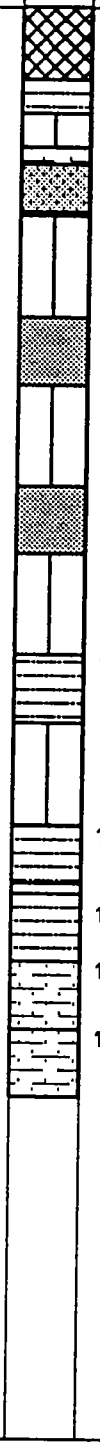
CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	31.00
SITE NAME :	BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	BH-3	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID
EASTING :	0.0000 estimated	DATE STARTED :	01/11/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/11/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silt with sand, ML	LT YELLOW BRN	SFT	MST	2 3 3 4	OVM 0.0	Black organic matter and ash present from 1-2'; slight methane odor.
-2	2			Interval Not Sampled						
-4	4		100	Sandy silt, ML	LT YELLOW RED	SFT	MST	3 4 4 6 7	OVM 0.0	Generally coarsens down from silt with little fine sand and some clay to med. sand w/some silt.
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Lean clay, CL	LT GREY	STF	DMP	8 8 11 12	OVM 0.0	Spoon broke off in hole. Redrilled hole 1.5' S 105 deg. Clay tight & cohesive w/lenses of silty clay.
-12	12			Interval Not Sampled						
-14	14			Silt, ML		STF	DMP	4 5 5 9	OVM 101.0	Petroleum odor and OVM readings increase with depth, interbedded silty and clayey layers.
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML		SFT	MST	3 4 4 4		OVM - lamp not working. Petroleum odor is noticeable but less prevalent than previous sample.
-22	22			Interval Not Sampled						
-24	24		100	Silt, ML	BROWNISH GREY	SFT	MST	3 5 6		Iron staining in horizontal bands indicative of water table fluctuations.
-26	26			Silty sand with gravel, SM		LSE	MST	8		Slight petroleum odor; very shelly.
-28	28			Interval Not Sampled						
-30	30		100	Well graded sand with silt and gravel, SW-SM		LSE	MST	9 14 14 14		Moist to 30.2'; wet to 31'; tip of spoon saturated. Slight to mod. pet. odor. Boring ended -31'.
-32	32									
-34	34									
-36	36									
-38	38									
-40	40									

Borehole Log

ROY F. WESTON, Inc.

CLIENT : BAKER/ YORKTOWN		TOTAL DEPTH : 32.00	
SITE NAME : BUILDING 81		LOGGER : J.H. GHENT	
WELL ID : BH-4		DRILLING COMPANY : FISHBURNE	
NORTHING : 0.0000 estimated		DRILLING RIG : CME 55 SKID	
EASTING : 0.0000 estimated		DATE STARTED : 01/11/93	
ELEVATION : 0.000 estimated		DATE COMPLETED : 01/11/93	



ELEVATION	DEPTH	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
		100	Fill	GREY	LSE	DMP	2 2 3 4	OVM 0.0	Black ash, roots, concrete and gravel fill mixed in.
-2	2	100	Silt, ML	DK GREY BROWN	LSE	MST		OVM 0.0	Black ash mixed in.
			Interval Not Sampled					OVM 0.0	
-4	4	100	Sandy silt, ML	YELLOW BROWN	SFT	MST	4	OVM 0.0	
			Clayey sand, SC	BROWN GREY	LSE	DMP	6 8 9	OVM 0.0	
-6	6		Lean clay, CL	LT GREY	STF	DMP		OVM 0.0	
			Interval Not Sampled						
-8	8								
-10	10	100	Lean clay, CL	LT GREY	STF	DMP	6 9 12 15	OVM 5.2	Heavily mottled red and yellowish red. Slight petroleum odor noticeable
-12	12		Interval Not Sampled						
-14	14	100	Lean clay, CL	LT GREY	SFT	DMP	4 7 7 12	OVM 32.0	MOttled red and brownish yellow. Slight petroleum odor. Silty lenses horizontal, like varves.
-16	16		Interval Not Sampled						
-18	18								
-20	20	100	Silt, ML	RED	SFT	DMP	4 4 6 6	OVM 4.0	Mica and ~5% mafics present with very slight petroleum odor.
-22	22		Interval Not Sampled						
-24	24	100	Silt, ML	BROWNISH-RED	SFT	DMP	3	OVM 5.0	
-26	26		Silt, ML	GREENISH GREY	SFT	DMP	2	OVM 15.0	
		100	Silt, ML		SFT	DMP	4 6 8 9	OVM 97.0	15% mafics with some mica present; glacuonitic.
-28	28	100	Sandy silt, ML	GREEN	SFT	MST	4 4 4 4	OVM 126.0	Glauconitic shelly sand with ~10% fine quartz sand and trace of mafic minerals. Mod. pet. odor. Wet at 31.5'. Boring terminated at 32'. 30% shells, 10% fine sand.
-30	30	100	Sandy silt, ML	GREEN	SFT	MST	5 2 1 3 2	OVM 95.0	
-32	32								
-34	34								
-36	36								
-38	38								
-40	40								

Borehole Log

ROY F. WESTON, Inc.

CLIENT : BAKER/ YORKTOWN		TOTAL DEPTH : 39.00	
SITE NAME : BUILDING 81		LOGGER : J.H. GHENT	
WELL ID : MW-1		DRILLING COMPANY : FISHBURNE	
NORTHING : 0.0000 estimated		DRILLING RIG : CME 55 SKID	
EASTING : 0.0000 estimated		DATE STARTED : 01/04/93	
ELEVATION : 0.000 estimated		DATE COMPLETED : 01/05/93	

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			100	Organic soil with sand, OL/OH	BLACK & BROWN	LSE	MST	4 1 2	OVM 0.0	
-2	2		100	No Sample Recovered				1 1 0		Hollow void, just below drain lines.
-4	4		100	Sandy silt, ML		SFT	DMP	0 0 6	OVM 109.0	
				Lean clay, CL	YELLOW RED	FRM	DMP	6 6 6	OVM 8.7	
-6	6		100	Sandy silt with gravel, ML	GREY	SFT	WET	6 4 4	OVM 35.0	
				Lean clay, CL	BROWN	FRM	MST	5 8 4	OVM 0.0	
-8	8		100	Lean Clay, CL	YEL BRN	SFT	MST	4 6 6	OVM 8.5	
				Lean clay, CL		STF	DMP	8 6 8	OVM 8.5	
-10	10		100	Lean clay, CL		FRM	DMP	8 6 7		
-12	12		100	Silt, ML	YELLOW RED	FRM	DMP	6 9 9	OVM 75.0	
-14	14		100	Organic soil with sand and clay	YELLOW BROWN	FRM	MST	9 3 5	OVM 138.0	Moderate odor in sandy lenses and pockets, like stale fuel.
-16	16		100	Silt, ML		FRM	DMP	5 6 7	OVM 151.0	
-18	18		100	Lean clay, CL	LT BROWN GREY	FRM	DMP	8 3 4	OVM 102.0	
				Sandy silt, ML	LT GREY GREEN	SFT	MST	4 4 4	OVM 158.0	Glauconitic moderate petroleum odor, 5 GY 6/1.
-20	20		100	Sandy silt, ML	REDDISH BROWN	SFT	MST	3 3 2	OVM 134.0	Mottled greenish grey, black, and red.
-22	22		100	Silt with sand, ML		LSE	MST	5 2 4		OVM 59/144 units in bottom tip.
-24	24		100	Sandy silt, ML	DK GREEN GREY	LSE	MST	4 5 5	OVM 137.0	Shell hash includes bivalved species.
				Well-graded gravel with silt, GW-GM	LT BRN GRY	LSE	MST	5 6 7	OVM 121.0	
-26	26		100	Silty gravel, GM	LT BROWN GREY	LSE	MST	7 8 9	OVM 106.0	
-28	28		100	Silty sand with gravel, SM		LSE	MST	8 3 4	OVM 135.0	
-30	30		100	Silty sand with gravel, SM	LT BROWN GREY	LSE	WET	4 3 4	OVM 48.0	Wet at 31.3' bgs. Lithology same as previous sample.
-32	32		100	Silty sand with gravel, SM		SFT	WET	3 4 8	OVM 141.0	Petroleum odor/OVM readings diminish with depth. Shell has fines downward to mostly finer material.
-34	34		100	Well graded sand with silt and gravel, SW-SM	GREY	LSE	SAT	10 8 5	OVM 61.0	Shell hash with fine grey sand; OVM readings decrease with depth.
-36	36		100	Well graded sand with silt and gravel, SW-SM	YELLOW BROWN	LSE	SAT	1 2 3	OVM 175.0	Mod. petroleum odor and slight sheen. Some green glauconitic sand w/abundant mafics, ~10% of sand (10 YR 6/8); clay content increases with depth.
-38	38		100	Silty gravel, GM	BROWN YELLOW	LSE	WET	1 3 4	OVM 5.0	
				Lean clay, CL	BLUE GREY	SFT	MST	4 4 2	OVM 0.0	
-40	40									

Borehole Log

ROY F. WESTON, Inc.

CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	46.00
SITE NAME :	BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	MW-2	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID
EASTING :	0.0000 estimated	DATE STARTED :	01/05/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/06/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			100	Silty sand, SM		SFT	DMP	1 2 4 4	OVM 0.0	Slightly more clayey with depth of spoon.
-2	2			Interval Not Sampled						
-4	4		100	Clayey sand, SC	RED BROWN	LSE	DMP	3 2 8 8	OVM 13.0	More clay content toward bottom with occassional fine pebbles.
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Silty sand, SM	RED BROWN	FRM	MST	4 7 7 11	OVM 0.0	Mottling in lower portion Sand faction fines downward - small pebbles are present throughout.
-12	12			Interval Not Sampled						
-14	14		100	Lean clay, CL	YELLOW BROWN	STF	DMP	3 5 8 8	OVM 5.0	V. slight pet. odor in heavily mottled red pocket at 14.2' 10 R 4/8 and lt. grey mottled 5 Y 7/2.
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML	LT BROWN	STF	DMP	3 5 5 6	OVM 80.0	Precipitated iron deposits in clay are hard and granular.
-22	22			Interval Not Sampled						
-24	24		100	Silty sand, SM	YELLOW RED	SFT	MST	3 4 4 4	OVM 4.0	Pocket of calcareous sand quartz and shells crushed at 24.5'.
-26	26			Interval Not Sampled						
-28	28									
-30	30		100	Silt, ML	LT RED BROWN	SFT	MST	2 2 1 2	OVM 19.0	
-32	32			Interval Not Sampled						
-34	34		50	Silt with sand, ML	LT OLIVE BROWN	SFT	WET	3 1 2 1	OVM 26.0	Dark mafic minerals are present ~5%.
-36	36			Not Classified - Incomplete Data						
-38	38									
-40	40			Interval Not Sampled	LT GREY BROWN	SFT	MST	1 0 0 0	OVM 1.0	Sat. at 40.5' in fine shelly silty sand, DK blk mineral deposits 39-40.5' mixed w/clay, moist-wet.

Borehole Log **ROY F. WESTON, Inc.**

CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	46.00
SITE NAME :	BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	MW-2	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID
EASTING :	0.0000 estimated	DATE STARTED :	01/05/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/06/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Interval Not Sampled	LT GREY BROWN	SFT	MST		OVM 1.0	Sat. at 40.5' in fine shelly silty sand, Dk blk mineral deposits 39-40.5' mixed w/clay, moist-wet.
-42	42			Interval Not Sampled						
-44	44		75	Silty sand with gravel, SM	YELLOW BROWN	SFT	SAT	4 6 8 8	OVM 0.0	White shells and shell hash in silty clay matrix
-46	46									
-48	48									
-50	50									
-52	52									
-54	54									
-56	56									
-58	58									
-60	60									
-62	62									
-64	64									
-66	66									
-68	68									
-70	70									
-72	72									
-74	74									
-76	76									
-78	78									
-80	80									

Borehole Log

ROY F. WESTON, Inc.

CLIENT : BAKER/ YORKTOWN		TOTAL DEPTH	: 41.00
SITE NAME : BUILDING 81		LOGGER	: J.H. GHENT
WELL ID : MW-3		DRILLING COMPANY	: FISHBURNE
NORTHING : 0.0000 estimated		DRILLING RIG	: CME 55 SKID
EASTING : 0.0000 estimated		DATE STARTED	: 01/06/93
ELEVATION : 0.000 estimated		DATE COMPLETED	: 01/07/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			100	Other	RED YELLOW BRN	SFT	DMP	4 3 3 4	OVM 0.0	Presence of pebbles diminishes with depth.
-2	2			Interval Not Sampled						
-4	4		100	Silt with sand, ML		LSE	DMP	3 5 7 7	OVM 0.0	
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Lean clay, CL	YEL BRN/LT GRY	STF	DMP	4 6 9 9	OVM 0.0	Heavily mottled with red and yellowish brown, very similar to BH-1.
-12	12			Interval Not Sampled						
-14	14		100	Lean clay, CL	REDDISH YELLOW	FRM	DMP	4 7 7 10	OVM 1.0	
				Silty sand, SM	LT YELLOW GREY	SFT	MST		OVM 0.0	
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML		SFT	MST	2 3 3 4	OVM 0.0	Sharp contact at 21' with mottled iron stained silty clay.
-22	22			Interval Not Sampled						
-24	24		10	Well-graded gravel, GW	BLACK/WHITE	NA	DMP	3 5 7 10	OVM 0.0	Black maganese? deposit very hard 2" diameter clogged spoon. Some shell hash with silt in tip.
				No Sample Recovered						
-26	26			Interval Not Sampled						
-28	28									
-30	30		100	Silty sand with gravel, SM	LT RED YELLOW	SFT	MST	11 12 7 8	OVM 0.0	
-32	32			Interval Not Sampled						
-34	34		100	Silty sand with gravel, SM	LT GREY	SFT	SAT	4 7 10 11	OVM 0.0	
-36	36			Interval Not Sampled						
-38	38									
-40	40		100	Silty sand, SM	REDDISH YELLOW	LSE	SAT	7 11 10 9	OVM 0.0	Some quartz sand ~10-15% mixed in with predominantly shell has material.

Borehole Log **ROY F. WESTON, Inc.**

CLIENT	: BAKER/ YORKTOWN	TOTAL DEPTH	: 41.00
SITE NAME	: BUILDING 81	LOGGER	: J.H. GHENT
WELL ID	: MW-3	DRILLING COMPANY	: FISHBURNE
NORTHING	: 0.0000 estimated	DRILLING RIG	: CME 55 SKID
EASTING	: 0.0000 estimated	DATE STARTED	: 01/06/93
ELEVATION	: 0.000 estimated	DATE COMPLETED	: 01/07/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	REDDISH YELLOW	LSE	SAT		OVM 0.0	Some quartz sand ~10-15% mixed in with predominantly shell has material.
-42	42									
-44	44									
-46	46									
-48	48									
-50	50									
-52	52									
-54	54									
-56	56									
-58	58									
-60	60									
-62	62									
-64	64									
-66	66									
-68	68									
-70	70									
-72	72									
-74	74									
-76	76									
-78	78									
-80	80									

Borehole Log — *ROY F. WESTON, Inc.*

CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	36.00
SITE NAME :	BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	MW-4	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID
EASTING :	0.0000 estimated	DATE STARTED :	01/07/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/07/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			75	Silty sand, SM	LT BROWN GREY	LSE	MST	3 7	OVM 0.0	~1' of loam and concrete pushed aside to place rig
-2	2			Silt with sand, ML	LT YELLOW RED	SFT	MST	9 10	OVM 0.0	fill ends at top of this layer.
				Interval Not Sampled						
-4	4		100	Sandy silt, ML	LT YELLOW RED	SFT	MST	3 5 5 6	OVM 0.0	
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Lean clay, CL	LT GREY	SFT	MST	4 7 7 8	OVM 3.0	Sl. petrol. odor towards spoon bottom, clay content inc. to ~8-½ and becomes tight & mod. plast.
-12	12			Interval Not Sampled						
-14	14		100	Sandy silt, ML	REDDISH YELLOW	LSE	DMP	5 5 4 6	OVM 25.0	Interbedded lenses of very fine sand and nearly pure silt.
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML		SFT	MST	4 5 5 7	OVM 14.0	Slight petroleum odor. A few small shell fragments near bottom at 21'.
-22	22			Interval Not Sampled						
-24	24		100	Silty sand, SM	GREENISH GREY	SFT	MST	5 7 8 7	OVM 0.5	Shelly zone started at 21'.
-26	26			Interval Not Sampled						
-28	28									
-30	30			Silty sand, SM			MST	6 6 8 8	OVM 35.0	Becomes wet at 30.5' and odor diminishes below here.
-32	32			Interval Not Sampled						
-34	34		100	Silty sand, SM	LT YELLOW GREY	LSE	SAT	4 4 5 6	OVM 3.0	Saturated zone w/horizontal iron bands indicative of water table fluctuations. Boring ends ~36'.
-36	36									
-38	38									
-40	40									

Borehole Log **ROY F. WESTON, Inc.**

CLIENT : BAKER/ YORKTOWN		TOTAL DEPTH	: 41.00
SITE NAME : BUILDING 81		LOGGER	: J.H. GHENT
WELL ID : MW-5		DRILLING COMPANY	: FISHBURNE
NORTHING : 0.0000 estimated		DRILLING RIG	: CME 55 SKID
EASTING : 0.0000 estimated		DATE STARTED	: 01/11/93
ELEVATION : 0.000 estimated		DATE COMPLETED	: 01/12/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Interval Not Sampled						
-2	2									
-4	4		100	Fill	LT YELLOW RED	LSE	DMP	4 10 10 9	OVM 4.0	5 YR 5/8. Black ash/ organics in upper 0.5' of spoon. Clay content increases with depth.
-6	6			Interval Not Sampled						
-8	8									
-10	10		100	Other	LT GREY	STF	DMP	4 7 9 11	OVM 0.0	Mottled red yellow 7-5 YR 5/8.
-12	12			Interval Not Sampled						
-14	14		100	Other		FRM	DMP	4 4 6 8	OVM 0.5	Silty varves inter-laminated in tight clay.
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silt, ML	BROWN	SFT	MST	2 4 4 3	OVM 3.5	Light tannish brown to strong brown 7.5 YR 5/8. Slight odor.
-22	22			Interval Not Sampled						
-24	24		100	Silt, ML	STRONG BROWN	SFT	MST	3 4 2 3	OVM 3.0	
-26	26			Interval Not Sampled						
-28	28									
-30	30		100	Silty sand with gravel, SM	LT GREY	LSE	MST	4 4 5 6	OVM 0.0	
-32	32			Interval Not Sampled						
-34	34		100	Silty sand with gravel, SM		LSE	MST	3 3 4 6	OVM 0.5	At 35.3' bed of 70% silt, 30% hash. At 35.7' same but saturated.
-36	36			Interval Not Sampled						
-38	38									
-40	40		100	Silty sand, SM	GREY	SFT	SAT	3 3 1 2	OVM 0.0	Boring terminated at 41'. Some black deposits like manganese at 40'.

Borehole Log **ROY F. WESTON, Inc.**

CLIENT :	BAKER/ YORKTOWN	TOTAL DEPTH :	41.00
SITE NAME :	BUILDING 81	LOGGER :	J.H. GHENT
WELL ID :	MW-5	DRILLING COMPANY :	FISHBURNE
NORTHING :	0.0000 estimated	DRILLING RIG :	CME 55 SKID
EASTING :	0.0000 estimated	DATE STARTED :	01/11/93
ELEVATION :	0.000 estimated	DATE COMPLETED :	01/12/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	GREY	SFT	SAT		OVM 0.0	Boring terminated at 41'. Some black deposits like manganese at 40'.
-42	42									
-44	44									
-46	46									
-48	48									
-50	50									
-52	52									
-54	54									
-56	56									
-58	58									
-60	60									
-62	62									
-64	64									
-66	66									
-68	68									
-70	70									
-72	72									
-74	74									
-76	76									
-78	78									
-80	80									

Borehole Log

ROY F. WESTON, Inc.

CLIENT : BAKER/ YORKTOWN		TOTAL DEPTH	: 21.00
SITE NAME : BUILDING 81		LOGGER	: J.H. GHENT
WELL ID : MW-6		DRILLING COMPANY	: FISHBURNE
NORTHING : 0.0000 estimated		DRILLING RIG	: CME 55 SKID
EASTING : 0.0000 estimated		DATE STARTED	: 01/12/93
ELEVATION : 0.000 estimated		DATE COMPLETED	: 01/12/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			100	Other	GREY/BLACK	LSE	DMP	1 1	OVM 18.0	Moderate petroleum odor like solvents; some roots present.
-2	2			Silty sand, SM		LSE	DMP	2 1	OVM 18.0	
				Interval Not Sampled						
-4	4		100	Silt, ML		SFT	DMP	3 4 4 5	OVM 49.0	Some roots present.
-6	6			Interval Not Sampled						
-8	8									
-10	10			Silt, ML	BROWN YELLOW	SFT	DMP	3 4 5 4	OVM 84.0	
				Silty sand with gravel, SM	GREEN	LSE	MST		OVM 84.0	Strong petroleum odor.
-12	12			Interval Not Sampled						
-14	14		100	Silty sand with gravel, SM	red brown	LSE	WET	3 4 6 8	OVM 143.0	
-16	16			Interval Not Sampled						
-18	18									
-20	20		100	Silty sand with gravel, SM	red brown	LSE	WET	8 9 8 8	OVM 133.0	
-22	22									
-24	24		100	Well graded sand with silt and gravel, SW-SM		LSE	WET	5 5 6	OVM 19.0	
-26	26			Sandy silt with gravel, ML	OLIVE GREEN	STF	SAT	5	OVM 19.0	
-28	28			Sandy silt with gravel, ML	BROWN	FRM	MST	4 4	OVM 69.0	
				Lean clay, CL	BLUE GREY GLEY	FRM	WET	3 4	OVM 14.0	
-30	30									
-32	32									
-34	34									
-36	36									
-38	38									
-40	40									

Borehole Log

ROY F. WESTON, Inc.

CLIENT	: BAKER/ YORKTOWN	TOTAL DEPTH	: 26.00
SITE NAME	: BUILDING 81	LOGGER	: J.H. GHENT
WELL ID	: MW-7	DRILLING COMPANY	: FISHBURNE
NORTHING	: 0.0000 estimated	DRILLING RIG	: CME 55 SKID
EASTING	: 0.0000 estimated	DATE STARTED	: 01/13/93
ELEVATION	: 0.000 estimated	DATE COMPLETED	: 01/13/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silt with sand, ML	GREY/BLACK	LSE	DMP	1 1	OVM 0.0	
-2	2			Sandy silt, ML	BROWNISH GREY	LSE	DMP	2 2	OVM 0.0	
				Interval Not Sampled						
-4	4		100	Silty sand, SM	YELLOW RED	LSE	DMP	3 3 3 3		<1% coarse to medium sand (5 YR 5/8).
-6	6			Interval Not Sampled						
-8	8									
			100	Silt, ML	YELLOW RED	SFT	DMP	3	OVM 0.0	5 YR 4/6.
-10	10			Interval Not Sampled	YELLOW RED	FRM	DMP	4 5 5	OVM 3.0	5 YR 4/6.
-12	12			Interval Not Sampled						
-14	14		100	Silt, ML	DK RED BROWN	FRM	MST	2 3 4 4	OVM 0.0	2.5 Y 3/4, mottled yellow and black.
-16	16		100	Lean clay, CL	BROWN RED	SFT	MST	4 4 5 4	OVM 0.0	Mottled yellow/grey and yellowish red 5 YR 5/6; Water entry zone at 18'.
-18	18			Silt, ML	DK RED	SFT	SAT		OVM 0.0	2.5 YR 3/6.
				Interval Not Sampled						
-20	20		100	Silt, ML	RED	SFT	MST	2 3 3 2	OVM 0.0	Mottled yellow.
-22	22			Interval Not Sampled						
-24	24		100	Silty sand, SM	REDDISH YELLOW	LSE	WET	3	OVM 0.0	White shells & shell hash
				Silt, ML	olive grey	SFT	MST	3	OVM 0.0	Shell hash w/red mottles
-26	26			Silt, ML	BLUE GREY	FRM	MST	6	OVM 0.0	5 GY 4/1;Fossils & shells poorly preserved, highly weathered, micaceous w/f. mafics; ~10%-silt faction
-28	28									
-30	30									
-32	32									
-34	34									
-36	36									
-38	38									
-40	40									

APPENDIX C

LIQUID LEVEL MEASUREMENTS

WESTON
MANAGERS DESIGNERS/CONSULTANTS

Fluid Level Measurements
Building 81, NWS Yorktown, VA

18 January 1993

Recorded By: Jefferson Ghent

WELL NO.	DTP	DTW	PT	ELEV.	WATER[1] ELEV.	CORRECTED[2] WATER ELEV.	COMMENTS
MW-1	ND	29.02	–	52.22	23.2	–	
MW-2	ND	34.87	–	57.80	22.93	–	
MW-3	ND	34.76	–	57.65	22.89	–	
MW-4	ND	29.41	–	52.63	23.22	–	
MW-5	ND	30.59	–	54.01	23.42	–	
MW-6	ND	16.37	–	39.73	23.36	–	
MW-7	ND	12.18	–	34.90	22.72	–	

DTP - Depth to product (feet, below top of casing).
DTW - Depth to water (feet), as measured relative to mark at top of PVC casing.
PT - Product Thickness (feet).
ELEV - Elevation of marked top of PVC casing, relative to meat sea level.
1 - Elevation of top of water table in feet.
2 - When product detected, groundwater elevation is corrected by a factor of 0.81 (Specific gravity of No. 2 fuel oil).
ND - Not detected.
– = Not applicable.

Fluid Level Measurements
Building 81, NWS Yorktown, VA

19 January 1993

Recorded By: Jefferson Ghent

WELL NO.	DTP	DTW	FT	ELEV.	WATER[1] ELEV.	CORRECTED[2] WATER ELEV.	COMMENTS
MW-1	ND	29.58	–	52.22	22.64	–	
MW-2	ND	34.87	–	57.80	22.93	–	
MW-3	ND	34.76	–	57.65	22.89	–	
MW-4	ND	29.54	–	52.63	23.09	–	
MW-5	ND	30.64	–	54.01	23.37	–	
MW-6	ND	16.50	–	39.73	23.23	–	
MW-7	ND	12.29	–	34.90	22.61	–	

DTP - Depth to product (feet, below top of casing).
DTW - Depth to water (feet), as measured relative to mark at top of PVC casing.
PT - Product Thickness (feet).
ELEV - Elevation of marked top of PVC casing, relative to mean sea level.
1 - Elevation of top of water table in feet.
2 - When product detected, groundwater elevation is corrected by a factor of 0.81 (Specific gravity of No. 2 fuel oil).
ND - Not detected.
– = Not applicable.

Fluid Level Measurements
Building 81, NWS Yorktown, VA

29 January 1993

Recorded By: Jefferson Ghent

WELL NO.	DTP	DTW	PT	ELEV.	WATER[1] ELEV.	CORRECTED[2] WATER ELEV.	COMMENTS
MW-1	ND	28.92	–	52.22	23.30	–	
MW-2	ND	34.77	–	57.80	23.03	–	
MW-3	ND	34.56	–	57.65	23.09	–	
MW-4	ND	29.59	–	52.63	23.04	–	
MW-5	ND	30.45	–	54.01	23.56	–	
MW-6	ND	16.67	–	39.73	23.06	–	
MW-7	ND	12.51	–	34.90	22.39	–	

DTP - Depth to product (feet, below top of casing).
DTW - Depth to water (feet), as measured relative to mark at top of PVC casing.
PT - Product Thickness (feet).
ELEV - Elevation of marked top of PVC casing, relative to mean sea level.
1 - Elevation of top of water table in feet.
2 - When product detected, groundwater elevation is corrected by a factor of 0.81 (Specific gravity of No. 2 fuel oil).
ND - Not detected.
– = Not applicable.

APPENDIX D

LABORATORY ANALYSES

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

Data:

W.O. # 6629-001-028
SITE: CTO-161

1. LAB NUMBER/FIELD NUMBER

CROSS REFERENCE

2. CHAIN OF CUSTODY:

COPIES OF ORIGINALS

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

Data:

CROSS REFERENCE OF LAB NUMBERS TO FIELD NUMBERS

W.O. #6629-01-028

SITE: CTO-161

Sample Date:	01/04/93
LAB #	**FIELD #**
93-0192	MW1-001
93-0193	MW1-002

Sample Date:	01/05/93
LAB #	**FIELD #**
93-0204	MW1-003

Sample Date:	01/06/93
LAB #	**FIELD #**
93-0194	MW2-001
93-0195	MW2-002
93-0198	BH1-001
93-0199	BH1-002

Sample Date:	01/07/93
LAB #	**FIELD #**
93-0196	MW3-001
93-0197	MW3-002
93-0200	MW4-001
93-0201	MW4-002
93-0205	MW4-003

Sample Date:	01/08/93
LAB #	**FIELD #**
93-0202	BH2-001
93-0203	BH2-003

Sample Date:	01/11/93
LAB #	**FIELD #**
93-0735	BH3-001
93-0736	BH3-002
93-0737	BH4-001
93-0738	BH4-002
93-0739	BH4-003

Sample Date:	01/12/93
LAB #	**FIELD #**
93-0728	MW5-001
93-0729	MW5-002
93-0730	MW6-001
93-0731	MW6-002

Sample Date:	01/13/93
LAB #	**FIELD #**
93-0732	MW7-001
93-0733	MW7-002
93-0734	MW7-003

Sample Date:	01/15/93
LAB #	**FIELD #**
93-0900	MW4-001
93-0901	MW5-001

Sample Date:	01/18/93
LAB #	**FIELD #**
93-0897	MW2-001
93-0898	MW2-101
93-0900	MW4-001
93-0902	MW6-001
93-0903	MW7-001
93-0904	MW2-201
93-0905	MW2-301
93-0899	MW3-001

Sample Date:	01/19/93
LAB #	**FIELD #**
93-0896	MW1-001

Sample Date:	01/26/93
LAB #	**FIELD #**
93-0899	MW3-001 (TRPH)

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

Data:

SAMPLE RESULTS

W.O.# 6629-001-028
SITE: CTO-161

Sample results include:

Site
Sampling Dates
Field Numbers
Lab Received Dates
Lab Numbers
Extraction Dates
Analyses Dates

PARAMETERS TESTED:

TPH (modified 8015)
HALOGENATED HYDROCARBONS (8240)
POLYAROMATIC HYDROCARBONS (625)
VOA (624)
GRAIN SIZE
LEAD (7421)
TRPH (418.1)

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

Data:

W.O. #6629-001-028

TPH (modified 8015)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/04/93	01/04/93	01/06/93	01/06/93	01/07/93	01/07/93
FIELD #:	MW1-001	MW1-002	MW2-001	MW2-002	MW3-001	MW3-002
LAB RCVD DATE:	01/08/93	01/08/93	01/08/93	01/08/93	01/08/93	01/08/93
LAB #:	93-0192	93-0193	93-0194	93-0195	93-0196	93-0197
EXTRACT DATE:	01/12/93	01/12/93	01/12/93	01/12/93	01/12/93	01/12/93
ANALYSIS DTE:	01/14/93	01/14/93	01/13/93	01/13/93	01/13/93	01/13/93
ANALYSIS: (ppm)	610.	1500.	<29.	<14.	<22.	<17.
TPH(mod 8015)						
Stnd: #2 Heating Fuel						

TPH (modified 8015)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/06/93	01/06/93	01/07/93	01/07/93	01/08/93	01/08/93
FIELD #:	BH1-001	BH1-002	MW4-001	MW4-002	BH2-001	BH2-003
LAB RCVD DATE:	01/08/93	01/08/93	01/08/93	01/08/93	01/08/93	01/08/93
LAB #:	93-0198	93-0199	93-0200	93-0201	93-0202	93-0203
EXTRACT DATE:	01/12/93	01/12/93	01/12/93	01/12/93	01/12/93	01/12/93
ANALYSIS DTE:	01/13/93	01/13/93	01/13/93	01/13/93	01/15/93	01/13/93
ANALYSIS: (ppm)	<20.	<18.	<21.	<21.	61.	<15.
TPH(mod 8015)						
Stnd: #2 Heating Fuel						

TPH (modified 8015)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/07/93	01/12/93	01/12/93	01/12/93	01/12/93	01/13/93
FIELD #:	MW4-003	MW5-001	MW5-002	MW6-001	MW6-002	MW7-001
LAB RCVD DATE:	01/08/93	01/15/93	01/15/93	01/15/93	01/15/93	01/15/93
LAB #:	93-0205	93-0728	93-0729	93-0730	93-0731	93-0732
EXTRACT DATE:	01/12/93	01/20/93	01/20/93	01/20/93	01/21/93	01/20/93
ANALYSIS DTE:	01/13/93	01/20/93	01/20/93	01/20/93	01/21/93	01/20/93
ANALYSIS: (ppm)	<21.	<26.	<26.	110.	3800.	75.
TPH(mod 8015)						
Stnd: #2 Heating Fuel						

TPH (modified 8015)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/13/93	01/13/93	01/11/93	01/11/93	01/11/93
FIELD #:	MW7-002	BH3-001	BH3-002	BH4-001	BH4-002
LAB RCVD DATE:	01/15/93	01/15/93	01/15/93	01/15/93	01/15/93
LAB #:	93-0733	93-0735	93-0736	93-0737	93-0738
EXTRACT DATE:	01/20/93	01/20/93	01/20/93	01/21/93	01/21/93
ANALYSIS DTE:	01/20/93	01/20/93	01/20/93	01/21/93	01/21/93
ANALYSIS: (ppm)	<21.	79.	22.	250.	330.
TPH(mod 8015)					
Stnd: #2 Heating Fuel					

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

HALOGENATED HYDROCARBONS (8240)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/04/93	01/04/93	01/07/93	01/12/93	01/11/93	01/11/93
FIELD #:	MW1-001	MW1-002	MW4-002	MW6-002	BH3-002	BH4-001
LAB RCVD DATE:	01/08/93	01/08/93	01/08/93	01/15/93	01/15/93	01/15/93
LAB #:	93-0192	93-0193	93-0201	93-0731	93-0736	93-0737
ANALYSIS DTE:	01/15/93	01/19/93	01/19/93	01/25/93	01/25/93	01/25/93
ANALYSIS (ppb):						
HALOGENATED HYDROCARBONS (8240)						
Acetone	<600.	<500.	<100.	<10000.	<100.	<4000.
Acrolein	<300.	<250.	<50.	<5000.	<50.	<2000.
Acrylonitrile	<300.	<250.	<50.	<5000.	<50.	<5000.
Benzene	<30.	<25.	<5.	<500.	<5.	<200.
Bromodichloromethane	<30.	<25.	<5.	<500.	<5.	<200.
Bromoform	<30.	<25.	<5.	<500.	<5.	<200.
Bromomethane	<60.	<50.	<10.	<1000.	<10.	<400.
2-Butanone	<60.	<50.	<10.	<1000.	<10.	<400.
Carbon Disulfide	<30.	<25.	<5.	<500.	<5.	<200.
Carbon Tetrachloride	<30.	<25.	<5.	<500.	<5.	<200.
Chlorobenzene	<30.	<25.	<5.	<500.	<5.	<200.
Chloroethane	<60.	<50.	<10.	<1000.	<10.	<400.
2-Chloro Ethyl Vinyl Ether	<60.	<50.	<10.	<1000.	<10.	<400.
Chloroform	<30.	<25.	<5.	<500.	<5.	<200.
Chloromethane	<60.	<50.	<10.	<1000.	<10.	<400.
Dibromochloromethane	<30.	<25.	<5.	<500.	<5.	<200.
Dibromomethane	<30.	<25.	<5.	<500.	<5.	<200.
1,4-Dichloro-2-Butane	<30.	<25.	<5.	<500.	<5.	<200.
Dichlorodifluoromethane	<60.	<50.	<10.	<1000.	<10.	<400.
1,2-Dichlorobezene	<30.	<25.	<5.	<500.	<5.	<200.
1,3-Dichlorobenzene	<30.	<25.	<5.	<500.	<5.	<200.
1,4-Dichlorobenzene	<30.	<25.	<5.	<500.	<5.	<200.
1,1-Dichloroethane	<30.	<25.	<5.	<500.	<5.	<200.
1,2-Dichloroethane	<30.	<25.	<5.	<500.	<5.	<200.
1,1-Dichloroethene	<30.	<25.	<5.	<500.	<5.	<200.

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

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HALOGENATED HYDROCARBONS (8240) CONTINUED

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/04/93	01/04/93	01/04/93	01/12/93	01/11/93	01/11/93
FIELD #:	MW1-001	MW1-002	MW4-002	MW6-002	BH3-002	BH4-001
LAB RCVD DATE:	01/0/893	01/08/93	01/08/93	01/15/93	01/15/93	01/15/93
LAB #:	93-0192	93-0193	93-0201	93-0731	93-0736	93-0737
ANALYSIS DTE:	01/15/93	01/19/93	01/19/93	01/25/93	01/25/93	01/25/93
ANALYSIS (ppb):						
HALOGENATED HYDROCARBONS (8240)						
trans-1,2-Dichloroethene	<30.	<25.	<5.	<500.	<5.	<200.
1,2-Dichloropropane	<30.	<25.	<5.	<500.	<5.	<200.
cis-1,3-Dichloropropene	<30.	<25.	<5.	<500.	<5.	<200.
trans-1,3-Dichloropropene	<30.	<25.	<5.	<500.	<5.	<200.
Ethanol	<600.	<500.	<100.	<10000.	<100.	<1000.
Ethylbenzene	<30.	630.	<5.	1127.	<5.	<200.
Ethyl Methacrylate	<60.	<50.	<10.	<1000.	<10.	<400.
2-Hexanone	<300.	<250.	<50.	<5000.	<50.	<2000.
Iodomethane	<60.	<50.	<10.	<1000.	<10.	<400.
Methylene Chloride	<30.	<25.	<5.	<500.	<5.	<200.
4-Methyl-2-Pentanone	<300.	<250.	<50.	<5000.	<50.	<2000.
Styrene	<60.	<50.	<10.	<1000.	<10.	<400.
1,1,2,2-Tetrachloroethane	<60.	<50.	<10.	<1000.	<10.	<400.
Tetrachloroethylene	<60.	<50.	<10.	<1000.	<10.	<400.
Toluene	<30.	<25.	<5.	<500.	<5.	<200.
1,1,1-Trichloroethane	37.6	100.	<5.	<500.	<5.	<200.
1,1,2-Trichloroethane	<30.	<25.	<5.	<500.	<5.	<200.
Trichloroethylene	<30.	<25.	<5.	<500.	<5.	<200.
Trichlorofluoromethane	<30.	<25.	<5.	<500.	<5.	<200.
Vinyl Chloride	<60.	<50.	<10.	<1000.	<10.	<400.
Xylene (Total)	<30.	<25.	<5.	<500.	<5.	<200.

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

Da

HALOGENATED HYDROCARBONS (8240) CONTINUED

SITE:	CTO-161
SAMPLE DATE:	01/11/93
FIELD #:	BH4-003
LAB RCVD DATE:	01/15/93
LAB #:	93-0739
ANALYSIS DTE:	01/25/93
ANALYSIS (ppb):	

HALOGENATED HYDROCARBONS (8240)

Acetone	<500.
Acrolein	<250.
Acrylonitrile	<250.
Benzene	<25.
Bromodichloromethane	<25.
Bromoform	<25.
Bromomethane	<50.
2-Butanone	<50.
Carbon Disulfide	<25.
Carbon Tetrachloride	<25.
Chlorobenzene	<25.
Chloroethane	<50.
2-Chloro Ethyl Vinyl Ether	<50.
Chloroform	<25.
Chloromethane	<50.
Dibromochloromethane	<25.
Dibromomethane	<25.
1,4-Dichloro-2-Butane	<25.
Dichlorodifluoromethane	<50.
1,2-Dichlorobezene	<25.
1,3-Dichlorobenzene	<25.
1,4-Dichlorobenzene	<25.
1,1-Dichloroethane	<25.
1,2-Dichloroethane	<25.
1,1-Dichloroethene	<25.

TC ANALYTICS, INCORPORATED

1200 Boissevain Avenue Norfolk, Virginia 23507
Tel. (804) 627-0400 FAX (804) 627-1118

D HALOGENATED HYDROCARBONS (8240) CONTINUED

SITE:	CTO-161
SAMPLE DATE:	01/11/93
FIELD #:	BH4-003
LAB RCVD DATE:	01/15/93
LAB #:	93-0739
ANALYSIS DTE:	01/25/93
ANALYSIS (ppb):	

HALOGENATED HYDROCARBONS (8240)

trans-1,2-Dichloroethene	<25.
1,2-Dichloropropane	<25.
cis-1,3-Dichloropropene	<25.
trans-1,3-Dichloropropene	<25.
Ethanol	<500.
Ethylbenzene	288.
Ethyl Methacrylate	<50.
2-Hexanone	<250.
Iodomethane	<50.
Methylene Chloride	<25.
4-Methyl-2-Pentanone	<250.
Styrene	<50.
1,1,2,2-Tetrachloroethane	<50.
Tetrachloroethylene	<50.
Toluene	<25.
1,1,1-Trichloroethane	<25.
1,1,2-Trichloroethane	<25.
Trichloroethylene	<25.
Trichlorofluoromethane	<25.
Vinyl Chloride	<50.
Xylene (Total)	<25.

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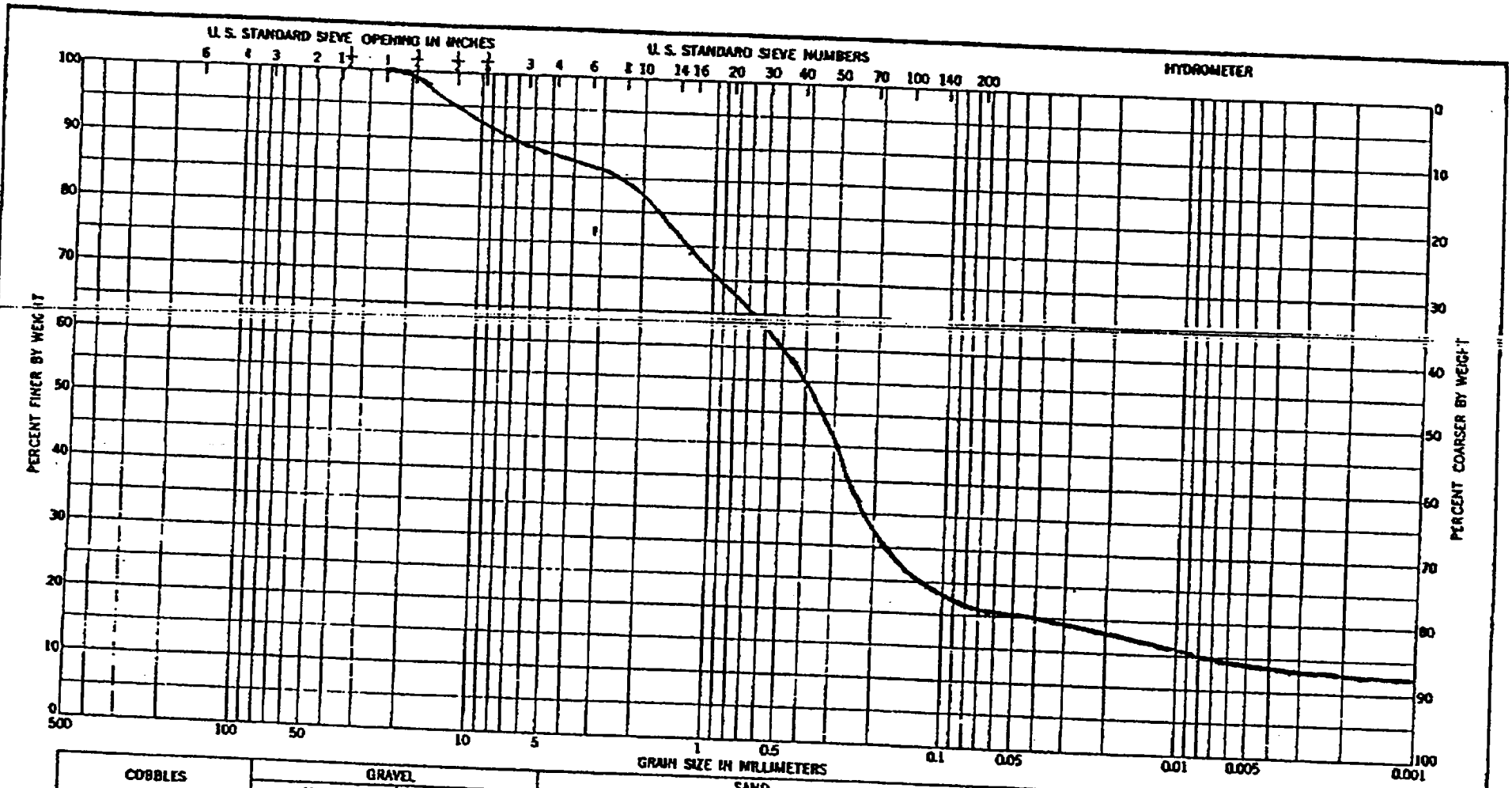
Data: **Grain Size ASTM D422**

SITE:	CTO-161	CTO-161
SAMPLE DATE:	01/05/93	01/13/93
FIELD #:	MW1-003	MW7-003
LAB RCVD DATE:	01/08/93	01/15/93
LAB #:	93-0204	93-0734
ANALYSIS DTE:	01/29/93	01/29/93
ANALYSIS:		

GRAIN SIZE (%)

SEIVE NUMBER	893-0204	893-0734
1"	100.	
3/4"	100.	
1/2"	95.0	
3/8"	93.0	
NO. 4	86.6	
NO. 8	80.2	
NO. 10	79.5	100.
NO. 16	74.5	98.8
NO. 30	62.9	98.4
NO. 40	57.5	98.0
NO. 50	48.8	97.8
NO. 80	30.4	97.6
NO. 100	26.6	97.4
NO. 200	20.0	88.8
Shell Hash/ Fine Gravel	12.0	
Sand	68.0	11.2
Silt	6.0	58.8
Clay	1.5	11.5
Colloids	12.5	18.5



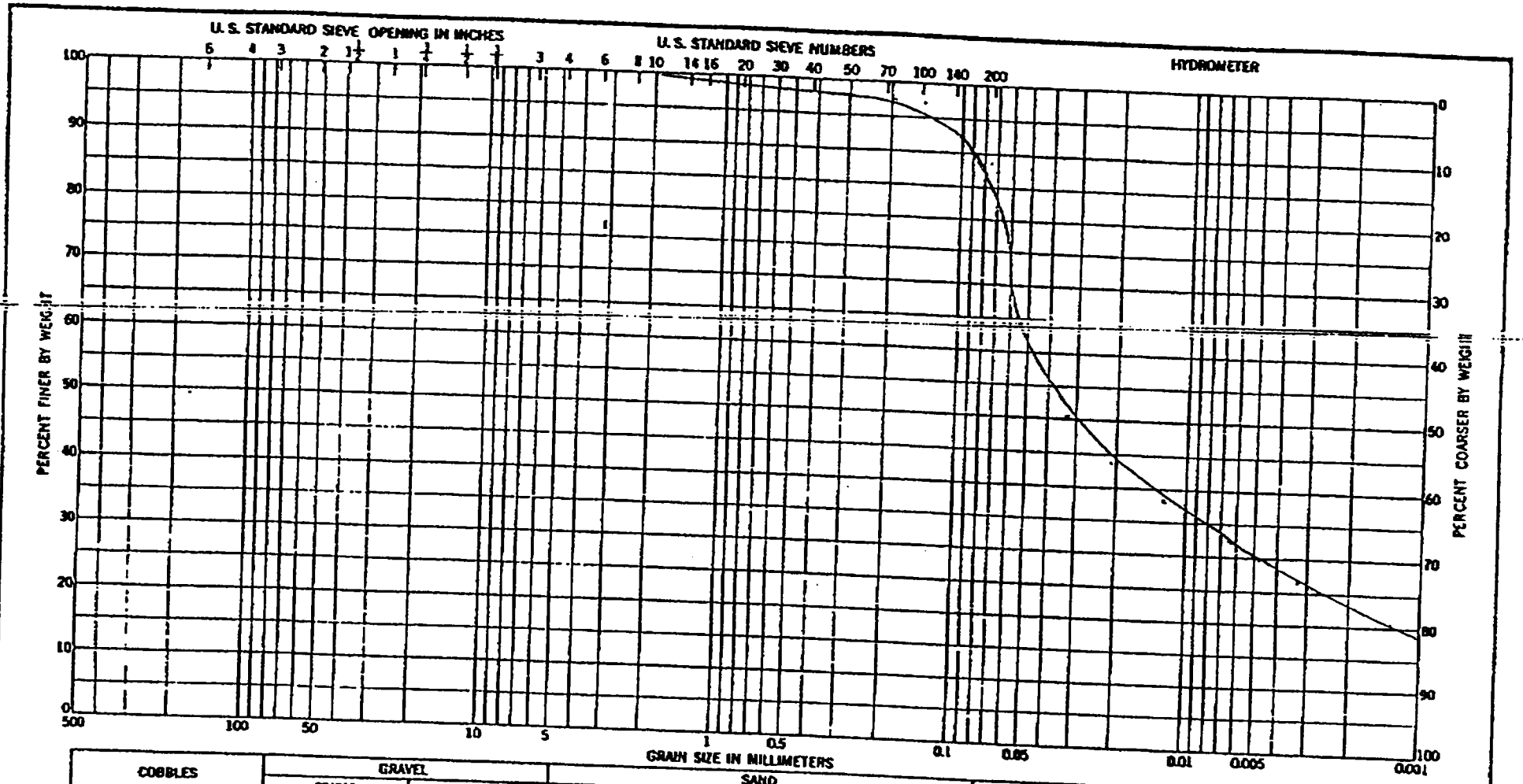
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
93204		Tan, fine to coarse SAND,	NA			
		with shell hash 68%, fine				
		gravel (cemented shell hash)				
		12%. trace silt 6%, trace				
		Clay 1.5%, little colloids	12.5%			

GRADATION CURVES

Project: Laboratory Test Results
T C Analytics 26-02-92-00225
Area:
Boring No.
Date: January 29, 1993

ENG FORM 1 MAY 83 2087

Figure 1



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
93734		Gray, Silt 58.8%, little fine Sand 11.2%, little Clay 11.5%, little colloids 18.5%				

Figure 2

GRADATION CURVES

Project: Laboratory Test Results
T C Analytics 26-02-92-00225

Area

Boring No. January 29, 1993

Date

ENG FORM 1 MAY 83 2087

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Data:

TRPH (418.1)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/19/93	01/18/93	01/18/93	01/26/93	01/18/93	01/15/93
FIELD #:	MW1-001	MW2-001	MW2-101	MW3-001	MW4-001	MW5-001
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93	01/27/93	01/20/93	01/20/92
LAB #:	93-0896	93-0897	93-0898	93-0899	93-0900	93-0901
ANALYSIS DTE:	01/24/93	01/24/93	01/24/93	01/31/93	01/24/93	01/24/92
ANALYSIS: (ppm)	26.86	<1.0	2.79	2.39	26.2	1.79

SITE:	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/18/93	01/18/93	01/18/93	01/18/93
FIELD #:	MW6-001	MW7-001	MW2-201	MW2-301
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93	01/20/93
LAB #:	93-0902	93-0903	93-0904	93-0905
ANALYSIS DTE:	01/24/93	01/24/93	01/24/93	01/24/93
ANALYSIS: (ppm)	3.7	1.48	<1.0	<1.0

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Data:

Pb (7421)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/19/93	01/18/93	01/18/93	01/15/93	01/18/93	01/15/93
FIELD #:	MW1-001	MW2-001	MW2-101	MW3-001	MW4-001	MW5-001
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93
LAB #:	93-0896	93-0897	93-0898	93-0899	93-0900	93-0901
ANALYSIS DTE:	01/27/93	01/27/93	01/27/93	01/27/93	01/27/93	01/27/93
ANALYSIS: (ppb) Pb (7421)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

SITE:	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/18/93	01/18/93	01/18/93
FIELD #:	MW6-001	MW7-001	MW2-301
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93
LAB #:	93-0902	93-0903	93-0905
ANALYSIS DTE:	01/27/93	01/27/93	01/27/93
ANALYSIS: (ppb) Pb (7421)	<5.0	<5.0	<5.0

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SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/19/93	01/18/93	01/18/93	01/18/93	01/18/93	01/18/93
FIELD #:	MW1-001	MW2-001	MW2-101	MW4-001	MW6-001	MW2-301
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93
LAB #:	93-0896	93-0897	93-0898	93-0900	93-0902	93-0905
ANALYSIS DATE:	01/28/93	01/28/93	01/28/93	01/28/93	01/28/93	01/28/93
ANALYSIS (ppb):						
VOA (624)						
Chloromethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Bromomethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Vinyl Chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methylene Chloride	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichlorofluoromethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroform	<1.0	2.0	2.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	4.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chloroethyl vinyl ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Bromoform	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	4.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4-Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

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POLYAROMATIC HYDROCARBONS (625)

SITE:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/19/93	01/18/93	01/18/93	01/18/93	01/18/93	01/18/93
FIELD #:	MW1-001	MW2-001	MW2-101	MW4-001	MW6-001	MW2-301
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93
LAB #:	93-0896	93-0897	93-0898	93-0900	93-0902	93-0905
EXTRACT DATE:	01/22/93	01/22/93	01/22/93	01/22/93	01/22/93	01/22/92
ANALYSIS DTE:	01/25/93	01/25/93	01/25/93	01/25/93	01/25/93	01/25/92
ANALYSIS (ppb):						
POLYAROMATIC HYDROCARBONS (625)						
Phenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Chloroethyl)ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chlorophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4-Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Chloroisopropyl)ether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Nitroso-di-n-propylamine	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachloroethane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Nitrobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Isophorone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Nitrophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4-Dimethylphenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Chloroethoxy)methane	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4-Dichlorophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2,4-Trichlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Naphthalene	16.	<5.0	<5.0	<5.0	68.	<5.0
Hexachlorobutadiene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chloro-3-methylphenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,6-Trichlorophenol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chloronaphthalene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dimethylphthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acenaphthylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acenaphthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4-Dinitrophenol	<25.	<25.	<25.	<25.	<25.	<25.
4-Nitrophenol	<25.	<25.	<25.	<25.	<25.	<25.
2,4-Dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,6-Dinitrotoluene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Diethylphthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Chlorophenyl-phenylether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Fluorene	10.	<5.0	<5.0	<5.0	<5.0	<5.0
4,6-Dinitro-2-methylphenol	<25.	<25.	<25.	<25.	<25.	<25.
4-Bromophenyl-phenylether	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorobenzene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pentachlorophenol	<25.	<25.	<25.	<25.	<25.	<25.

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SPMP:	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161	CTO-161
SAMPLE DATE:	01/19/93	01/18/93	01/18/93	01/18/93	01/18/93	01/18/93
FIELD #:	MW1-001	MW2-001	MW2-101	MW4-001	MW6-001	MW2-301
LAB RCVD DATE:	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93	01/20/93
LAB #:	93-0896	93-0897	93-0898	93-0900	93-0902	93-0905
EXTRACT DATE:	01/22/93	01/22/93	01/22/93	01/22/93	01/22/93	01/22/92
ANALYSIS DTE:	01/25/93	01/25/93	01/25/93	01/25/93	01/25/93	01/25/92
ANALYSIS (ppb):						
POLYAROMATIC HYDROCARBONS (625) CONTINUED						
Phenanthrene	13.	<5.0	<5.0	<5.0	<5.0	<5.0
Anthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-butylphthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Butylbenzylphthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
3,3'-Dichlorobenzidine	<10.	<10.	<10.	<10.	<10.	<10.
Benzo(a)anthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
bis(2-Ethylhexyl)phthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chrysene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Di-n-octylphthalate	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(b)fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(k)fluoranthene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(a)pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Indeno (1,2,3-cd)pyrene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dibenz(a,h)anthracene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzo(g,h,i)perylene	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hexachlorocyclopentadiene	<10.	<10.	<10.	<10.	<10.	<10.
N-Nitrosodiphenylamine	<10.	<10.	<10.	<10.	<10.	<10.
Benzidine	<80.	<80.	<80.	<80.	<80.	<80.
N-Nitrosodimethylamine	<10.	<10.	<10.	<10.	<10.	<10.

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Data:

W.O. # 6629-001-028
SITE: CTO-161

QA/QC DATA

The following pages contain the QA/QC Data to support the parameters tested. The data has been divided into the following sections:

ACCURACY FOR KNOWN SPIKE RECOVERIES

ACCURACY FOR MATRIX SPIKES/STANDARD ADDITION RECOVERIES

PRECISION BY REPLICATE MEASUREMENTS AND PERCENT RELATIVE DEVIATION

QA/QC RANGES

DATA PRESENTED FOR:

TPH (modified 8015)
HALOGENATED HYDROCARBONS (8240)
POLYAROMATIC HYDROCARBONS (625)
VOA (624)
GRAIN SIZE
LEAD (7421)
TRPH (418.1)

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TPH (modified 8015)

Date Analyzed: 01/12/93, 13, 14, 15, 20, 01/21/93

Lab #	Field #
93-0192	MW1-001
93-0193	MW1-002
93-0194	MW2-001
93-0195	MW2-002
93-0196	MW3-002
93-0197	MW3-002
93-0198	BH1-001
93-0199	BH1-002
93-0200	MW4-001
93-0201	MW4-002
93-0202	BH2-001
93-0203	BH2-003
93-0205	MW4-003
93-0728	MW5-001
93-0729	MW5-002
92-0730	MW6-001
92-0731	MW6-002
93-0732	MW7-001
93-0733	MW7-002
93-0735	BH3-001
93-0736	BH3-002
93-0737	BH4-001
93-0738	BH4-002

ACCURACY

KNOWN SPIKE RECOVERIES

(in percent)

94 83 106 105 81 114

MATRIX SPIKE/STANDARD ADDITIONS

(in percent)

Matrix Spikes were performed on:

93-0194/MW2-001	79
93-0202/BH2-001	80
93-0729/BH4-002	89
93-0730/BH4-001	84

PRECISION

Replicates were performed on:

93-0728/MW5-002	<PQL
93-0737/BH4-001	13. %
93-0192/MW1-001	3.5%
93-0201/MW4-002	<PQL

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Pb (7421)

Date Analyzed: 01/27/93

Lab #	Field #
93-0896	MW1-001
93-0897	MW2-001
93-0898	MW2-101
93-0899	MW3-001
93-0901	MW5-001
93-0902	MW6-001
93-0903	MW7-001
93-0904	MW2-201

ACCURACY

KNOWN SPIKE RECOVERIES
(in percent)
98

MATRIX SPIKE/STANDARD ADDITIONS
(in percent)
Matrix Spike was performed on:
93-0897/MW2-001
89 %

PRECISION
Replicate was performed on:
93-0897/MW2-001
Both values less than PQL.

TRPH (418.1)

Date Analyzed: 01/24/93

Lab #	Field #
93-0896	MW1-001
93-0897	MW2-001
93-0898	MW2-201
93-0899	MW3-001
93-0900	MW4-001
93-0901	MW5-001
93-0902	MW6-001
93-0903	MW7-001
93-0904	MW2-201
93-0905	MW2-301

ACCURACY

KNOWN SPIKE RECOVERIES
(in percent)
98

TC ANALYTICS, INCORPORATED

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Data: VOA (624)

ANALYSIS	ACCURACY KNOWN SPIKE RECOVERIES %
Bromodichloromethane	100
Bromoform	120
Bromomethane	91
Carbon Tetrachloride	71
Chlorobenzene	97
Chloroethane	90
2-Chloro Ethyl Vinyl Ether	85
Chloroform	65
Chloromethane	100
Dibromochloromethane	92
1,2-Dichlorobenzene	140
1,3-Dichlorobenzene	130
1,4-Dichlorobenzene	130
Dichlorofluoromethane	65
1,1-Dichloroethane	110
1,2-Dichloroethane	92
1,1-Dichloroethene	94
trans-1,2-Dichloroethene	100
1,2-Dichloropropane	100
cis-1,3-Dichloropropene	100
trans-1,3-Dichloropropene	105
Methylene Chloride	20
1,1,2,2-Tetrachloroethane	135
Tetrachloroethene	80
1,1,1-Trichloroethane	76
1,1,2-Trichloroethane	79
Trichloroethene	76
Trichlorofluoromethane	95
Vinyl Chloride	84

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Data: **POLYAROMATIC HYDROCARBONS (625)**

ANALYSIS	ACCURACY KNOWN SPIKE RECOVERIES %
1,4-Dichlorobenzene	90
N-Nitroso-di-n-propylamine	77
1,2,4-Trichlorobenzene	99
Acenaphthene	101
2,4-Dinitrotoluene	117
Pyrene	128
Di-n-butylphthalate	96
Phenol	88
2-Chlorophenol	94
4-Chloro3-methylphenol	110
4-Nitrophenol	145
Pentachlorophenol	

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Data:

QA/QC RANGES

TPH (Modified 8015)

STANDARD: #2 Heating Fuel
ACCURACY: Soil 73 - 126%

PRECISION
< or = 20% Relative Difference

TRPH (418.1)

ACCURACY
75% - 125%

LEAD (7421)

ACCURACY
85 - 115%

PRECISION
< or = 15% Relative Difference

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Data:

W.O. # 6629-001-028
SITE: CTO-161

DETECTION AND QUANTIFICATION LIMITS

PARAMETERS REPORTED FOR:

TPH (modified 8015)
HALOGENATED HYDROCARBONS (8240)
POLYAROMATIC HYDROCARBONS (625)
VOA (624)
GRAIN SIZE
LEAD (7421)
TPH (418.1)

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Data

TPH (Modified 8015)

STANDARD:	#2 Heating Fuel
MATRIX:	Soil
AMOUNT EXTRACTED:	5 g (nominal)
EXTRACTION VOLUME:	1 ml

TPH (ppm)	
IDL	3.50
MDL	0.7 mg/Kg
PQL	9.47

TPH (418.1)

MATRIX:	Water
AMOUNT EXTRACTED:	1L (Nominal)
FINAL EXTRACTION VOLUME:	100 ml

TPH (ppm)	
IDL	0.10
MDL	0.10
PQL	0.10

LEAD (7421)

MATRIX:	Water

Pb (ppb)	
IDL	0.61
MDl	0.61
PQL	5.0

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Data:

HALOGENATED HYDROCARBONS (8240)

ANALYSIS	PQL (ppb)
Acetone	500.
Acrolein	250.
Acrylonitrile	250.
Benzene	25.
Bromodichloromethane	25.
Bromoform	25.
Bromomethane	50.
2-Butanone	50.
Carbon Disulfide	25.
Carbon Tetrachloride	25.
Chlorobenzene	25.
Chloroethane	50.
2-Chloro Ethyl Vinyl Ether	50.
Chloroform	25.
Chloromethane	50.
Dibromochloromethane	25.
Dibromomethane	25.
1,4-Dichloro-2-Butane	25.
Dichlorodifluoromethane	50.
1,2-Dichlorobezene	25.
1,3-Dichlorobenzene	25.
1,4-Dichlorobenzene	25.
1,1-Dichloroethane	25.
1,2-Dichloroethane	25.
1,1-Dichloroethene	25.
trans-1,2-Dichloroethene	25.
1,2-Dichloropropane	25.
cis-1,3-Dichloropropene	25.
trans-1,3-Dichloropropene	25.
Ethanol	500.
Ethylbenzene	<5.
Ethyl Methacrylate	<60.
2-Hexanone	250.
Iodomethane	50.
Methylene Chloride	25.
4-Methyl-2-Pentanone	250.
Styrene	50.
1,1,2,2-Tetrachloroethane	50.
Tetrachloroethylene	50.
Toluene	25.

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Data:

1,1,1-Trichloroethane	25.
1,1,2-Trichloroethane	25.
Trichloroethylene	25.
Trichlorofluoromethane	25.
Vinyl Chloride	50.
Xylene (Total)	25.

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Data:

VOA (624)

ANALYSIS	POL (ppb)
Chloromethane	5.0
Bromomethane	5.0
Vinyl Chloride	5.0
Chloroethane	5.0
Methylene Chloride	5.0
Trichlorofluoromethane	5.0
1,1-Dichloroethene	1.0
1,1-Dichloroethane	1.0
trans-1,2-Dichloroethene	2.0
Chloroform	1.0
1,2-Dichloroethane	1.0
1,1,1-Trichloroethane	1.0
Carbon Tetrachloride	1.0
Bromodichloromethane	1.0
1,2-Dichloropropane	1.0
cis-1,3-Dichloropropene	5.0
Trichloroethene	1.0
Dibromochloromethane	1.0
1,1,2-Trichloroethane	1.0
Benzene	1.0
trans-1,3-Dichloropropene	5.0
2-Chloroethyl vinyl ether	5.0
Bromoform	1.0
Tetrachloroethene	1.0
1,1,2,2-Tetrachloroethane	1.0
Toluene	1.0
Chlorobenzene	1.0
Ethylbenzene	1.0
1,2-Dichlorobenzene	5.0
1,3-Dichlorobenzene	5.0
1,4-Dichlorobenzene	5.0

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Data:

POLYAROMATIC HYDROCARBONS (625)

ANALYSIS	POL (ppb)
Phenol	5.0
bis(2-Chloroethyl)ether	5.0
2-Chlorophenol	5.0
1,3-Dichlorobenzene	5.0
1,4-Dichlorobenzene	5.0
1,2-Dichlorobenzene	5.0
bis(2-Chloroisopropyl)ether	5.0
N-Nitroso-di-n-propylamine	5.0
Hexachloroethane	5.0
Nitrobenzene	5.0
Isophorone	5.0
2-Nitrophenol	5.0
2,4-Dimethylphenol	5.0
bis(2-Chloroethoxy)methane	5.0
2,4-Dichlorophenol	5.0
1,2,4-Trichlorobenzene	5.0
Naphthalene	5.0
Hexachlorobutadiene	5.0
4-Chloro-3-methylphenol	5.0
2,4,6-Trichlorophenol	5.0
2-Chloronaphthalene	5.0
Dimethylphthalate	5.0
Acenaphthylene	5.0
Acenaphthene	5.0
2,4-Dinitrophenol	25.
4-Nitrophenol	25.
2,4-Dinitrotoluene	5.0
2,6-Dinitrotoluene	5.0
Diethylphthalate	5.0
4-Chlorophenyl-phenylether	5.0
Fluorene	5.0
4,6-Dinitro-2-methylphenol	25.
4-Bromophenyl-phenylether	5.0
Hexachlorobenzene	5.0
Pentachlorophenol	25.
Phenanthrene	5.0
Anthracene	5.0
Di-n-butylphthalate	5.0
Fluoranthene	5.0
Pyrene	5.0

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Data:

Butylbenzylphthalate	5.0
3,3'-Dichlorobenzidine	10.
Benzo(a)anthracene	5.0
bis(2-Ethylhexyl)phthalate	5.0
Chrysene	5.0
Di-n-octylphthalate	5.0
Benzo(b)fluoranthene	5.0
Benzo(k)fluoranthene	5.0
Benzo(a)pyrene	5.0
Indeno (1,2,3-cd)pyrene	5.0
Dibenz(a,h)anthracene	5.0
Benzo(g,h,i)perylene	5.0
Hexachlorocyclopentadiene	10.
N-Nitrosodiphenylamine	10.
Benzidine	80.
N-Nitrosodimethylamine	10.

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Data:

GLOSSARY OF TERMS

IDL
Instrument Detection Limit
Minimum concentration of analyte that can be measured with 99% confidence that the analyte concentration is greater than zero.

MDL
Method Detection Limit
Minimum concentration of analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. Sample amounts extraction volumes and final volumes are considered in determining MDL.

PQL
Practical Quantification Limit
Concentration of analyte that can be determined precisely and accurately. Sample amounts extraction volumes and final volumes are considered in determining MDL.

TPH
Total Petroleum Hydrocarbons

ppm
Parts Per Million
Equivalent units mg/L, ug/ml and mg/Kg.

ppb
Parts Per Billion
Equivalent units ug/L ng/ml and ug/Kg.

APPENDIX E

REFERENCES

REFERENCES

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