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FINAL CORRECTIVE ACTION PLAN TANK SYSTEM 1489 AND 1508 AIRCRAFT FIREFIGHTER TRAINING FACILITY MILLINGTON SUPPACT TN

11/24/1992

ENSAFE/ALLEN & HOSHALL

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Final Corrective Action Plan
Tank Systems 1489 and 1508
Aircraft Firefighting Training Facility
Naval Air Station Memphis
Millington, Tennessee

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina

CONTRACT N62467-89-D-0318

CTO-026

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November 24, 1992

Response to Comments on the Draft CAP
NAS Memphis Fire Mats
CTO 026

Comment: The introductory portion of this report is unnecessarily lengthy. The introduction has 14 pages while the CAP portion contains only 10 pages. An introduction, informative as it is, is not one of the requirements of the CAPG.

Response: **I believe the information in the CAP introduction is important to the reader. Although the CAP reiterates the EAR findings verbatim in many cases, the reader will have an easier time following this information in one document instead of having to continue to go back and forth between the CAP and EAR.**

Sect. 2.1 Corrective Actions Considered

Comment: Reviewing the CAP, I'm a bit confused about the subsoil conditions at this site.

a. Section 2.1.1 states that soil contamination cleanup levels were not encountered in areas adjacent to the tank beds or in any plume associated with the UST's. The cost data (Appendix A) is also based on the assumption that excavated material is not contaminated, but the Soil Corrective Action of the CAP (Section 2.2.1) proposes to remove all residual soil contamination beneath the UST's that exceed cleanup level. This implies contaminated soil in the tank pit, which conflict with previously made statements.

Response: **The above sentence cited from Section 2.1.1 is out of context. In Section 2.1.1, the sentence states, "Although soil contamination exceeding clean-up levels was not encountered in areas adjacent to the tank bed or in any plumes associated with the USTs, soils directly beneath the tanks may contain levels that exceed TDEC clean-up levels." The cost data within Appendix A does address contaminated soil disposal but only in Note 5 of the cost estimate. In Note 5, the disposal cost is only estimated in unit costs because we have no estimation of how much soil contamination could be present below the tank. Also in Sections 2.1.1 and 2.3, unit cost for soil disposal is addressed. Again, we did not address a volume of soil to be disposed because we have no indication on how much soil beneath the tank is contaminated above action levels.**

We are addressing the possibility of soil contamination existing directly beneath the tank because groundwater contamination was found directly adjacent to the tank pit. If groundwater contamination is present adjacent to the tank, then the tank source must have some residual soil contamination

directly beneath the tank. I contacted Mr. Glen Birdwell at TDEC to discuss our addressing the possibility of soil contamination directly beneath the tank in a soil corrective action section. He agreed with our approach of removing the tank and performing confirmatory sampling.

Comment: b. Per D.5 of EAR, the soil contamination at this site does not exceed TDEC applicable cleanup levels. Per CAPG, if soil contamination exceeding the cleanup levels were not encountered, then per CAPG only Section A needs to be complied with.

If soil contamination does exceed TDEC cleanup level, the CAP shall select and discuss three remediation techniques. Tank removal is recommended support action but not a remedial action.

Response: **I discussed the following approach with Mr. Glen Birdwell of TDEC. Since the tank has not been removed during previous activities, the tank removal will be addressed as a soil corrective action. After tank removal, the soil beneath the tank will be analyzed to ensure that we do not have a source for groundwater contamination. If soil contamination exists above TDEC cleanup levels, then the soil will be removed and disposed of at an industrial landfill. Mr. Birdwell agreed with the above approach and stated that tank removal could be considered a remedial action.**

Comment: 2. Unit cost ($25 per CY) for soil disposal at a landfill appears to be low.

Response: **This quote has been increase to $30 per cubic yard.**

Comment: 3. Required TCLP analysis will cost more than $350 per sample.

Response: **The analytical cost has been increased to $500 per sample. This price is quoted from American Interplex Laboratories located in Little Rock, AR.**

Comment: 4. Total cost for removing UST 1489 ($4650) appears low.

Response: **This cost has been increased to $7056.**

Comment: 5. Total cost for removing UST 1509 ($6450) appears low.

Response: **This cost has been increased to $9744.**

Section 2.1.2 GW Corrective Action

Comment: 1. I consider pump and treat with either activated carbon or a stripping tower as one remedial technique and not two. A third method needs to be selected.

Response: **During my conversation with Mr. Birdwell, he agreed to consider the two options, pump and discharge to POTW and pump and treat with carbon adsorption, as two separate groundwater corrective actions. We both agreed that the only real option for groundwater remediation at this site is some type of pump and discharge or pump and treat option.**

Comment: 2. Under the No Action scenario, CAPG Section A requirements shall be met. They were not included in this CAP.

Response: **I discussed the No Action scenario for groundwater with Mr. William Mann of TDEC. Although the regulations require a site specific standard if the party believes that the site should not be subject to the applicable cleanup standards, I asked Mr. Mann if TDEC would consider No Action as a corrective action given the site conditions at NASMEM (groundwater velocity (0.16-0.21 ft/yr), non-drinking water aquifer, no continual source upon removal of tank, etc.). Because we have included a monitoring schedule for groundwater in the CAP and promised to implement a pump and treat option if groundwater migration occurs at an unexpected faster rate, TDEC agreed to consider No Action as a corrective action thus presently eliminating the need for a site specific standard.**

Appendix B presents the phone log for EnSafe/Allen & Hoshall's conversation with Mr. William Mann of TDEC.

Comment: 3. Monitoring plan: The EAR determined that GW was contaminated. Data on page 17 of CAP supports contamination in GW, therefore, I do not understand the statement on page 18 "If any well shows contamination above the TDEC cleanup levels, groundwater remediation with one of the two treatment options will be implemented.

Response: **The statement on page 18 will be changed to the following, "During monitoring, if any well shows contamination above the TDEC cleanup levels, groundwater remediation with one of the two treatment options will be implemented. This statement is saying that if the groundwater is detected to be migrating offsite, then one of the pump and treat options will be employed.**

Comment: 4. CAPG require a discussion of advantages/disadvantages of each action. Not included in this CAP.

Response: **The advantages/disadvantages have been itemized in text.**

Comment: 5. I consider your pump and treat analysis deficient. The EAR states that hydraulic conductivity is extremely low and that a pump test would immediately drain the well and yet in the CAP you recommend pumping GW at a rate of 5 gpm. The aquifer cannot deliver 5 gpm.

Per contract, slug testing and soil permeability testing was included and absolutely necessary for the pump and treat analysis. In reference to the 5 gpm recommendation, I suggest a thorough reevaluation of the pump and treat recommendation and the GW flow/pump analysis to be part of this CAP. The selection of an alternate remedial method may be a prudent choice.

Response: **I realize that the flowrate of 5 gpm is high given the low hydraulic conductivities. However, assuming a flowrate of 5 gpm gives one a conservative treatment system design. For example, if we selected carbon adsorption and the flowrate is lower than 5 gpm (which should be the case), the life of the carbon adsorption unit will increase dramatically thus decreasing carbon usage. Even if the flowrate is proven to be as low as 0.5 gpm, a groundwater pump and treatment system can be designed. The pumping system would just contain a level control switch in the well to only operate the pump when water is present at a specific level in the well.**

Comment: 6. The criteria for design pg. 19/20 and the cost estimates for both the soil remediation and no action are unsatisfactory. Revised cost estimate to meet requirements of CAPG Sections C.1a-g, C.2.a-g and D.

Response: **The CAP will include a more itemized cost estimate for the soil corrective action option. However, the cost estimate for the No Action option outlined in Table 2-1 is only for monitoring because that is the only line item involved with No Action. I believe that Table 2-1 meets the requirements of C.2.a-g and D.**

Comment: 7. Ditto for air stripping.

Response: **The air stripping option has been removed from the CAP and replaced with groundwater recovery and discharge to the POTW (without treatment)**

Section 2.2 Corrective Action Chosen

Comment: 1. There is no residual soil contamination beneath the UST's. The EAR did not find any. Tank removal is not considered remedial action.

Response: **Please see above response to Comment 2.1.b.**

Comment: 2. The NO ACTION choice will require additional justifications.

Comment: a. Comply with CAPG Section A

Response: **See response to comment 2 of Section 2.1.2.**

Comment: b. A risk assessment may be required by TDEC if No Action is recommended.

Response: **A risk assessment is not required by the CAPG.**

Comment: c. A detailed monitoring plan will be required but is not included in this CAP.

Response: **A detailed monitoring plan is outlined in Section 2.5 of this CAP from the No Action choice.**

Comment: 3. Cost estimate shall be per CAPG, Section C.1a-g and D.

Response: **See response to Comment 6 of Section 2.1.2.**

Comment: 4. Ditto for GW section.

Response: **As comment 2 above states, the No Action choice will require additional justification, this comment states ditto for GW section. The No Action choice is in the groundwater section, therefore I really do not understand your ditto.**

Section 2.3 Corrective Action Plan Costs

Comment: 1. The corrective action plan cost estimate is unsatisfactory. Provide itemized cost date for tank removal, soil removal if any, sampling costs for BTEX, TPH, and TCLP are low, and costs associated with follow up monitoring that will be required with the no action choice. See CAPG Section D. It requires a detailed, itemized etc. cost estimate. It also requires cost data incurred to date etc.

Response: **I will itemize the cost estimate involved with the soil corrective active option. However, the cost estimate for the no action groundwater corrective action option is presented in Table 2-1 in detail and explained in the text on page 21.**

Comment: 2. The statement "If sampling event..." is not sat. There is sufficient experience to know how long it should take.

Response: **The statement has been revised in the final CAP.**

Section 2.4 Proposed Implementation Schedule

Comment: 1. Schedule in Appendix D is not acceptable. There is no way that the activity can budget the $$, develop the scope of work, solicit bids and award the contract to remove the UST's by 7 Dec. 92. I suggest that you and activity personnel get together and come up with a realistic schedule. Does not meet requirements of Section E.

Response: **The schedule will be corrected upon discussion with NASMEM personnel.**

Section 2.5 Monitoring

Comment: 1. The CAP did not address CAPG requirements of Section F.1a-d, F.2a-b, F.3a-b, F.4a-c.

Response: **Only the CAPG requirements of F.1a (possibly d), F.3a-b, and F.4a apply the No Action option. These requirements will be addressed in the final CAP.**

Comment: 2. Is this follow up monitoring part of the tank removal work or is it part of the NO ACTION choice. What are the reporting periods, provide schedule. What is the STATUS REPORT and what should it include?

Response: **The follow up monitoring is part of the No Action option. The reporting periods and schedule are outlined in Section 2.5. We do not have a set format for the status report. The status report will present the findings during monitoring.**

Comment: 3. The statement "active remediation will be employed" does not tell me anything. What will the Station do? Another EAR? Defer actions as part of the RFI?

Response: **The above statement will be revised to state that one of the options, pump and discharge or pump and treat, will be chosen if contamination is found in the site monitoring wells.**

Appendix A

Comment: 1. Cost estimate is not acceptable. It looks more like a list of actions with a cost grand total. An acceptable version would show the cost for each line item. The $11,100.00 is too low.

Response: **The cost estimate will be revised to list itemized costs line by line.**

General Comments

Comment: 1. CAPG Section G requirement was not addressed.

Response: **The CAP has been revised to include a signature page.**

Note: As requested, the cost values utilized to determine cost estimates in the CAP have been attached to these responses.

Costs for No Action Option as Outlined in Table 2-1

Year 1

Analytical

$100/BTX Sample		
$100/TPH Sample		
$200/Sample * 2 Sampling Events * (8 Samples + 5 QA/QC Samples) =		$5200

Labor

2 events * 48 labor hours * $35/hr =	$3360	
40 labor hours * $35/hr =	$1400	
		$4760

Shipping

2 events * $150/event =		$300

Bailers

$150/_____ * 6 bailers =		$900
	Total year 1 =	$11,160

Years 2-5

Analytical — $200/sample * (8 samples + 5 QA/QC Samples) =		$2600
Labor — 88 labor hours * $35/hr =		$3080
Shipping		$150
Bailers		NA
	Total Years 2-5 = $5830/yr =	$23,320

Groundwater Pump and Discharge to POTW Capital

Well Installation	$1700
Grundfos Pump	$1100
Junction Box	$1100
Labor 120 hrs * $35/hr	$4200
Piping and Electrical	$2000
	$10,000

Operation and Maintenance

40 hrs/year * $35/hr =	$1400
Electricity	$500
	$1900 /yr

Carbon Adsorption

Two PC 3	$4000	
Well Installation	$1700	
Grundfos Pump	$1100	
Junction Box	$1100	
Labor 120 hrs * $35/hr	$4200	
Piping and Electrical	$6000	
Carbon Equipment	$500	
Concrete Equipment Pad	$1000	
	$19,600	~ $20,000

Operation and Maintenance

Two carbon Regenerations per year	$2000	/yr
Electrical Costs	$2000	/yr
	$4000	/yr

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1.0 INTRODUCTION

The following is a corrective action plan (CAP) for the underground storage tank (UST) systems 1489 and 1508 at the Aircraft Firefighting Training Facility (AFFTF) of the Naval Air Station (NAS) Memphis (Facility I.D. #9-791683) in Millington, Tennessee. The CAP was prepared following completion of the Environmental Assessment Report (EAR) submitted to the Navy October 12, 1992 by EnSafe/Allen & Hoshall.

In the following sections, the CAP summarizes the EAR's findings, general information concerning the evaluated corrective action options, and detailed specifications and costs for the chosen corrective action.

1.1 Summary Of EAR Findings

The EAR was completed in accordance with the Environmental Assessment Plan (EAP) submitted to the Navy June 4, 1992, by EnSafe/Allen & Hoshall. The findings are presented below.

1.1.1 Site History

The AFFTF has been active since 1949. It consists of east (MAT 305) and west (MAT 392) fire mats on several acres of land in an area designated as solid waste management unit (SWMU) No. 5 for an upcoming RCRA Facility Investigation (RFI). The fire mats are circular, bermed concrete pads with mock aircraft cockpits used in firefighting and pilot rescue drills. During training drills, the cockpits are sprayed with JP-5 jet fuel and ignited. Firefighters extinguish the blaze with high pressure sprays of water or foam. The jet fuel is electrically pumped on demand to the cockpits from USTs via underground piping. Wastewater, fuel, and foam collect in the fire mat drains and are piped to an oil/water separator. The separated fuel is pumped back to fire MAT 305 on demand, and the separated water is discharged to the sanitary sewer.

Fire MAT 305 has three 1800-gallon USTs for storage of JP-5 fuel, while fire MAT 392 has one 5000-gallon JP-5 UST. Previously, the tanks stored JP-4 fuel. A tank tightness test conducted on July 2, 1991, indicated that the west tank (UST 1508) and one of the east tanks (UST 1489) were leaking. The condition of these tanks was reported to the Tennessee Department of Environment and Conservation (TDEC) on July 3, 1991, and the two tanks were taken out of service. The amount of fuel released was not known.

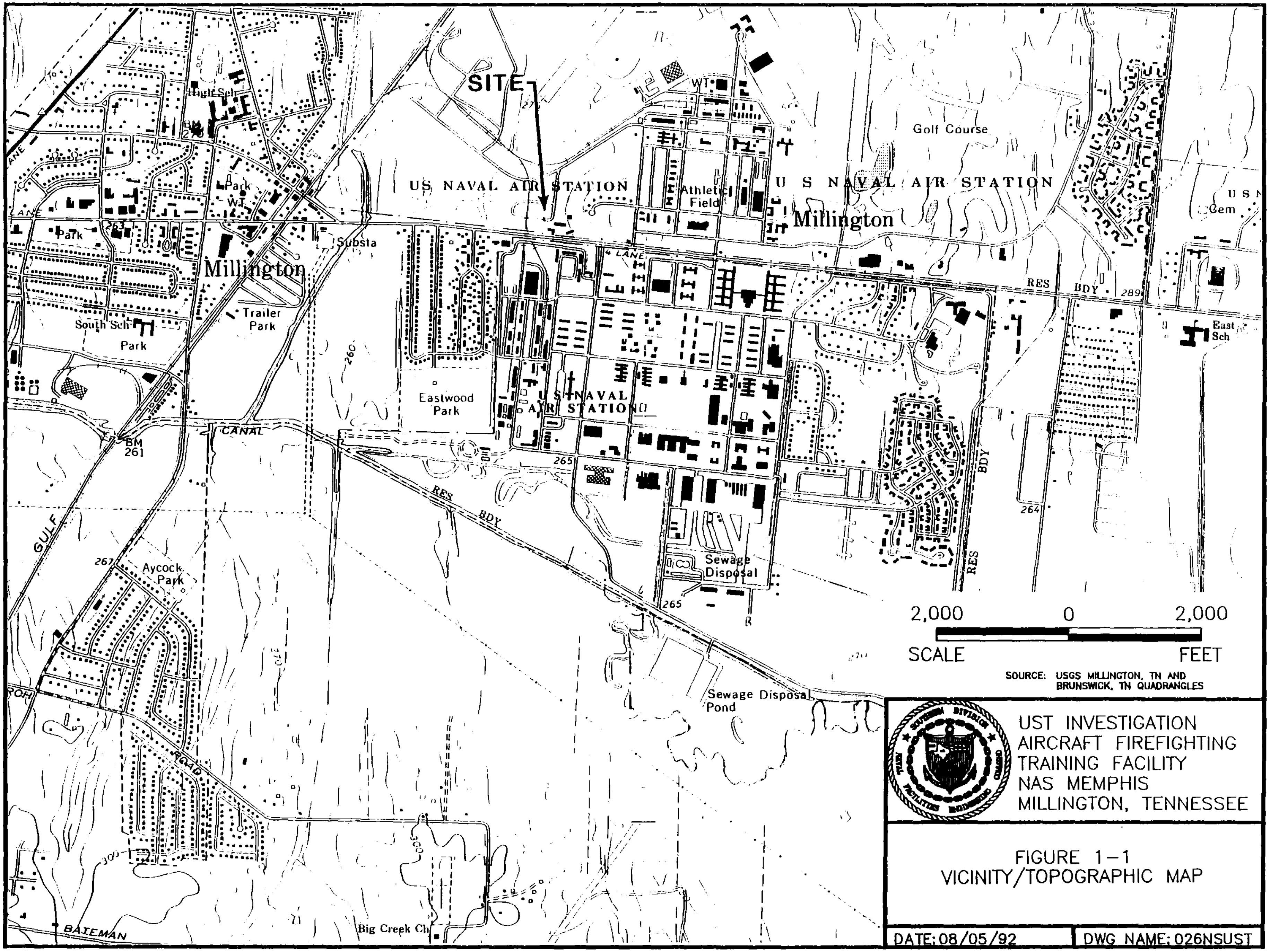
A former firefighting training area exists approximately 120 feet northwest of eastern UST 1489. Controlled fires were extinguished with hand extinguishers. An inactive concrete pit and concrete trough apparently held the fuel that was burned during the operations and discharged waste to nearby drainage ditches.

1.1.2 Site Location and Layout

Figure 1-1 presents a site location map with topography of the site and surrounding area. Figure 1-2 details the site layout of the AFFTF, specifically the subject USTs, utilities, and boring and monitoring well locations.

The site and surrounding area are characterized by rolling, low-relief topography. The site rests upon the flanks of a broad, flat to subtly mounded area which descends slightly to the north and northwest to a lowland occupied by a creek. The site has been partly filled and graded from construction of the fire mats, and partly excavated and bermed for water control and drainage to the creek. The fire mats have been constructed as a broad subtle mound intersected by a drainage ditch. The USTs are located on the lower flanks or lateral ends of this broad mound, east-northeast of MAT 305 and west-northwest of MAT 392.

Surface water flow is directed by topography and drainage ditches toward the northern creek. Groundwater flow would generally follow the influences of north-northwest sloping topography, and of discharge to the creek. However, the mounded fire mats and the potential water recharge



UST INVESTIGATION
AIRCRAFT FIREFIGHTING
TRAINING FACILITY
NAS MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 1-1
VICINITY/TOPOGRAPHIC MAP

DATE: 08/05/92 | DWG NAME: 026NSUST

from firefighting activities may produce a radial influence over the general north-northwest groundwater flow.

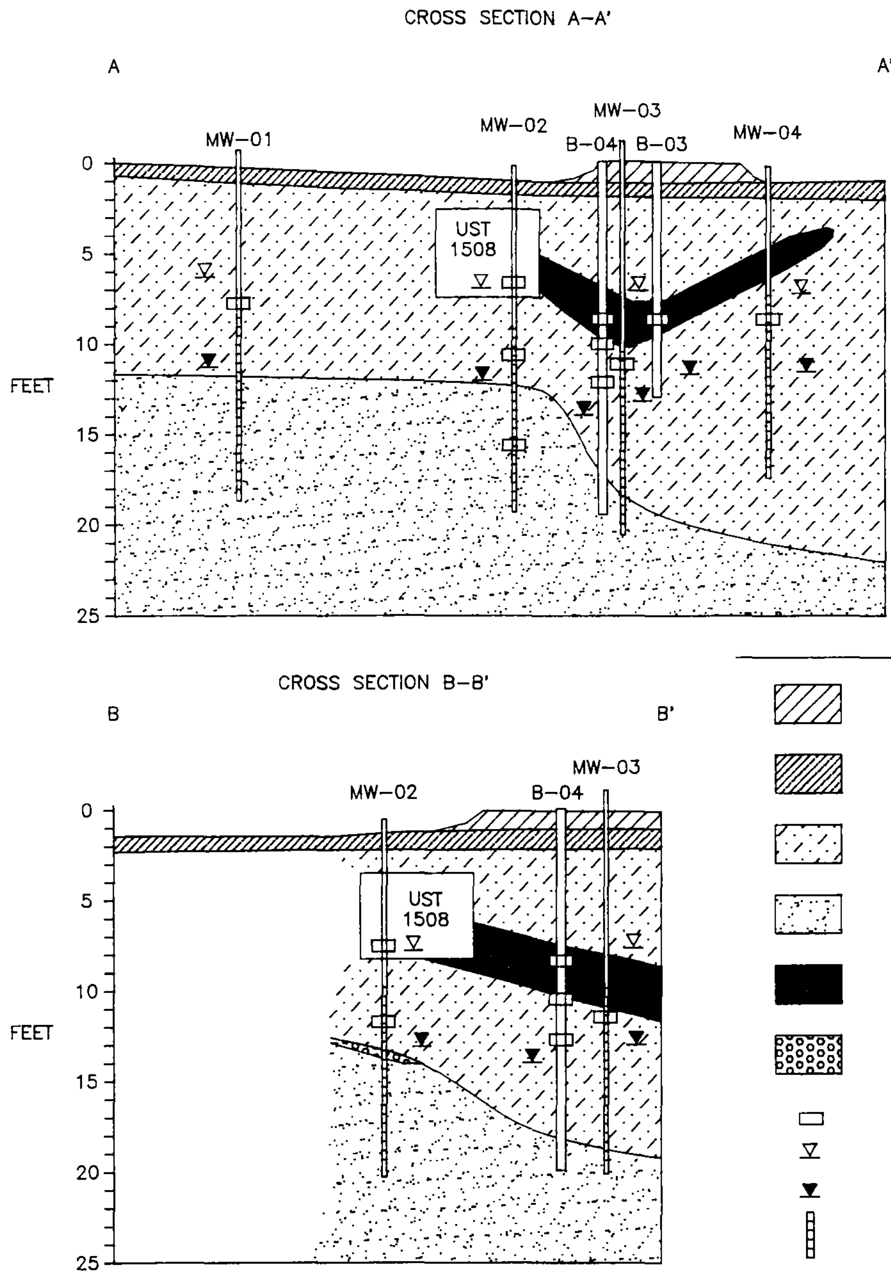
1.1.3 Site Geology

Figure 1-3 presents the location of the cross sections which were utilized to interpret subsurface conditions at the sites. Figures 1-4 and 1-5 present cross sections of the UST 1508 and UST 1489 areas coinciding with their expressed map locations in Figure 1-3. Boring logs, included in Appendix B of the EAR, document the lithology of the soil horizons encountered. In the EAR report, the author used the term "silt and clay" to describe soils with matrices of similar proportions of silt and clay. "Silt" or "clay" used separately refer to soils with only one predominant grain size category.

The shallow geological profile at the site (0 to 20 feet) consists of mottled orange/brown/gray silt and clay with discontinuous horizons and lenses of brown to black organic-rich clay, underlain by similarly mottled or uniform gray silt. The soils correlate with the regional Pleistocene loess deposits. Groundwater was generally encountered at the interface between the underlying silt and overlying silt and clay. This underlying silt acts as a semi-confined aquifer, containing pressurized groundwater. Upon boring into this aquifer, groundwater slowly rises several feet into the open boreholes.

Soil permeabilities of the unsaturated zone and shallow aquifer are very low. Physical soil testing indicates that the unsaturated silt and clay have vertical permeabilities on the order of 10^{-8} to 10^{-7} cm/sec (or 10^{-9} to 10^{-8} ft/sec). Permeabilities of the aquifer silt are assumed to range on the order of 10^{-5} cm/sec (or 10^{-6} ft/sec), as discussed in Section C.3 of the EAR.

For further information regarding regional geology, please refer to Section D.1 of the EAR.



LEGEND

- – FILL
- – TOPSOIL: SILT, SAND AND ORGANICS
- – SILT AND CLAY
- – SILT
- – CLAY
- – SAND, SILT AND GRAVEL
- – LOCATION OF ANALYZED SOIL SAMPLE
- – PIEZIOMETRIC WATER LEVEL IN WELL
- – TOP OF WATER–BEARING ZONE
- – SCREENED INTERVAL IN WELL

30 0 30
SCALE FEET

NOTE: WATER LEVELS IN WELLS ARE HIGHER THAN WHEN ORIGINALLY ENCOUNTERED UNDER SEMI–CONFINED CONDITIONS.

STRATIGRAPHIC LOG FOR B–03 IS INCONSISTENT WITH GENERAL STRATIGRAPHY. DISCREPANCIES IN THIS BORING HAVE BEEN OMITTED.

UST INVESTIGATION
AFFTF USTS
NAS MEMPHIS
MILLINGTON, TN.

FIGURE 1–4
GEOLOGICAL CROSS SECTIONS
UST 1508

DATE: 10/08/92 | DWG NAME: 026CRS2

1.1.4 Site Hydrogeology

Soil borings and well logs in the vicinity of the site indicate that the uppermost stratigraphic units encountered to depths of 20 to 50 feet are soft, pliable, brown and gray clay, silt and clay, and silt. Groundwater occurs under semi-confined conditions in the silt beds capped beneath clays or silty clays. Groundwater was typically encountered at 9 to 12 feet, but rose in monitoring wells to about 3 to 6 feet below ground surface.

Horizontal groundwater flow direction is depicted by the potentiometric maps presented in Figures 1-6 and 1-7. The data used in developing these maps were collected on July 8, July 27, and August 6, 1992. As shown in the figures, horizontal groundwater flow in the vicinity of western UST system 1508 is to the northwest from upgradient well MW-01 through UST bed MW-02, to downgradient well MW-04 toward a stream channel in the woods. Groundwater in the vicinity of eastern UST system 1489 flows to the north from the area of upgradient well MW-05, through MW-06 and UST bed MW-11, to downgradient wells MW-07, MW-09, and MW-10 where the flow bends to the northwest apparently controlled by the channelized stream.

1.1.5 Nature and Extent of Contamination

Soils

Soil contamination exceeding clean-up levels was not encountered at the tank beds or in any plumes associated with the USTs. Sitewide, only one value exceeding clean-up levels was encountered (MW-08; 3,300 ppm GRO; Figure 1-8). This finding is because the applicable clean-up criteria reflect the site's low contaminant migration potential due to very low permeabilities, and the unsuitability of the groundwater as a potential drinking water supply. However, moderate levels (below clean-up levels) of soil contamination occur over large portions of the site.

The spatial distribution of soil contamination at the AFFTF was determined by studying analytical results in terms of variabilities in area and depth. The objective was to determine the zones of contamination attributable to the USTs, to identify other zones attributable to separate sources and eliminate these zones from consideration in delineation of a UST plume.

The EAR concluded that soil contamination at MW-08 resulted from past operations at the former firefighting area and concrete pit, not from UST 1489. Contaminant concentrations are high, but UST program regulations do not apply to this area. This contamination will be further investigated during the RFI.

Groundwater

As discussed in Section C.7 of the EAR, groundwater GRO and BTX contamination have been detected in monitoring wells MW-02 and MW-11 of the UST beds, MW-06 by the oil/water separator, and MW-07 and MW-08 around the abandoned concrete firefighting pit. Soil analytical data (discussed in Section D of the EAR) and groundwater flow patterns support the conclusion that MW-06, 07, and 08 contamination are from sources other than the USTs, and hence are not part of a UST-derived groundwater plume. MW-02 and MW-11 indicate groundwater contamination at each of the UST beds, but their immediately downgradient wells are reported as non-detect. Therefore, the UST-derived contaminant plumes are believed to be confined to their respective tank beds and no further than the immediate surroundings. The limited nature of groundwater plumes at the site is logical based on the extremely low permeabilities of aquifer soils.

Figure 1-9 presents the levels of groundwater contamination for benzene and GRO in map view. Contamination contours were not applicable due to the single point registers of both UST-derived contaminant plumes.

2.0 CORRECTIVE ACTION PLAN (CAP)

This CAP will provide general information concerning the corrective actions that were evaluated and the detailed specifications and costs for the corrective action options which were chosen. This section of the CAP was completed upon review of the contaminant plumes outlined in the EAR.

2.1 Corrective Actions Considered

2.1.1 Soil Corrective Action

Although soil contamination exceeding clean-up levels was not encountered in areas adjacent to the tank bed or in any plumes associated with the USTs, soils directly beneath the tanks may contain levels that exceed TDEC clean-up levels. Soil beneath the tank is expected to be contaminated because the underlying groundwater is contaminated. In many cases, the leaked fuel may follow from the leak down the outer surface of the tank and percolate into the soil beneath the tank's bottom.

The soil corrective action will involve removing both USTs because neither UST 1508 nor UST 1489 has been removed during previous investigative activities. Once the tanks have been removed, confirmatory sampling will be performed for BTX and TPH (GRO). If groundwater is encountered in the excavation pit, then groundwater samples will be collected and soil samples will be collected directly above the groundwater level on the side of the pit. If contamination is detected above TDEC clean-up levels, the pit area will be overexcavated until contamination exceeding cleanup levels is removed. If contaminated soil requires disposal to a permitted industrial landfill, the unit cost for transportation and disposal is $30 per cubic yard. The analytical samples required for disposal will be $500 per sample.

UST 1489 is adjacent to two other 1800-gallon USTs which are positioned within the same pit. During removal of UST 1489, the adjacent tank must be shored to prevent the tank from rolling into the excavated area. The total estimated cost for removing UST 1489 is $7056. This cost is based upon excavation of soils and shoring, tank removal and disposal to a permitted industrial landfill, confirmatory analytical costs, backfilling, and site restoration.

An approximate 6'x10' concrete pad is situated on the ground surface above UST 1508. This pad must be moved before the tank can be removed. A pump control panel is on top of the pad. These controls along with a new concrete pad must be relocated. Once the pad has been moved, UST 1508 will be removed. The total estimated cost for removing UST 1508 is $9744. This cost is based upon excavation of soils and concrete pad removal/replacement, replacement of pump control panel, tank removal and disposal to a permitted industrial landfill, confirmatory analytical costs, backfilling, and site restoration.

Appendix A presents a detailed cost estimate for removal of both tanks.

2.1.2 Groundwater Corrective Actions

Groundwater contamination in the general vicinity of USTs 1508 and 1489 is from multiple sources. The extent to which the USTs contributed to the overall contamination in this area is believed to be confined to their tank beds and no further than the immediate surroundings. The limited nature of groundwater plumes at the site is logical based on the extremely low permeabilities of aquifer soils. A more detailed discussion of the results from this groundwater monitoring program can be found in the EAR.

Based upon water use and analytical data, the shallow groundwater in the vicinity of the site is classified as non-drinking water. Current groundwater concentrations of benzene and TPH (GRO) at the tank beds are compared to cleanup levels presented below.

	Result for MW-02 at UST 1508 (ppb)	**Results for MW-11 at UST 1489 (ppb)**	**Cleanup Levels (ppb)**
Benzene	350	130	70
TPH (GRO)	1,200	420	1,000

Three technologically feasible and reliable corrective action options were considered to fully remediate petroleum-contaminated groundwater to the applicable cleanup levels mentioned above. These options include the following:

- No Action
- Groundwater Recovery with Direct Discharge to the POTW
- Activated Carbon Adsorption (Pump and Treat)

No Action - In the no action scenario, the tanks and any contaminated soil will be removed, thus eliminating the source of contamination. In this scenario, the petroleum-contaminated groundwater will not be actively remediated. The contaminated groundwater plume would continue to move in the direction of groundwater flow. Because the soil permeability in the area of the tanks is very low, the migration of contaminants would be minimal. As mentioned in the EAR, the calculated groundwater flow rates in the area of USTs 1508 and 1489 are 0.21 ft/yr and 0.16 ft/yr, respectively.

The TDEC was contacted to discuss the no action option and whether the State would consider this option as a groundwater corrective action. Because EnSafe/Allen & Hoshall agreed to include a monitoring schedule for groundwater in this CAP and promised to implement a pump and treat option if groundwater migration occurred at a faster rate than expected, TDEC agreed to consider no action as a corrective action. Appendix B contains the phone log presenting the conversation.

Onsite wells will be monitored to ensure that no offsite groundwater migration occurs at levels above TDEC groundwater cleanup levels. For the two UST areas, the following wells and pits will be monitored.

UST 1489 Area	**UST 1508 Area**
MW-05 (Background Well)	MW-01 (Background Well)
MW-11 (Tank Pit)	MW-02 (Tank Pit)
MW-10	MW-03
MW-07	MW-04

The monitoring schedule for all wells and associated costs are described in Section 2.5. During monitoring, if any downgradient well shows contamination above the TDEC cleanup levels, groundwater remediation with one of the two treatment options discussed below will be implemented to prevent further contaminant migration.

Groundwater Recovery with Direct Discharge to the POTW - Groundwater will be recovered through the use of a single recovery well as discussed in the previous section. Because of the relatively low flow volume (< 0.5 gpm) expected during pumping, it may be possible to pump and discharge untreated water to the sanitary sewer. The estimated low flow is based upon the aquifer characteristics at the AFFTF site. If a discharge permit is required and obtained from the City of Millington, the water will be discharged directly to the oil/water separator onsite. If a discharge permit can be obtained only if the contaminated groundwater is treated prior to discharge, a treatment system such as carbon adsorption must be employed. The advantages of this option are no groundwater treatment and the prevention of further groundwater migration. The disadvantages are capital and O&M costs associated with the pumping system.

The estimated capital cost for the groundwater recovery system is $10,000. This cost includes the groundwater recovery well installation, one groundwater recovery pump, piping and electrical, and engineering labor. The operation and maintenance cost for the system is approximately $1900/year, based upon labor and utility costs and groundwater monitoring for five years.

Activated Carbon Adsorption - For this option, groundwater will be removed by the use of groundwater recovery wells, treated with carbon adsorption, and discharged to the POTW. Because of the isolated area for both tanks, only one well for each UST should be needed. For purposes of designing the two treatment units, an estimated flowrate of 5 gpm will be used. According to the aquifer characteristics, a more realistic flowrate of < 0.5 gpm is expected. However, assuming a higher flowrate will produce a conservative design for the activated carbon adsorption system. If a flowrate less than 5 gpm is observed, the unit's efficiency will be longer due to smaller organic loadings. Before the pump and treat system is implemented, an aquifer yield test will be performed to ensure proper system design.

For treated water discharge, the AFFTF has an oil/water separator onsite that is utilized in treating the wastewater generated from the firefighting training activities. The effluent from the oil/water separator is discharged to the city of Millington's publicly owned treatment works (POTW). As stated in the previous option, the CAP proposes to discharge the treated groundwater to the oil/water separator upon approval from the Public Works Offices at NAS Memphis and the city of Millington. If approval is denied, disposal of treated groundwater may be achieved onsite to surface water (NPDES permit required).

Carbon adsorption is a process in which granular activated carbon, from lignite, bituminous coal, lignin, or petroleum product, is used to remove organic compounds from contaminated water. The contaminated water flows through a packed column of granular activated carbon where the organic compounds are removed by physical or chemical adsorption. Physical adsorption works by forming molecular condensation in the capillaries of the solid, whereas chemical adsorption requires formation of a monomolecular layer of the contaminant on the surface through forces of residual valence of the surface molecules. Carbon adsorption may be applied to liquid phase or vapor-phase organic materials.

Carbon adsorption treats contaminated liquid and vapor-phase volatile organics effectively and reliably. In addition, the process of retrieving the groundwater retards the migration of contaminants. The advantages of carbon adsorption are that this type of system is readily available and implementable, and the capital cost is less or comparable to other organic removal systems. The disadvantages of carbon adsorption are materials handling of spent carbon, inorganic plugging of filters (iron and manganese), suspended solid plugging of filters, high organic concentrations deplete the carbon source quickly thus increase the material handling and carbon regeneration costs.

Cost - The criteria used to design and estimate the cost of implementation is shown below.

<u>Design Criteria</u>
Q= 5 gpm
Influent BTX= 350 ppb (1508), 130 ppb (1489)
Effluent BTX= 23 ppb (1508), 9 ppb (1489)

The estimated capital cost for the carbon adsorption treatment system is $20,000. This cost includes two PC 3 carbon adsorbers, equipment freight, replacement carbon, two pumps, piping and electrical, engineering labor, and well installation. The operation and maintenance cost for carbon adsorption is approximately $4000/year which is based upon electrical and carbon regeneration. This cost is for remediating both the UST 1489 area and the UST 1508 area. Appendix C presents the specifications for the carbon adsorption unit.

2.2 Corrective Actions Chosen

2.2.1 Soil Corrective Action

Since USTs 1508 and 1489 have not been removed in previous work, the CAP proposes to remove both tanks and any residual soil contamination beneath the USTs that exceeds clean-up levels. This action is to eliminate the source of groundwater contamination and the possibility for future releases of BTX and TPH (GRO). The tank and soil exceeding clean-up levels will be transported to a permitted industrial landfill.

2.2.2 Groundwater Corrective Action

The corrective action chosen to address groundwater contamination is the no action" alternative. As previously discussed, the soil permeability is very low and the contaminated groundwater plume should not travel an appreciable distance over time. The direction of groundwater flow is to the northwest toward a channelized stream. This stream is approximately 168 feet from UST 1508 and 270 feet from UST 1489. Due to low groundwater flow velocities, the plume will take an extended period of time to reach the stream from the existing contaminated areas. During this time, natural attenuation of the contaminants will also occur, thereby decreasing the size of the contaminant plume. While the no action scenario does not actively remediate the contaminated groundwater, it is a feasible approach because the contaminants are not exposed directly to humans and wildlife, thus diminishing any potential harm to human health or the environment.

Another reason that the no action option appears to be more feasible than pump and treat is the impermeable soil in this area. The "tight" soils will minimize the pump and treat system's ability to achieve substantial and continuous flow rates, rendering the system inefficient. Although no active remediation is occurring in the no action option, monitoring should detect offsite contaminant migration if it occurs.

2.3 Corrective Action Plan Costs

As stated before, the estimated cost for removing UST 1489 is $7056, and the estimated cost for removing UST 1508 is $9744. Both of these costs are based upon excavation of soils, tank removal and disposal to a permitted industrial landfill, confirmatory analytical costs, backfilling, and site restoration. If contaminated soil requires disposal to a permitted industrial landfill, the unit cost for transportation and disposal is $30 per cubic yard. The analytical samples required for disposal will be $500 per sample.

The cost for groundwater monitoring is the only cost associated with the chosen corrective action for groundwater, no action. The monitoring will be in accordance with the monitoring schedule presented in Section 2.5.

The cost is outlined in Table 2.1 below. The analytical cost is based upon $100/sample for BTX and $100/sample for TPH (GRO) and performing the sampling and analysis in accordance with NEESA Level C protocol. The sampling event should take approximately two days, therefore five QA/QC samples will be required with the groundwater samples. The sampling labor cost is based upon two geologists performing the sampling and utilizing 48 total labor hours at $35.00/hour per event. The estimated labor cost for the completion and submission of status reports was based upon 40 hours at $35.00/hr. The labor costs outlined in Table 2.1 include labor for sampling and status reports. Six Teflon bailers at $150/bailer will be purchased and dedicated to six of the eight wells. Teflon (rather than PVC) bailers are specified so the wells can also be used for the RFI. The remaining two wells already have dedicated bailers due to previous and future RFI work.

Table 2-1
Costs for No Action Option

Item	Monitoring Year				
	1*	2**	3**	4**	5**
Analytical	$5200	$2600	$2600	$2600	$2600
Labor	$4760	$3080	$3080	$3080	$3080
Shipping	$300	$150	$150	$150	$150
Bailers	$900	--	--	--	--
Subtotal	$11160	$5830	$5830	$5830	$5830
Total (1-5)	**$34,480**				

Notes:

* - Two Sampling Events for Year 1.
** - One Sampling Event for Years 2-5.
-- - Purchase of Bailers (First Year Only).

2.4 Proposed Implementation Schedule

The proposed implementation schedule is located in Appendix D.

2.5 Monitoring

After the tank and contaminated soils (if present) have been removed, the wells listed below will be monitored to determine additional migration of contaminants. Groundwater samples will be analyzed for the TDEC-required parameters of benzene/toluene/total xylenes (BTX) and TPH (GRO). For the UST 1489 area, MW-5 (background well), MW-11 (tank pit), MW-10, and MW-7 will be monitored. For the UST 1508 area, MW-1 (background well), MW-02 (tank pit), MW-03, and MW-04 will be monitored. Groundwater samples from each of these wells will be taken semi-annually for one year and annually for the next five years. These samples will be collected during the first one-third of the reporting period.

The analytical results from the monitoring, a status report of the conditions at the site, and a description of the progress and any problems which have been encountered will be submitted within 15 days of the end of the reporting period. Within Table 2.1, the outlined labor costs include labor required for sampling the before stated wells and labor required for completing and submitting status reports. The estimated labor cost for completion and submission of status reports was based upon 40 hours per report at $35.00 per hour. For labor required for sampling, two geologists ($35/hr/geologist) will require 48 hours.

If the results of the groundwater monitoring indicate that appreciable migration of contaminants is occurring (to be determined by the TDEC), either the pump and discharge or the pump and treat option will be employed. If migration is not detected from monitoring, after the five-year period, the results will be evaluated and a determination of discontinuing monitoring will be requested from TDEC.

2.6 Signature Page

I, the undersigned, do hereby affirm that the information contained in this report is accurate and correct to the best of my knowledge and belief.

______________	______________	______________
Name and Title	Date	License Number

____
Signature

______________	______________	______________
Name and Title	Date	License Number

____
Signature

Appendix A

Cost Estimate
for
USTs 1489 and 1508
Removal

COST ESTIMATE
UNDERGROUND STORAGE TANK(S) REMOVAL
NAS MEMPHIS AFFTF

Removal of the following underground storage tanks:

(1) 1,800 gallon, JP-5, Steel Tank
(1) 5,000 gallon, JP-5, Steel Tank

***State Notification and Permitting**
-Prepare and submit a 30-day closure notification form to the Tennessee Department of Environment and Conservation (TDEC).
-Prepare site Health and Safety Plan.

***Site Preparation**
-Excavate to the top of the tank(s).
-Drain product from piping, flush and cap piping.
-Remove fill pipe, submersible pumps (if applicable), and other tank fixtures. Vent lines will be left in place and tank openings will be temporarily plugged.

***Vapor Purging**
-Using dry ice the UST(s) will be purged of vapors following API 1604 procedures.
-Monitor the UST and excavation for vapors using Combustible Gas Indicator.

***UST(s) Removal**
-Prior to removal, all accessible holes will be capped with the exception of a 1/8-inch vent hole.
-Remove the tank(s) from the ground and secure the tanks prior to transportation.
-Brace other tanks located within the same tankpit as the 1,800 gallon UST.
-Inspect tank(s) for possible holes or fractures.
-Excavated material will be placed on and covered with visqueen until waste characterization can be perform. A berm will also be constructed around stockpile to prevent washoff.
-Barricade excavation.

***Pump Controls Relocation**
-Relocate pump controls and concrete slab for 5,000 gallon UST. Electrical work will be performed by a licensed electrician.

***Soil/Water Sampling**
-Soil samples will be collected from each corner of the excavation(s).
-If encountered, groundwater samples will be collected.
-Composite soil samples will be collected from the excavated material.
-Each sample will be submitted to a State approved laboratory and analyzed for Gasoline and Diesel Range Organics.

***Tank Transportation and Disposal**
-Each tank will be labeled prior to transportation.
-Tanks will be taken to a disposal facility and destroyed according to API 1604 procedures.
-A Certificate of Disposal will be provided.

***Backfilling of Excavation**
-Provided laboratory analysis indicate that levels of contaminants found in excavated material are below State action levels, excavated material will be used to backfill the excavation(s).
-The remaining pit area will be backfilled with suitable backfill material (sand or soil).

***Final Closure Report**
-A final closure report will be submitted with all required documentation to the TDEC.

Estimated Costs for the above are as follows:

Permitting	$500.00
Site Preparation	$2000.00
Vapor Purging	$1000.00
UST(s) Removal	$3500.00
Pump Controls Relocation	$3000.00
Laboratory Analysis (14 samples for Gasoline and Diesel Range Organics)	$3000.00
Tank(s) Transportation and Disposal	$2000.00
Backfilling of Excavation	$1500.00
Final Closure Report	$300.00

Total $16,800.00

NOTE:

1) Estimate assumes tanks will be empty
2) Estimate assumes excavated material is not contaminated
3) Estimate assumes both USTs are removed during the same event
4) Estimate assumes no resurfacing
5) Soil disposal costs would be $30/cubic yard plus $500 for each sample characterization

Appendix B

Phone Log

RECORD OF ☐ VISIT ☐ CONFERENCE OR ☑ TELEPHONE CALL

TIME: 8:50 Am

DATE: 10-2-92

NAME(S) OF PERSON(S) CONTACTED OR IN CONFERENCE AND LOCATION: William MANN, TDEC 543-6695

COPIES TO:

SUBJECT: NAS Memphis USTs 1489 And 1508 CAP

FILE:

DIGEST

I called William Mann regarding the NAS Memphis CAP. EnSafe/Allen + Hoshall wants to do "No Action" for groundwater at the aforementioned site. I called Mann to determine if TDEC would acknowledge "No Action". The groundwater contamination is above cleanup levels but only in wells directly adjacent to the UST pit area. I propose to remove the UST and residual soil contamination, backfill, and monitor to determine if groundwater moves during the next year. Mr Mann said that ~~to~~ the alt. sounded good to him and TDEC would consider this option.

CONCLUSION, ACTION TAKEN, OR REQUIRED

TDEC agrees to consider "No Action" as an alternative presented in the CAP.

DATE: 10-2-92

ORIGINATOR: [signature]

Environmental and Safety Designs, Inc.

FORM1

EnSafe(SM)

5705 STAGE RD. MEMPHIS, TN. 38134 #(901)372-7962

Appendix C

Carbon Adsorption Unit Specifications

CARBONAIR

To: Ms. May Mishu

October 8, 1992
Proposal Number:202399

Carbonair STAT 30 Sieve Tray Aeration Technology

Equipment Description

- One Carbonair STAT 30 Air Stripper
- 3 ft. long x 1 ft. wide
- number of aeration trays: 1
- total height: 8 feet maximum
- #304 stainless steel welded construction
- 2 HP, 230/460 V, 3 ph blower motor
- gravity discharge

Technical Specifications - 350 ppb

Critical compound	benzene
Influent concentration	350 ppb
Effluent concentration	23 ppb
Liquid flow rate	5 gpm
Air flow rate	100 cfm
Water temperature	55°F
Air-to-water ratio	150:1

Technical Specifications - 130 ppb

Critical compound	benzene
Influent concentration	130 ppb
Effluent concentration	9 ppb
Liquid flow rate	5 gpm
Air flow rate	100 cfm
Water temperature	55°F
Air-to-water ratio	150:1

Controls, consisting of:

Control panel, model No. STAT Control System

HOA switch for blower
Blower pressure failure switch
Main disconnect
High sump alarm shutdown/light
Motor starters with overload protection
Alarm reset button
NEMA 3R enclosure
Contacts for upstream/downstream disable

Accepted for Purchaser:

____
(Name/Title)
Date: ______________________________

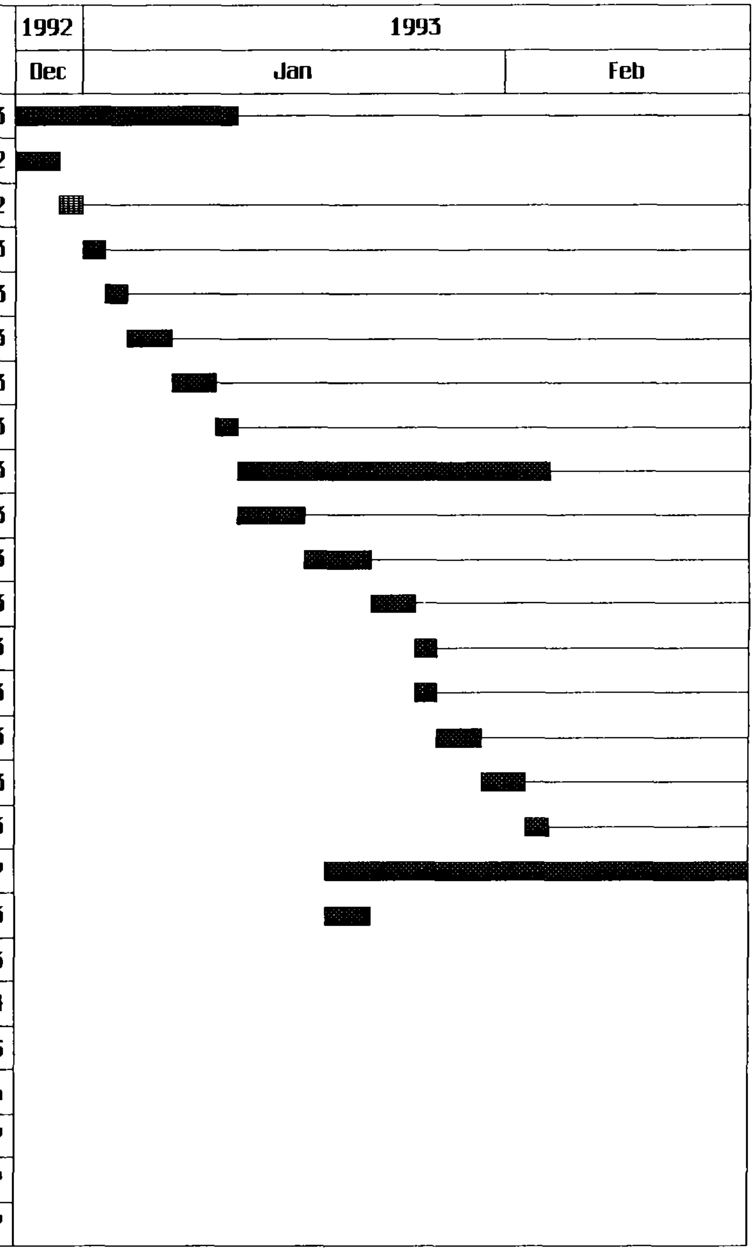
Appendix D

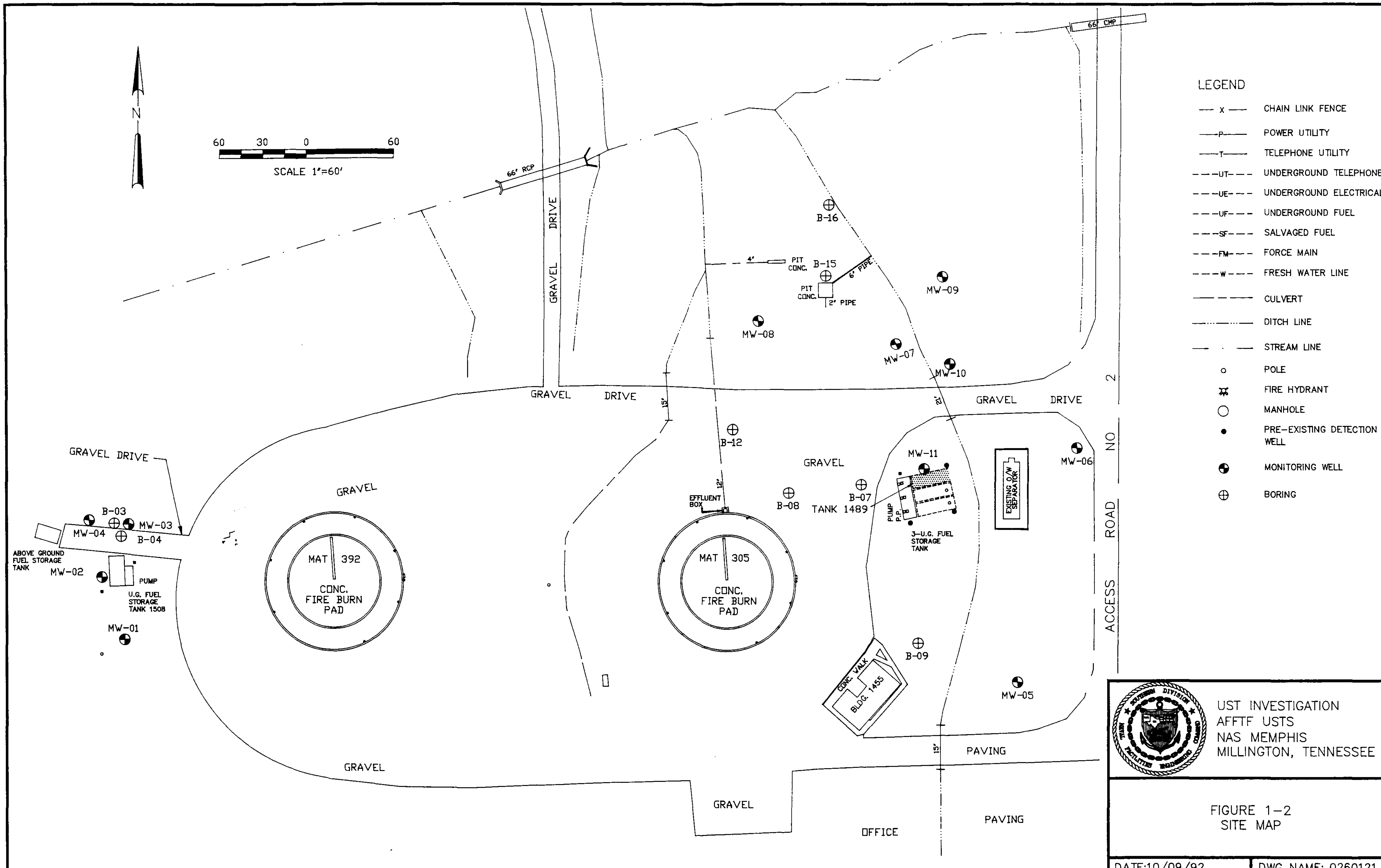
Proposed CAP Implementation Schedule

PROPOSED IMPLEMENTATION SCHEDULE FOR USTs 1489 AND 1508

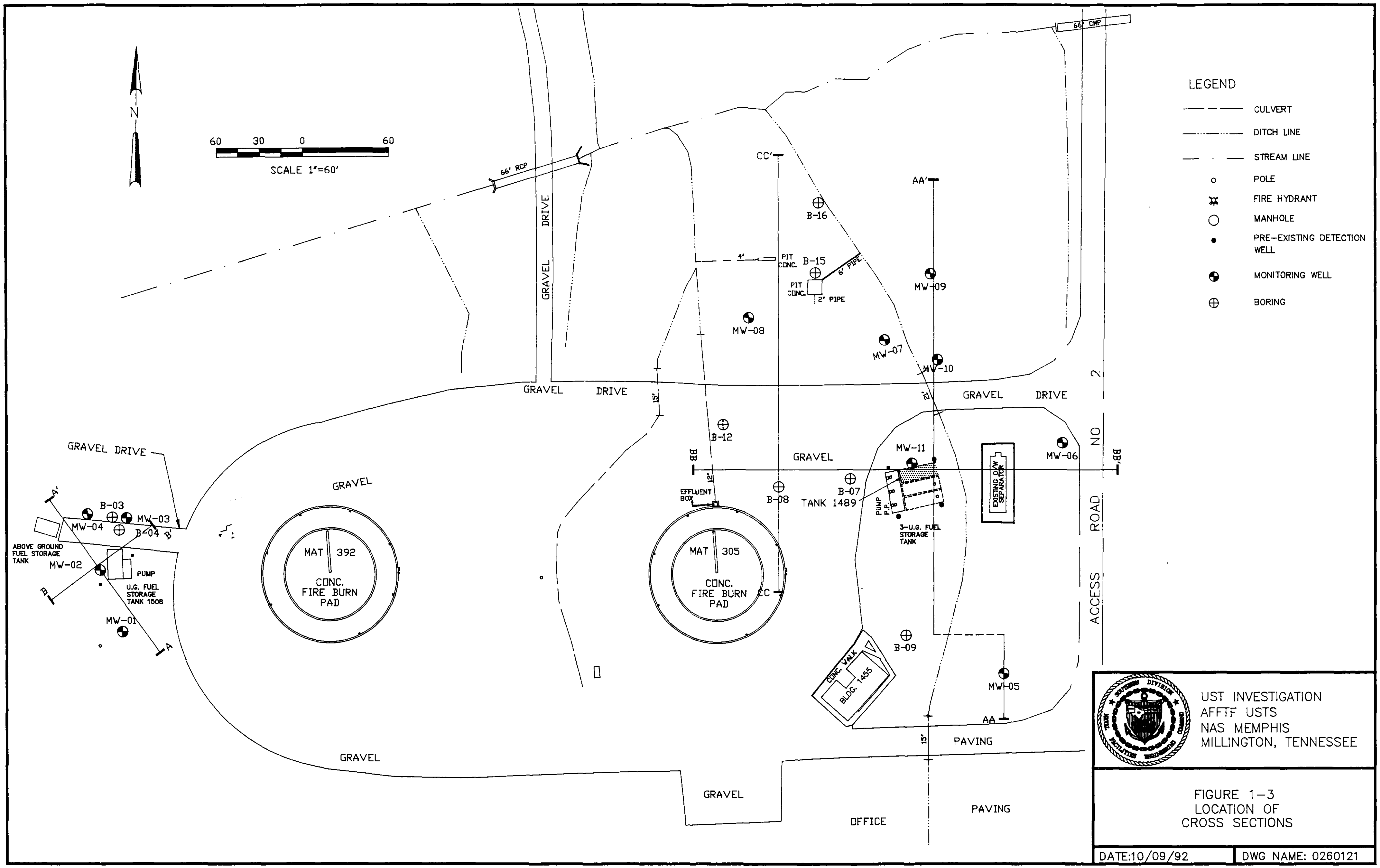
NAS MEMPHIS, MILLINGTON, TN

Task Name	Start Date	End Date
REMOVAL OF UST 1489	28-Dec-92	12-Jan-93
Excavate Soil	28-Dec-92	29-Dec-92
Place Shoring	30-Dec-92	30-Dec-92
Remove Tank	4-Jan-93	4-Jan-93
Confirmatory Sampling	5-Jan-93	5-Jan-93
Soil Disposal (if needed)	6-Jan-93	7-Jan-93
Backfilling	8-Jan-93	11-Jan-93
Site Restoration	12-Jan-93	12-Jan-93
REMOVAL OF UST 1508	13-Jan-93	2-Feb-93
Remove Control Panel	13-Jan-93	15-Jan-93
Remove Concrete Pad	19-Jan-93	21-Jan-93
Excavate Soil	22-Jan-93	25-Jan-93
Remove Tank	26-Jan-93	26-Jan-93
Confirmatory Sampling	26-Jan-93	26-Jan-93
Soil Disposal (if needed)	27-Jan-93	28-Jan-93
Backfilling	29-Jan-93	1-Feb-93
Site Restoration	2-Feb-93	2-Feb-93
GROUNDWATER MONITORING	20-Jan-93	21-Apr-97
First Round Sampling	20-Jan-93	21-Jan-93
Second Round Sampling	30-Jul-93	2-Aug-93
Third Round Sampling	16-Feb-94	17-Feb-94
Fourth Round Sampling	8-Mar-95	9-Mar-95
Fifth Round Sampling	28-Mar-96	29-Mar-96
Sixth Round Sampling	18-Apr-97	21-Apr-97
GROUNDWATER DATA REVIEW	29-Apr-97	12-May-97
GROUNDWATER MONITORING REPORT	13-May-97	27-Jun-97



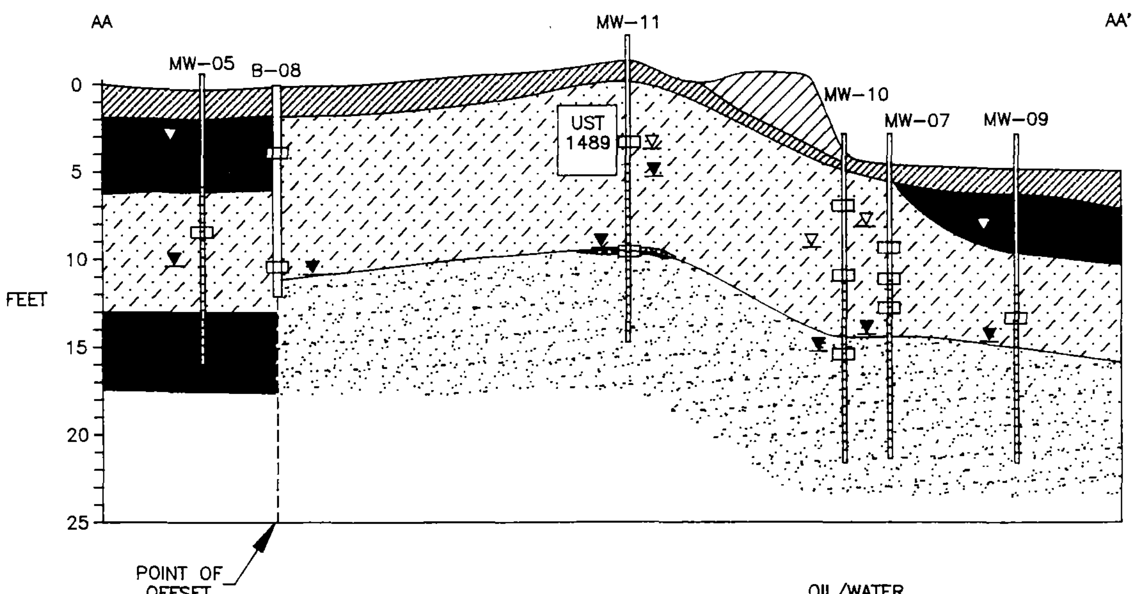

N
60 30 0 60
SCALE 1"=60'
66" RCP
66" CMP
GRAVEL DRIVE
GRAVEL DRIVE
GRAVEL DRIVE
GRAVEL DRIVE
GRAVEL
GRAVEL
GRAVEL
GRAVEL
PAVING
PAVING
OFFICE
ACCESS ROAD NO 2
B-16
4"
PIT CONC.
B-15
6" PIPE
PIT CONC.
2" PIPE
MW-09
MW-08
MW-07
MW-10
15'
21'
B-12
12'
EFFLUENT BOX
B-08
B-07
TANK 1489
MW-11
PUMP P.P.
3-U.G. FUEL STORAGE TANK
EXISTING O/W SEPARATOR
MW-06
B-03
MW-04
MW-03
B-04
ABOVE GROUND FUEL STORAGE TANK
MW-02
PUMP
U.G. FUEL STORAGE TANK 1508
MW-01
MAT 392
CONC. FIRE BURN PAD
MAT 305
CONC. FIRE BURN PAD
B-09
CONC. WALK
BLDG. 1455
MW-05
15'
LEGEND
CHAIN LINK FENCE
POWER UTILITY
TELEPHONE UTILITY
UNDERGROUND TELEPHONE
UNDERGROUND ELECTRICAL
UNDERGROUND FUEL
SALVAGED FUEL
FORCE MAIN
FRESH WATER LINE
CULVERT
DITCH LINE
STREAM LINE
POLE
FIRE HYDRANT
MANHOLE
PRE-EXISTING DETECTION WELL
MONITORING WELL
BORING
UST INVESTIGATION
AFFTF USTS
NAS MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 1-2
SITE MAP
DATE:10/09/92
DWG NAME: 0260121

0046166012



00461 668 022

CROSS SECTION AA–AA'



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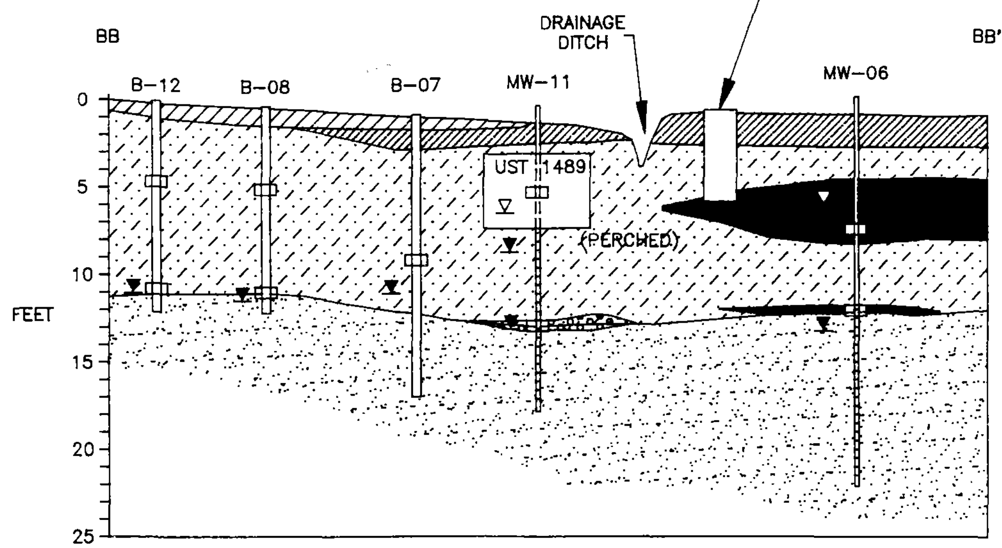

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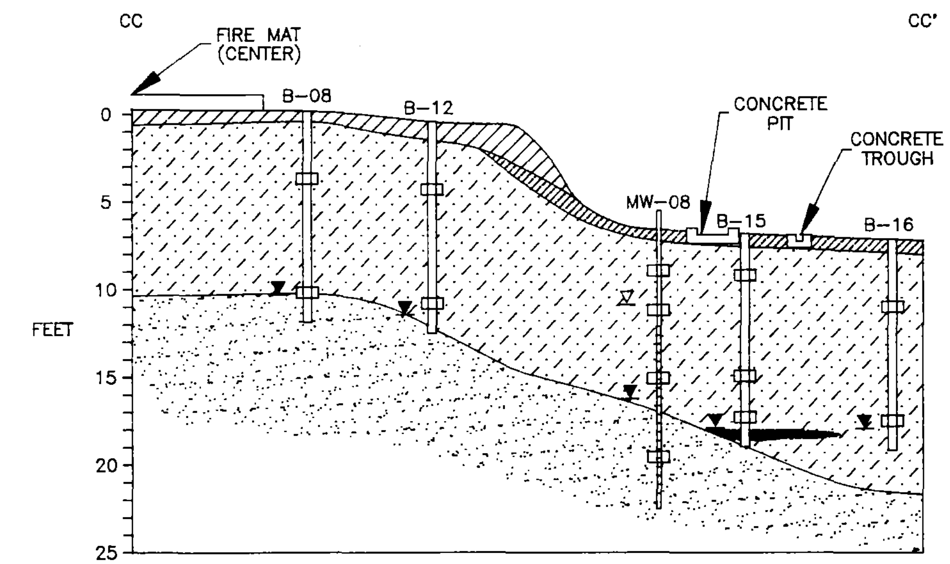


LEGEND

- – FILL
- – TOPSOIL: SILT, SAND AND ORGANICS
- – SILT AND CLAY
- – SILT
- – CLAY
- – EXTREMELY HARD, COMPACT SILT AND CLAY
- – LOCATION OF ANALYZED SOIL SAMPLE
- – PIEZIOMETRIC WATER LEVEL IN WELL
- – TOP OF WATER–BEARING ZONE
- – SCREENED INTERVAL IN WELL

SCALE 60 0 60 FEET

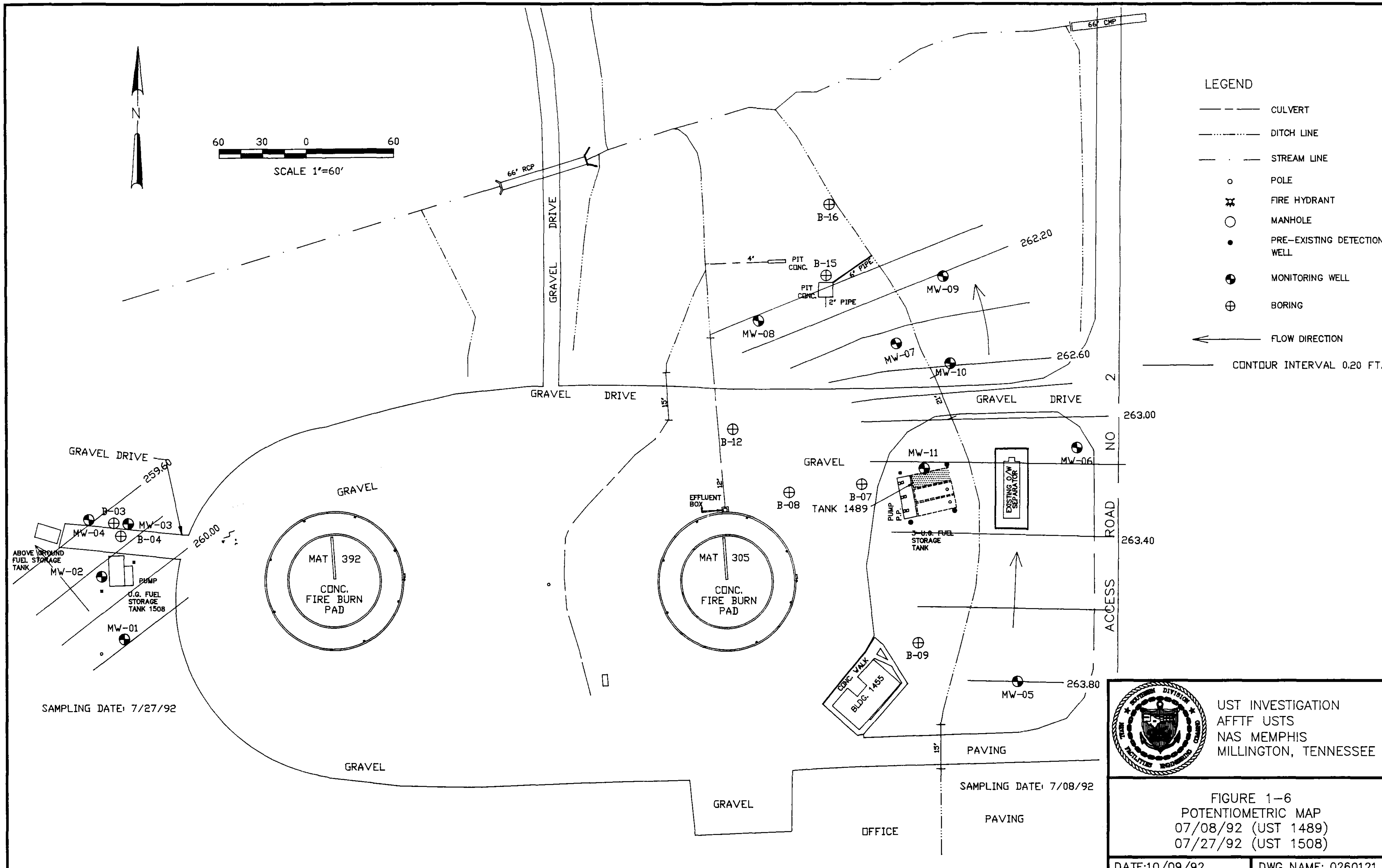
NOTE: WATER LEVELS IN WELLS ARE HIGHER THAN WHEN ORIGINALLY ENCOUNTERED UNDER SEMI–CONFINED CONDITIONS

UST INVESTIGATION
AFFTF USTS
NAS MEMPHIS
MILLINGTON, TN.

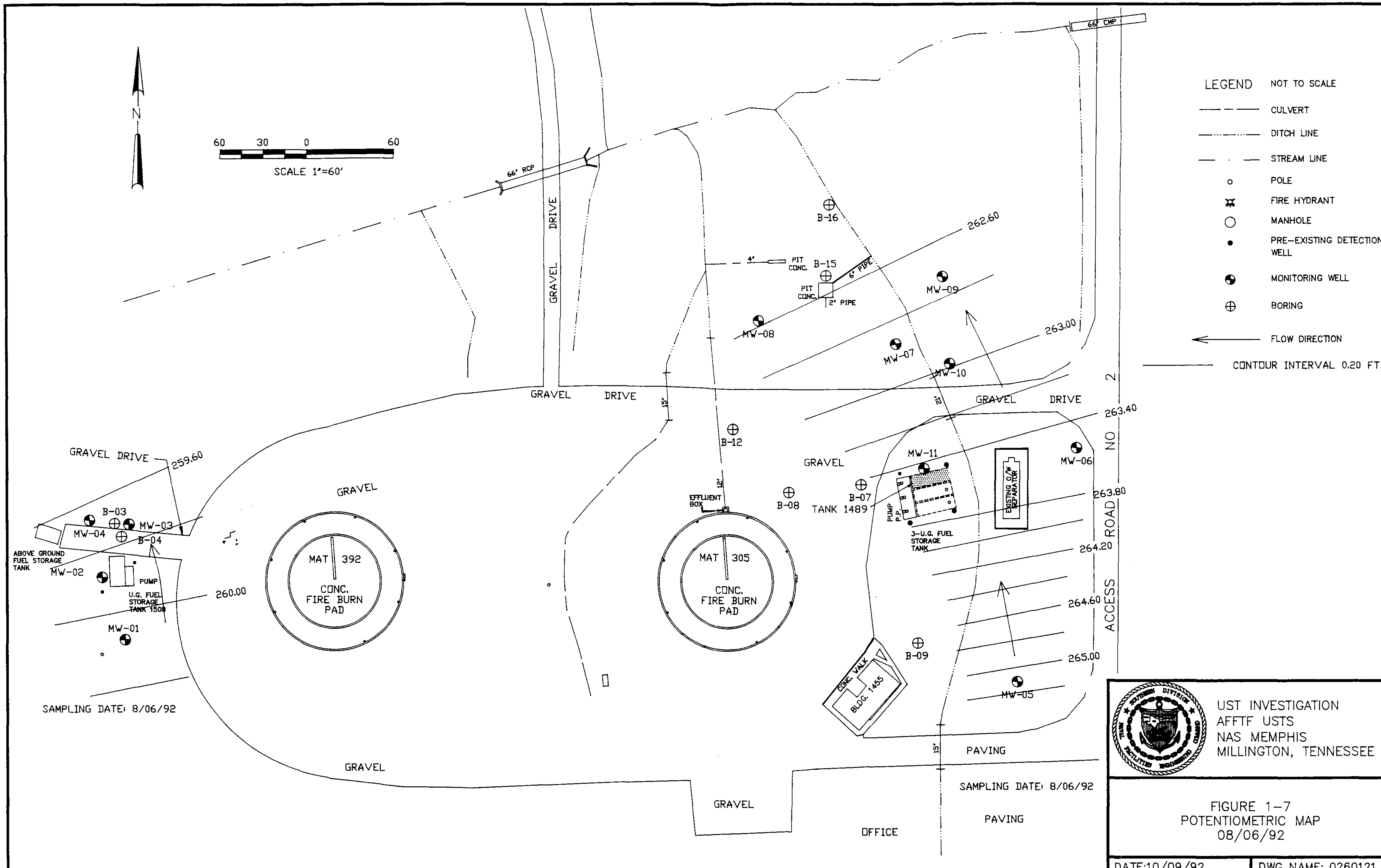
FIGURE 1–5
GEOLOGICAL CROSS SECTIONS
UST 1489

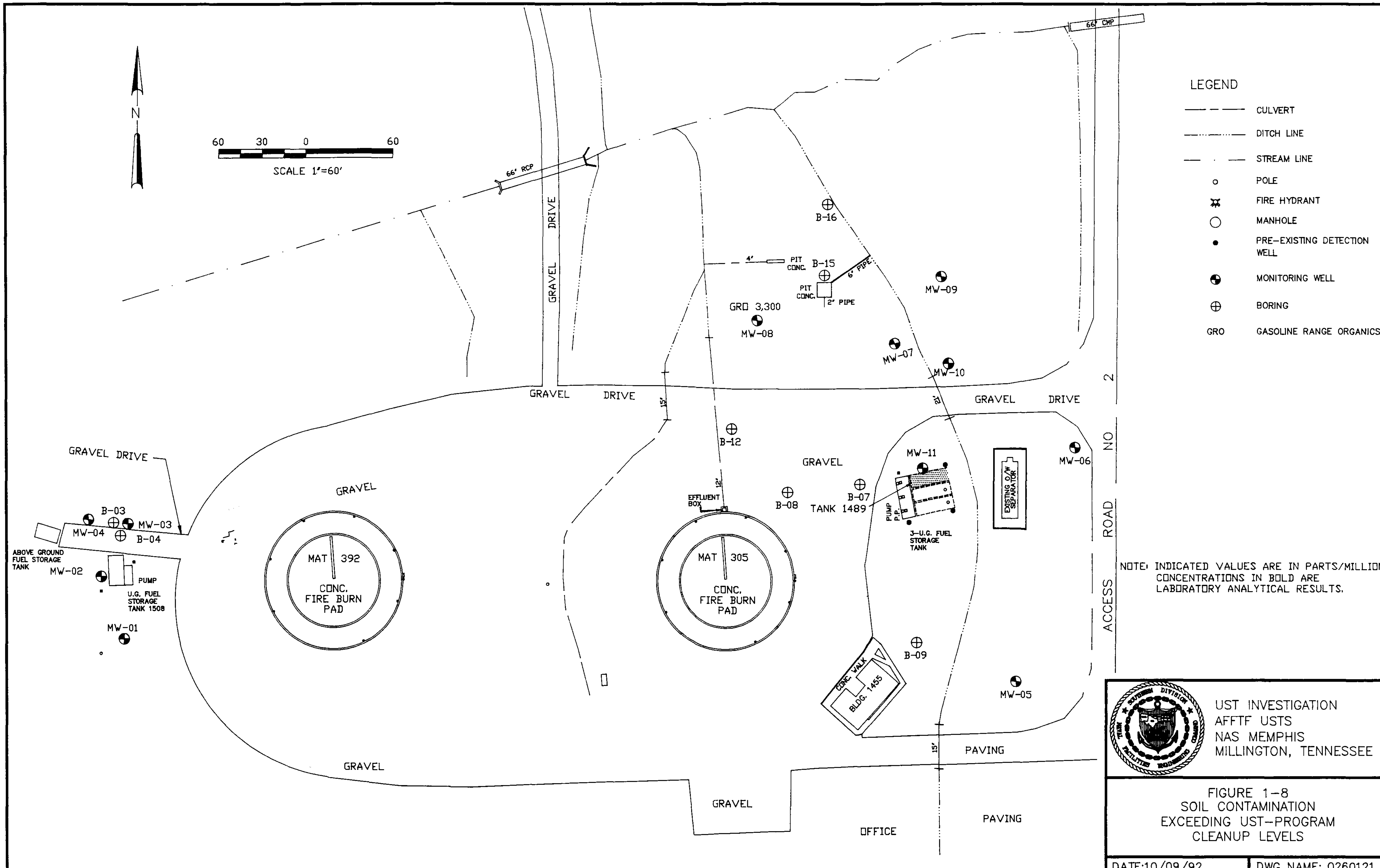
DATE: 10/08/92 | DWG NAME: 026CRS1

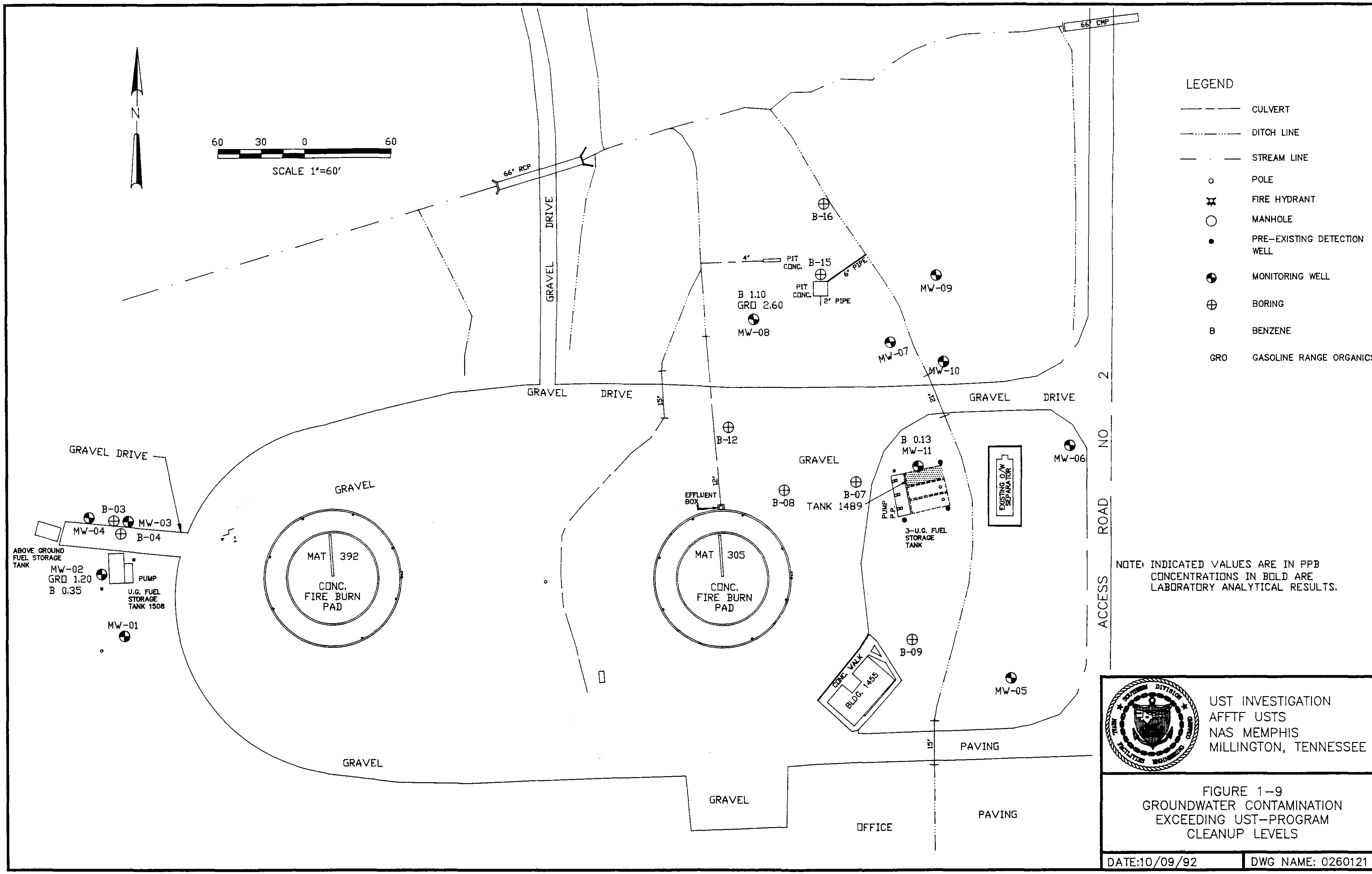
0046166032



00461GGG B42


N
60 30 0 60
SCALE 1"=60'
LEGEND NOT TO SCALE
CULVERT
DITCH LINE
STREAM LINE
POLE
FIRE HYDRANT
MANHOLE
PRE-EXISTING DETECTION WELL
MONITORING WELL
BORING
FLOW DIRECTION
CONTOUR INTERVAL 0.20 FT.
66" RCP
66" CMP
GRAVEL DRIVE
B-16
B-15
PIT CONC.
6" PIPE
2" PIPE
4'
262.60
263.00
263.40
263.80
264.20
264.60
265.00
259.60
260.00
MW-08
MW-09
MW-07
MW-10
MW-11
MW-06
MW-05
MW-04
MW-03
MW-02
MW-01
B-03
B-04
B-07
B-08
B-09
B-12
GRAVEL
DRIVE
15'
12'
21'
EFFLUENT BOX
TANK 1489
PUMP P.P.
3-U.G. FUEL STORAGE TANK
EXISTING O/W SEPARATOR
ACCESS ROAD NO 2
ABOVE GROUND FUEL STORAGE TANK
PUMP
U.G. FUEL STORAGE TANK 1508
MAT 392
CONC. FIRE BURN PAD
MAT 305
CONC. FIRE BURN PAD
CONC. WALK
BLDG. 1455
PAVING
OFFICE
SAMPLING DATE: 8/06/92
SAMPLING DATE: 8/06/92
UST INVESTIGATION
AFFTF USTS
NAS MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 1-7
POTENTIOMETRIC MAP
08/06/92
DATE:10/09/92
DWG NAME: 0260121


N
60 30 0 60
SCALE 1"=60'
LEGEND
CULVERT
DITCH LINE
STREAM LINE
POLE
FIRE HYDRANT
MANHOLE
PRE-EXISTING DETECTION WELL
MONITORING WELL
BORING
GRO GASOLINE RANGE ORGANICS
66" RCP
66" CMP
GRAVEL DRIVE
GRAVEL
PIT CONC.
B-15
6" PIPE
2" PIPE
B-16
GRO 3,300
MW-08
MW-09
MW-07
MW-10
B-12
B-08
B-07
TANK 1489
MW-11
PUMP P.P.
3-U.G. FUEL STORAGE TANK
EXISTING O/W SEPARATOR
MW-06
ACCESS ROAD NO 2
EFFLUENT BOX
MAT 392
CONC. FIRE BURN PAD
MAT 305
CONC. FIRE BURN PAD
B-03
MW-03
MW-04
B-04
ABOVE GROUND FUEL STORAGE TANK
MW-02
PUMP
U.G. FUEL STORAGE TANK 1508
MW-01
B-09
MW-05
CONC. WALK
BLDG. 1455
PAVING
OFFICE
NOTE: INDICATED VALUES ARE IN PARTS/MILLION. CONCENTRATIONS IN BOLD ARE LABORATORY ANALYTICAL RESULTS.
UST INVESTIGATION
AFFTF USTS
NAS MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 1-8
SOIL CONTAMINATION
EXCEEDING UST-PROGRAM
CLEANUP LEVELS
DATE:10/09/92
DWG NAME: 0260121



UST INVESTIGATION
AFFTF USTS
NAS MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 1-9
GROUNDWATER CONTAMINATION EXCEEDING UST-PROGRAM CLEANUP LEVELS

DATE:10/09/92 | DWG NAME: 0260121

00461 666052