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FINAL SITE SPECIFIC STANDARD REQUEST FOR BUILDING N-126 MILLINGTON SUPPACT TN

1/21/1994

ENSAFE ALLEN AND HOSHALL

FINAL
SITE SPECIFIC STANDARD REQUEST
BUILDING N-126
NAVAL AIR STATION MEMPHIS
MILLINGTON, TENNESSEE
FACILITY ID #0-791709

Prepared for:

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT NO. N62467-89-D-0318
CTO-067

Prepared by:

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January 21, 1994

FINAL
SITE SPECIFIC STANDARD REQUEST
BUILDING N-126
NAVAL AIR STATION MEMPHIS
MILLINGTON, TENNESSEE
FACILITY ID #0-791709

The following is submitted to request a Site Specific Standard as outlined in the Tennessee's Technical Guidance Document-008, which is included in *Tennessee's Division of Underground Storage Tanks Reference Handbook*, dated January 1992.

1. **Determine the soil permeability, as required in the Division's Environmental Assessment Guidelines.**

   Nine soil borings were drilled at the site to define the extent of soil contamination and characterize surficial sediments. Shelby tube samples collected adjacent to boring B-5 at depth intervals of 11 to 13 feet and 16 to 18 feet indicate average permeabilities of 2.4×10^{-6} and 4.5×10^{-7} centimeter per second (cm/sec). Shelby tube samples were analyzed in accordance with Method 9100 of *Test Methods for Evaluation of Solid Waste, Third Edition* (SW-846) and in general accordance with American Society of Testing and Materials (ASTM) D-5084-90. The samples were collected from the zone suspected of having the highest permeability and from the soil-water interface. A site diagram with boring locations (Figure 1) is included in Attachment 1 and results of the permeability analysis are presented in Attachment 2.

2. **Determine the groundwater classification of the aquifer or water source (i.e., drinking water supply or non-drinking water supply), as required in the Division's Environmental Assessment Guidelines.**

   A water use survey was completed to classify the surficial aquifer as either a drinking water or non-drinking water aquifer. This survey included a water well search and

analyzing of a groundwater sample for the primary and secondary drinking water standards. The results of each task are presented below.

Well Search: A water use survey was conducted in the facility's vicinity to determine whether any domestic or agricultural wells are accessing the surficial aquifer. A water well survey completed by the Memphis and Shelby County Health Department found the closest shallow well to be approximately one mile west of the site. Attachment 3 provides the information regarding these wells.

Groundwater Analysis: Six of the borings drilled at the site were converted into groundwater monitoring wells. A groundwater sample was collected from monitoring well MW-5 on May 27, 1993, and analyzed for primary and secondary drinking water standards in accordance with the Tennessee Department of Environment and Conservation (TDEC)'s Technical Guidance Document 002. Analytical results (included in Table 1) indicate iron, manganese, and turbidity in excess of the respective suggested levels for drinking water. A site diagram with monitoring well locations (Figure 2) is included in Attachment 1. Laboratory reports associated with this sample are included in Attachment 2.

Table 1
N-MW-5 - Drinking Water Quality

Parameters	Result (mg/L)	Standard (mg/L)
Iron	11.7	0.3
Manganese	8.7	0.05
Turbidity	230 NTU	1 NTU

Note: Turbidity is a primary drinking water standard and is expressed in Nephelometric Turbidity Units (NTU). Iron and manganese are secondary drinking water standards.

Aquifer Classification: Because the shallow aquifer is not being used as a water source (drinking or otherwise) near the site, and the elevated iron, manganese, and turbidity content fails to meet the drinking water standards, the aquifer can be characterized as a "non-drinking water" aquifer.

3. **Determine the land use in the area prior to the site being used to store petroleum products.**

   The property was undeveloped before the underground storage tank (UST) farm was constructed. Before the U.S. Navy acquired the property, it was used for agricultural purposes by the previous owners.

4. **Determine the current and projected future uses of the surrounding land.**

   The petroleum site is within a large facility owned and operated by the Navy. It is more than 3,000 feet to the nearest property boundary. This area will be turned over to the City of Millington as part of the U.S. Navy Base Realignment and Closure (BRAC). Millington is planning to develop the airfield adjacent to this site. It is unclear at this time whether the site will be included with the development of the airfield. Land use in the area of the facility primarily is zoned as commercial/industrial.

5. **Determine the extent of petroleum contamination in both soil and groundwater to the appropriate cleanup levels in the regulations.**

   Based on water quality and soil permeability data presented above, total petroleum hydrocarbons (TPH) and benzene, toluene, and xylenes (BTX) soil cleanup levels for this site would be 1,000 and 500 parts per million (ppm), respectively. Likewise, the TPH and benzene groundwater cleanup levels for this site would be 1.0 and 0.070 ppm, respectively. These levels are based on guidelines presented in the *Tennessee's Division of Underground Storage Tanks Reference Handbook.*

Soil Sample Results: Discrete soil samples were collected from each boring and submitted to International Technologies Analytical Services in Knoxville, Tennessee for BTEX, Gasoline Range Organic (GRO) and Diesel Range Organics (DRO) analyses. Laboratory results indicate measurable DRO concentrations in borings N-SB-3, N-SB-4, and N-SB-8 at concentrations of 110 milligrams per kilograms (mg/kg), 87 mg/kg, and 58 mg/kg, respectively. Contaminants were detected from 7 to 21 feet below ground surface (bgs). BTEX and GRO concentrations of 2.0 mg/kg and 76 mg/kg, respectively, were detected at the 7 to 9 foot interval in N-SB-8. The remaining soil samples contained no concentrations above the method detection limits. Likewise, no soil samples contained concentrations of BTX and TPH above the soil cleanup levels established for this site. Table 2 summarizes soil analytical results. Laboratory reports are presented in Attachment 2.

Table 2
Soil Analytical Results
Building N-126 USTs (mg/kg)

Sample Number	Depth (feet)	BTEX	Gasoline Range Organics (GRO)	Diesel Range Organics (DRO)
N-SB-1-13	11 - 13	BDL	BDL	BDL
N-SB-2-8	7 - 8	BDL	BDL	BDL
N-SB-2-20	18 - 20	BDL	BDL	BDL
N-SB-3-13	11 - 13	BDL	BDL	BDL
N-SB-3-13DUP	11 - 13	BDL	BDL	BDL
N-SB-3-21	19 - 21	BDL	BDL	110
N-SB-4-8	6 - 8	BDL	BDL	BDL
N-SB-4-18	16 - 18	BDL	BDL	87
N-SB-5-9	7 - 9	BDL	BDL	BDL
N-SB-5-20	18 - 20	BDL	BDL	BDL
N-SB-6-12	10 - 12	BDL	BDL	BDL
N-SB-7-17	15 - 17	BDL	BDL	BDL

Table 2 Soil Analytical Results Building N-126 USTs (mg/kg)				
Sample Number	Depth (feet)	BTEX	Gasoline Range Organics (GRO)	Diesel Range Organics (DRO)
N-SB-8-9	7 - 9	0.7	40	BDL
N-SB-8-9DUP	7 - 9	2.0	76	29
N-SB-8-13	11 - 13	BDL	BDL	58
N-SB-8-20	18 - 20	BDL	BDL	BDL

Notes:

BDL = Below Detection Limit
mg/kg = milligrams per kilogram (ppm)

Detection Limits:

GRO = 10 mg/kg
BTEX = 0.1 mg/kg
DRO = 10 mg/kg

Groundwater Sample Results: Free product was not observed in groundwater in any site monitoring wells. TPH concentrations found in N-MW-5 (17.2 ppm) and N-MW-6 (2.0 ppm) marginally exceeded TDEC's cleanup level of 1.0 ppm. These wells are located next to and north of the tank pit, respectively. Xylene was detected in N-MW-5 at 0.002 ppm. However, the State of Tennessee has not established cleanup levels for xylene in its UST regulations. In addition, this value is considerably lower than the 0.07 ppm cleanup value for benzene. Analytical data indicate the extent of impacted groundwater is limited primarily to the vicinity of the tank pit. Analytical results are summarized in Table 3. Laboratory reports for groundwater analyses are provided in Attachment 2.

Table 3
Groundwater Analytical Results
Building N-126 USTs

Sample ID	Date Sampled	Benzene (mg/L)	Toluene (mg/L)	Ethyl Benzene (mg/L)	Total Xylenes (mg/L)	GRO (mg/L)	DRO (mg/L)
N-MW-1	5/27/93	0.001U	0.001U	0.001U	0.001U	0.1U	0.1U
N-MW-2	5/27/93	0.001U	0.001U	0.001U	0.001U	0.1U	0.1U
N-MW-2DUP	5/27/93	0.001U	0.001U	0.001U	0.001U	0.1U	0.1U
N-MW-3	5/27/93	0.001U	0.001U	0.001U	0.001U	0.1U	0.1U
N-MW-4	5/27/93	0.001U	0.001U	0.001U	0.001U	0.1U	0.1U
N-MW-5	5/27/93	0.001U	0.001U	0.001U	0.002*	0.170	17.0
N-MW-6	7/20/93	0.001U	0.001U	0.001U	0.001U	0.1U	2.0
N-MW-6DUP	7/20/93	0.001U	0.001U	0.001U	0.001U	0.1U	1.5

Note:
* - Analyte confirmed on secondary column
U - Analyte not detected

6. **Determine the background level of petroleum contamination in both the soil and groundwater in the area.**

Analytical data presented in the Final Environmental Assessment Report for this site indicate background TPH and BTX concentrations in water and soil are below their respective laboratory detection limits. The laboratory detection limits for BTX and TPH in soil were 0.1 and 10 ppm, respectively. Likewise, the laboratory detection limits for BTX and TPH in water were 0.001 and 0.1 ppm, respectively.

7. **Determine the current and projected future uses of the groundwater at the petroleum site and the surrounding area.**

As stated above, the surficial aquifer is classified as a non-drinking water aquifer. Furthermore, the aquifer's low permeability would prevent large volumes of groundwater from being extracted. Therefore, no current or projected uses of the groundwater are expected at the petroleum site or the surrounding area.

8. Determine the depth to the groundwater at the petroleum site.

Static water level of the surficial aquifer at the site ranges between approximately 268 to 278 feet above mean sea level (msl), which corresponds to approximately 16.5 to 8 feet bgs.

9. Determine the groundwater recharge area and recharge rate for the petroleum site and the surrounding area.

The petroleum site consists mainly of concrete, gravel, and grass surfaces. Because gravel and grass surfaces are permeable, they could serve as recharge areas.

An indication of the recharge rate for the petroleum site and the surrounding area can be obtained by determining the hydraulic conductivity using an aquifer test and subsequently calculating the groundwater linear velocity. TDEC personnel have deemed this method acceptable.

The above method for calculating the groundwater linear velocity was used in the Final Environmental Assessment report for this facility, in which the groundwater velocity in at the site was determined to range between approximately 0.014 and 0.087 feet per day (ft/day).

This low groundwater velocity is another indication of the poor recharge for the site and surrounding area.

10. Determine the hydrology of the petroleum site and the surrounding area.

Six monitoring wells have been installed at the site. Static water level measurements at each well were collected on May 28, June 3, and July 7, 1993. Using these water level measurements, piezometric surface diagrams were constructed to show groundwater flow direction. Copies of these diagrams (Figure 3, Figure 4, and Figure 5) are included in Attachment 1. Groundwater flow was directed to the northwest on each day the

measurements were collected except for the diagram for July 7, 1993, which indicates local groundwater flow is directed toward the tank pit. The depression in the piezometric surface may be the result of increased infiltration into the tank pit or the result of reduced rainfall during July, which might have lowered the groundwater level.

Groundwater Gradient: The highest and lowest horizontal hydraulic gradients were calculated using the piezometric surface diagrams. The lowest gradient was calculated from 5/28/93 diagram using the following relationship:

Lowest gradient = 2.28 ft. head change/96 ft. distance = 0.024 ft./ft.

The highest gradient was calculated from the 7/20/93 with the following relationship:

Highest gradient = 10 ft. head change/70 ft. distance = 0.143 ft./ft.

The following relationship was used in determining the horizontal hydraulic gradient:
Where:

$i = \Delta h/L$

i = hydraulic gradient (ft./ft.)

Δh = change in piezometric surface elevation (ft.)

L = distance over which piezometric surface elevation changes (ft.)

Groundwater Flow Velocity: The lowest and highest estimated groundwater flow velocities were calculated using the following formula:

$$V = Ki/n_e$$

Where:

V = groundwater velocity

K = horizontal hydraulic conductivity

i = horizontal hydraulic gradient

n_e = effective porosity

For the velocity calculations, an average hydraulic conductivity of 0.234 feet/day was used. This value was obtained by averaging the hydraulic conductivity results from the slug tests presented below. To estimate the potential range of groundwater velocity, separate calculations were made with both the highest and lowest gradients previously derived. The effective porosity was obtained from the Tri-State Testing Services, Inc., laboratory reports in Attachment 2. An average of the four reported porosity values for boring N-126-SB9 was used in calculating velocity.

Lowest estimated groundwater velocity = (0.234)(0.0237)/(0.394) = 0.014 ft./day
Highest estimated groundwater velocity = (0.234)(0.146)/(0.394) = 0.087 ft./day

Slug Tests Results: Rising and falling head slug tests were conducted during the field investigation to enhance estimates of aquifer characteristics. Before a slug test was started, the static water level in the well was measured using an electronic water-level indicator. A "slug" was then "instantaneously" introduced into the well, at which time, the water level and the time "T_0" were recorded. Periodically, water level/elapsed time measurements were recorded as the head fell back to the original level. Similarly, each rising head slug test was performed by removing the "slug" and recording water level/elapsed time measurements as the head rose back to normal. The time required for a slug test to be completed is a function of the water level rate of change and the hydraulic conductivity of the aquifer.

An In-Situ pressure transducer and a two-channel Hermit 1000C data logger were used to measure and recorded water levels in the wells. To facilitate graphing of the data, the Hermit was programmed to record water level measurements on a logarithmic time scale. The slug used during the tests was a 5-foot-long, 1.5-inch-diameter stainless steel cylinder with a steel ring welded on one end. A Teflon-coated cable tethered to the cylinder suspended the slug in the well just above or below the water level. At the beginning of

each test, the data logger was activated the instant the slug was either lowered into or removed from the water.

Data from the slug tests were compiled using the computer program AQTESOLV (Aquifer Test Solver) by the Geraghty and Miller Modeling Group (1989). AQTESOLV has several widely published and accepted analytical solutions for many different kinds of aquifer tests. Rising and falling head slug test data were plotted using the unconfined aquifer solution. For this solution, time (elapsed) versus displacement (change in water level) is plotted on semi-logarithmic graph paper. Hydraulic conductivity (K) was computed by the program using an equation Bouwer and Rice (1976) developed for unconfined aquifers.

The hydraulic conductivities calculated from the rising and falling head slug tests are presented in Table 4. Injecting the slug produces falling head data and rising heads result from withdrawing the slug. For MW-1 only one test is reported because an equipment malfunction produced anomalous results. The average hydraulic conductivity presented in Table 4 was calculated using both the falling and rising head data from all of the wells.

Table 4
Slug Test Results

Well	K - Falling Head (feet/minute)	K - Rising Head (feet/minute)	K - Falling Head (feet/day)	K - Rising Head (feet/day)
N-126 MW-1	4.8907E-05	N/A	7.0426E-02	N/A
N-126 MW-2	5.0160E-04	3.0440E-04	7.2230E-01	4.3834E-01
N-126 MW-3	4.7204E-05	5.2103E-05	6.7974E-02	7.5028E-02
N-126 MW-4	5.9370E-05	1.5050E-04	8.5493E-02	2.1672E-01
N-126 MW-5	1.4480E-04	1.5490E-04	2.0851E-01	2.2306E-01

Average K (ft./day) = 2.3421E-01

Note: N/A - No data available due to equipment malfunction and anomalous results.

11. Determine the proximity, quality, and current and projected future uses of surface waters in the vicinity of the petroleum site.

The nearest surface water to the petroleum site is a ditch that receives surface runoff during rainfall. The ditch is approximately 2400 feet northwest of the petroleum site on undeveloped property.

The ditch currently collects surface runoff for drainage with no known changes in use.

12. Determine the acute toxicity of the waste petroleum product by performing a bioassay (chronic toxicity bioassays may be required).

Acute toxicity data for AVGAS are presented in Attachment 4. These data were obtained from the United States Coast Guard Chemicals Hazard Response Information System (CHRIS) manual.

13. Describe the physical and chemical characteristics of the petroleum contamination.

Physical and chemical characteristics of the petroleum contamination also were obtained from the CHRIS manual and are presented in Attachment 4.

14. Perform an Exposure Assessment to determine the effect of the petroleum contamination on all potential receptors (e.g. humans, aquatic species, animals, and plants).

Routes for exposure to petroleum contamination may include air and dust inhalation, water ingestion, soil ingestion, and dermal absorption. However, since petroleum contamination identified at this site is limited the subsurface, the potential for exposure via air and dust inhalation, soil ingestion and dermal absorption would be minimal. Likewise, since there are no water wells or surface water near the site, exposure via water ingestion would also be minimal.

15. Determine the potential for petroleum vapors entering a building if the petroleum contamination was not remediated to the appropriate cleanup levels in the regulations.

The zone of contamination is 75 feet from the nearest unoccupied building and 150 feet from the nearest occupied building. Given the extremely low groundwater velocities and the depth of identified impacts, potential for petroleum vapors entering a building would be minimal.

16. Explain why the petroleum contamination cannot or should not be remediated to the appropriate cleanup levels in the regulations.

Petroleum contamination should not be remediated because of the following:

- The source of the release has been eliminated; therefore, the concentration of petroleum constituents within the subsurface will not increase.

- The material's location is not accessible to the public.

- Aquifer in question is a non-drinking water aquifer according to background determinations.

- No quasi-public, commercial and residential water wells are screened in the surficial aquifer within a 1-mile radius of the site.

- The zone of contamination is inside the naval facility, approximately 3,000 feet from the nearest property boundary; therefore, the potential for offsite contaminant migration and impact is practically non-existent. Furthermore, natural biodegradation and attenuation of the contaminant plume will occur, thereby decreasing the plume's size.

- The material is within a geological subsurface whereby potential for exposure to receptors is minimal.

- Contamination at this site that exceed TDEC action levels, is limited to TPH in groundwater. Concentrations of benzene found in groundwater were below TDEC's action levels. Likewise, concentrations of BTX and TPH found in soils were below TDEC action levels.

17. Explain the actions to be taken if a Site Specific Standard was granted for the site and a problem developed in the future (e.g., vapors in a building, an impacted water well, free product in an underground utility, etc.).

If a problem listed above was encountered in the future, an immediate investigation to determine the source would be undertaken. If it is determined the source is related to the UST site, a cleanup method acceptable to TDEC would be implemented immediately.

18. Determine the site specific contamination concentration for both soil and groundwater which should be applied to the petroleum site (the level which would not adversely effect human health or the environment).

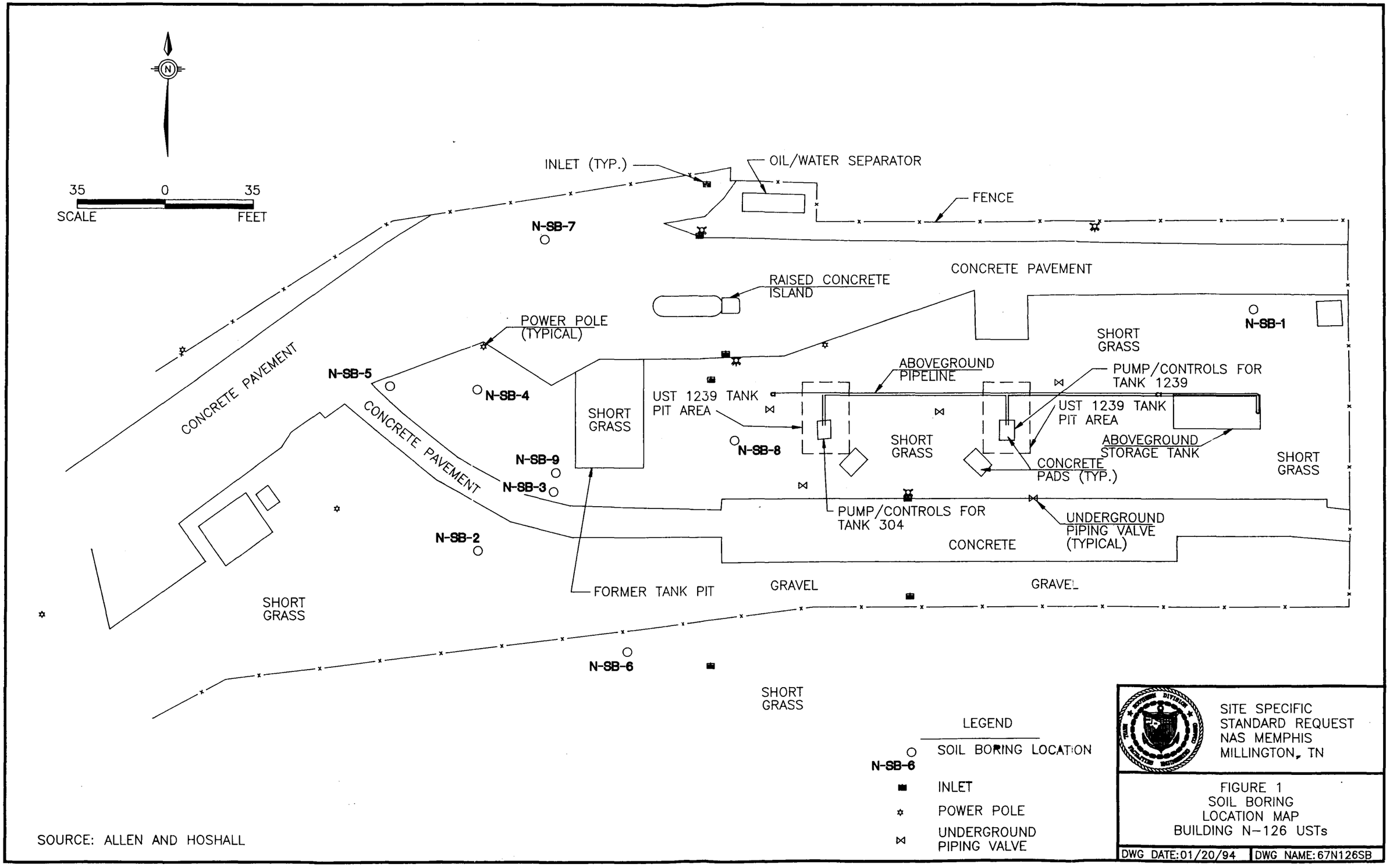
Since BTX and TPH concentrations found in soil did not exceed the TDEC cleanup levels for this site (500 and 1,000 ppm, respectively), no site specific contamination concentration is required for soil.

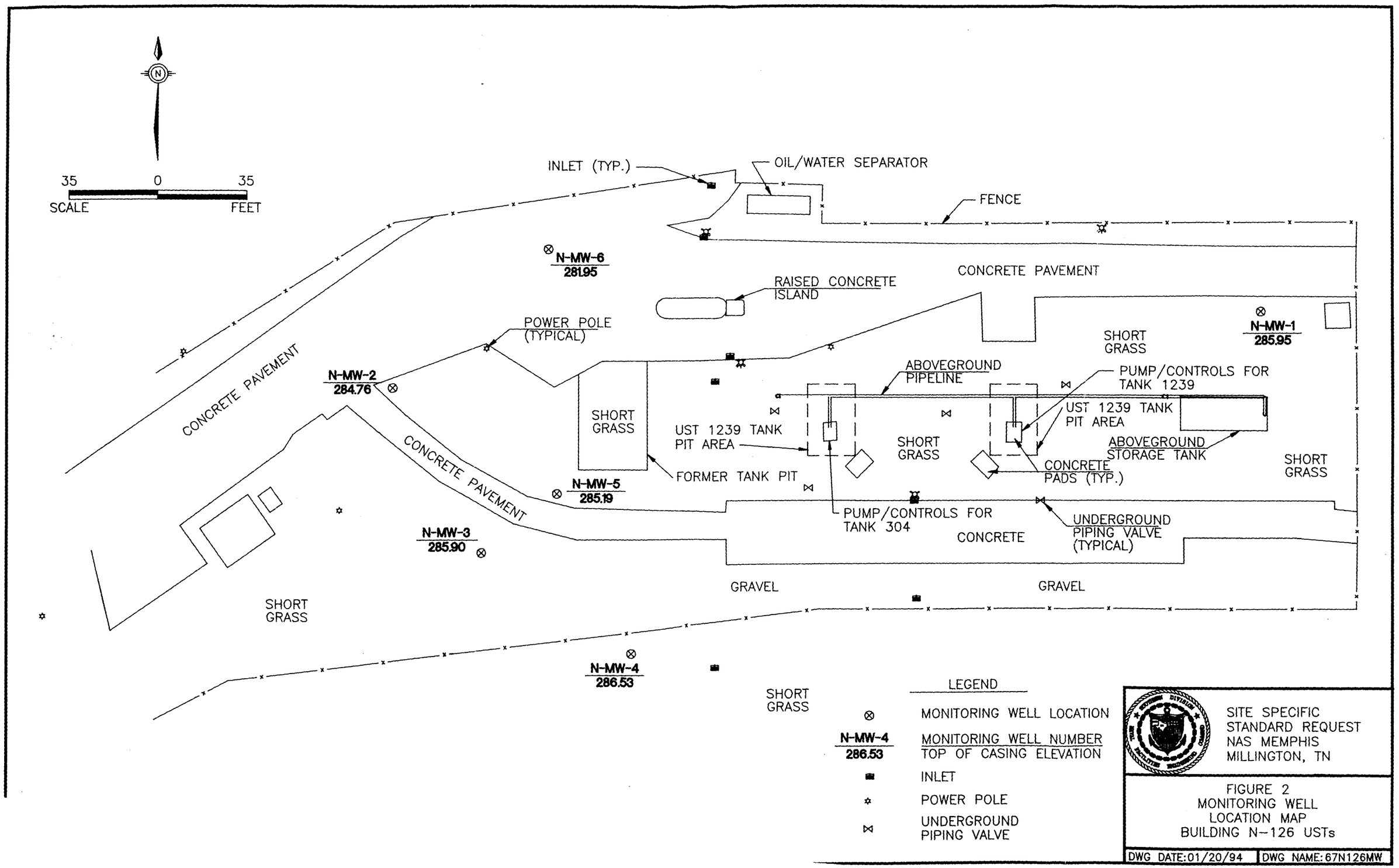
Likewise, benzene concentrations found in groundwater did not exceed the TDEC cleanup level for this site (0.07 ppm); therefore, no site specific contamination concentration is required for this constituent in groundwater.

The site specific contamination concentration for TPH in groundwater should be 100 ppm.

19. Describe how the site specific contaminant concentrations were determined.

The maximum concentration of TPH found in groundwater at the site is 17 ppm. This concentration is well below the calculated 5,233 ppm LD_{50} for TPH for species tested as presented in *Hydrocarbon Contaminated Soils and Groundwater Volume 3*, Kostecki and Calabrese, 1993. The proposed site specific contaminant concentration for TPH in groundwater is well below this LD_{50}, and yet it would be an indicator that concentrations have increased and an investigation to determine the source should be undertaken. Additionally, the exposure assessment in item 14 indicated potential for exposure to TPH at the site would be minimal.


N
35 0 35
SCALE FEET
INLET (TYP.)
OIL/WATER SEPARATOR
FENCE
N-SB-7
CONCRETE PAVEMENT
RAISED CONCRETE ISLAND
POWER POLE (TYPICAL)
N-SB-1
SHORT GRASS
ABOVEGROUND PIPELINE
PUMP/CONTROLS FOR TANK 1239
N-SB-5
N-SB-4
CONCRETE PAVEMENT
SHORT GRASS
UST 1239 TANK PIT AREA
UST 1239 TANK PIT AREA
N-SB-8
SHORT GRASS
ABOVEGROUND STORAGE TANK
CONCRETE PADS (TYP.)
SHORT GRASS
N-SB-9
CONCRETE PAVEMENT
N-SB-3
PUMP/CONTROLS FOR TANK 304
UNDERGROUND PIPING VALVE (TYPICAL)
N-SB-2
CONCRETE
FORMER TANK PIT
GRAVEL
GRAVEL
SHORT GRASS
N-SB-6
SHORT GRASS
LEGEND
SOIL BORING LOCATION
N-SB-6
INLET
POWER POLE
UNDERGROUND PIPING VALVE
SITE SPECIFIC STANDARD REQUEST
NAS MEMPHIS
MILLINGTON, TN
FIGURE 1
SOIL BORING LOCATION MAP
BUILDING N-126 USTs
DWG DATE:01/20/94
DWG NAME:67N126SB
SOURCE: ALLEN AND HOSHALL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SCALE FEET
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OIL/WATER SEPARATOR
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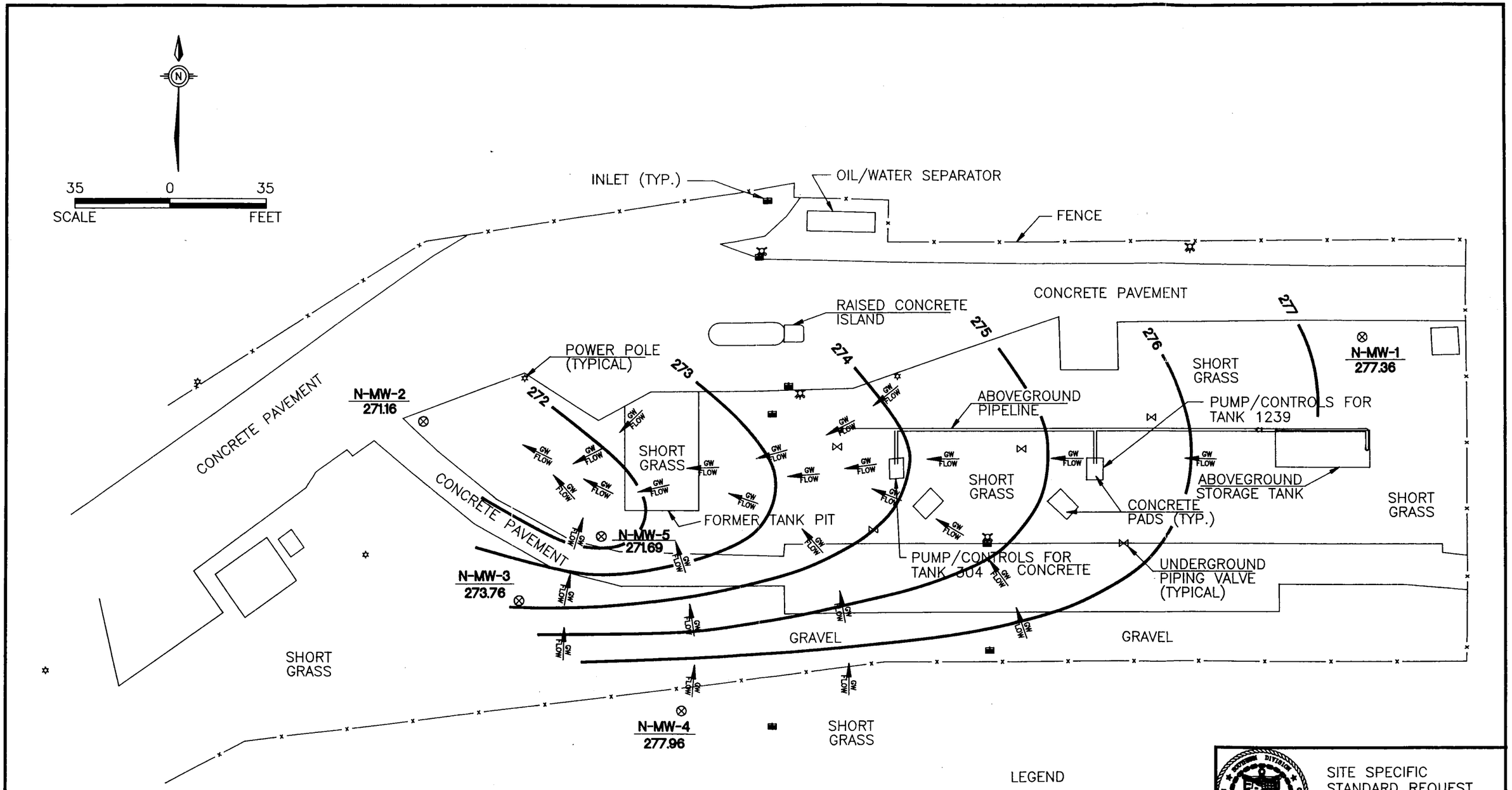
N-MW-6
281.95
CONCRETE PAVEMENT
RAISED CONCRETE ISLAND
POWER POLE (TYPICAL)
N-MW-1
285.95
SHORT GRASS
N-MW-2
284.76
ABOVEGROUND PIPELINE
PUMP/CONTROLS FOR TANK 1239
CONCRETE PAVEMENT
SHORT GRASS
UST 1239 TANK PIT AREA
UST 1239 TANK PIT AREA
SHORT GRASS
ABOVEGROUND STORAGE TANK
CONCRETE PADS (TYP.)
SHORT GRASS
CONCRETE PAVEMENT
N-MW-5
285.19
FORMER TANK PIT
PUMP/CONTROLS FOR TANK 304
UNDERGROUND PIPING VALVE (TYPICAL)
N-MW-3
285.90
CONCRETE
GRAVEL
GRAVEL
SHORT GRASS
N-MW-4
286.53
SHORT GRASS
LEGEND
MONITORING WELL LOCATION
N-MW-4
286.53
MONITORING WELL NUMBER
TOP OF CASING ELEVATION
INLET
POWER POLE
UNDERGROUND PIPING VALVE
SITE SPECIFIC
STANDARD REQUEST
NAS MEMPHIS
MILLINGTON, TN
FIGURE 2
MONITORING WELL
LOCATION MAP
BUILDING N-126 USTs
DWG DATE:01/20/94
DWG NAME:67N126MW



LEGEND

N-MW-2 271.16 ⊗ — SOIL BORING/MONITORING WELL GROUNDWATER ELEVATION LOCATION

GW FLOW — GROUNDWATER FLOW

274 — PIEZOMETRIC CONTOUR

SOURCE: ALLEN AND HOSHALL

SITE SPECIFIC
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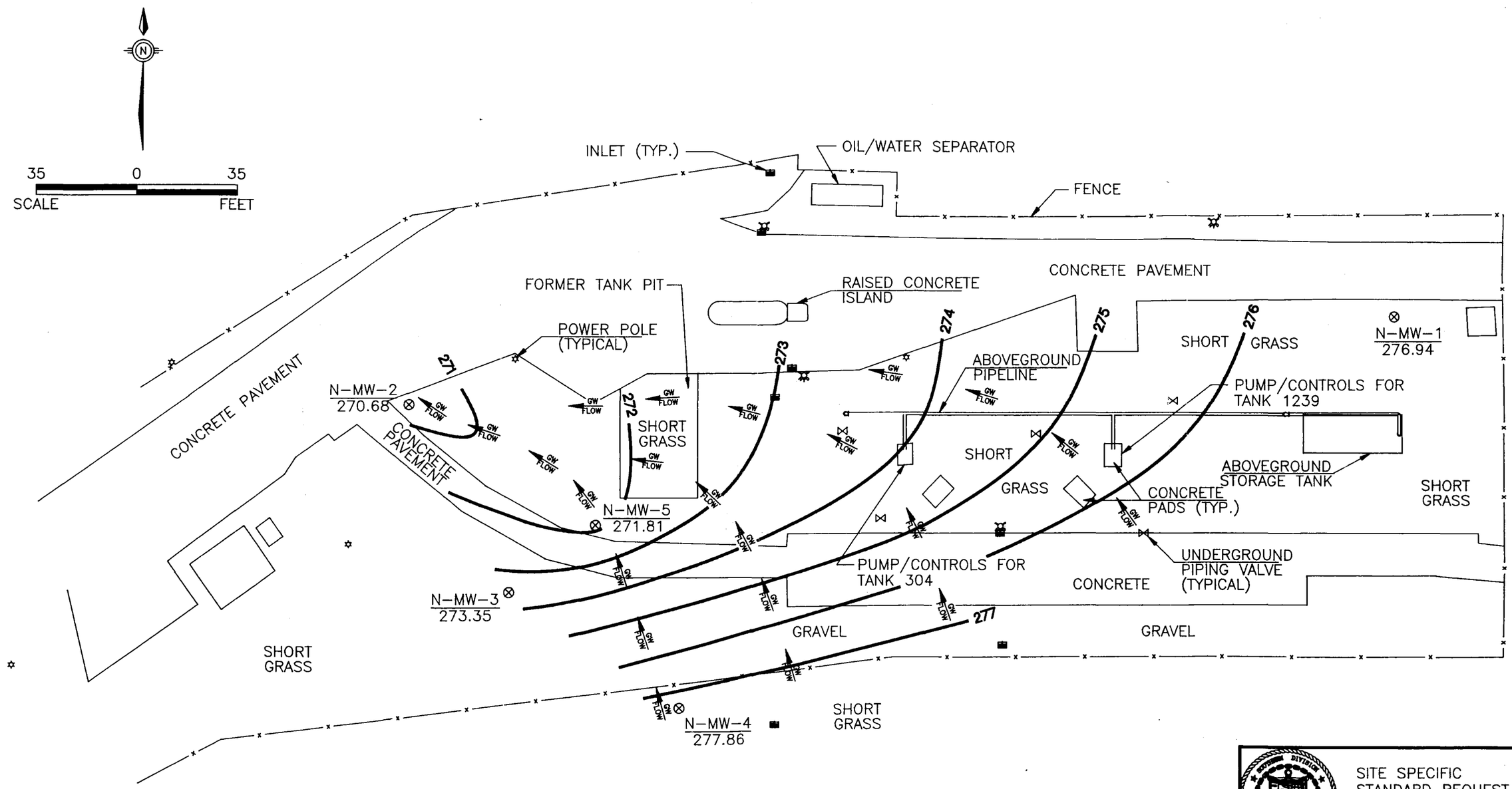
NAS MEMPHIS
MILLINGTON, TN

FIGURE 3
PIEZOMETRIC SURFACE
MAP 05/28/93
BUILDING N-126 USTs

DWG DATE:01/20/93 | DWG NAME:67N126P1



LEGEND

⊗ – MONITORING WELL LOCATION

N-MW-4 / 286.53 – MONITORING WELL NUMBER / WATER ELEVATION

272 – PIEZOMETRIC CONTOUR

GW FLOW – GROUNDWATER FLOW

SOURCE: ALLEN AND HOSHALL

SITE SPECIFIC
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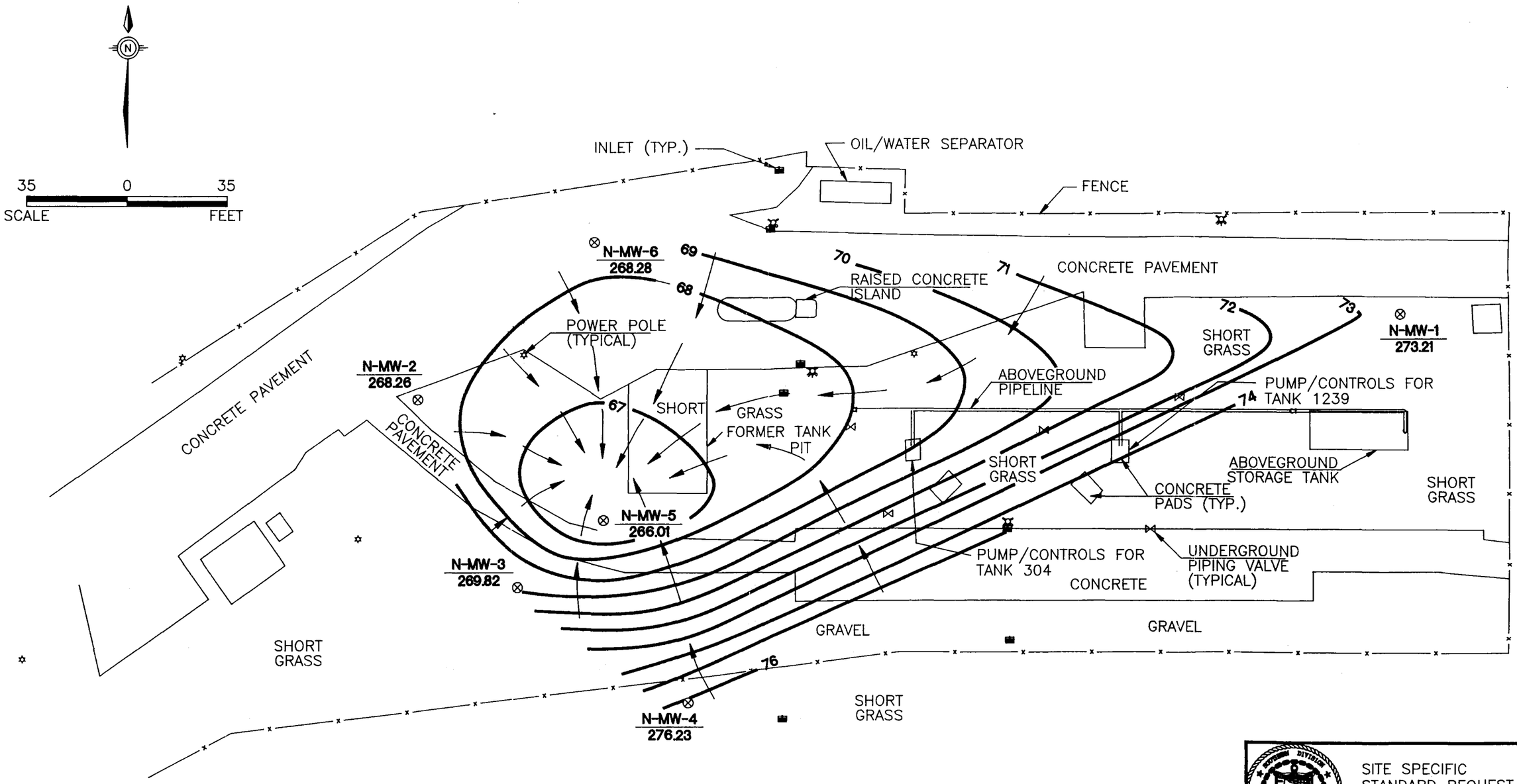
NAS MEMPHIS
MILLINGTON, TN

FIGURE 4
PIEZOMETRIC SURFACE
MAP 06/03/93
BUILDING N-126 USTs

DWG DATE:01/20/94 | DWG NAME:67N126P2



SOURCE: ALLEN AND HOSHALL

SITE SPECIFIC
STANDARD REQUEST
NAS MEMPHIS
MILLINGTON, TN

FIGURE 5
PIEZOMETRIC SURFACE
MAP 07/20/93
BUILDING N-126 USTs

DWG DATE:01/20/94 | DWG NAME:67N126P3

ATTACHMENT 2

LABORATORY REPORTS

Tri-State Testing Services, Inc.

Measurement of Hydraulic Conductivity

Client: Ensafe/Allen & Hoshall

Date of Report: 06/02/93

Project Name: Naval Air Station @ Millington, TN

Sample I.D.: Boring N-126-SB9 Sample: ST 1, Depth 11'-13'

Soil Description: Brown & Gray Silty Clay

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	121.6	124.0
Dry Density (Lbs/ft^3)	96.0	97.5
Moisture (% Dry Wt)	26.7	27.2
Porosity (n)	.401	.406
Degree of Saturation (%)	97.9	100.0

Permeability

Temperature Correction, R_t = 1.015

$K_1 = 6.3 \times 10^{-7}$ cm/sec
$K_2 = 3.6 \times 10^{-7}$ cm/sec
$K_3 = 3.6 \times 10^{-7}$ cm/sec
$K_4 = 4.1 \times 10^{-7}$ cm/sec

Coefficient of Permeability, $K_{20} = 4.5 \times 10^{-7}$ cm/sec

Tested in accordance with Method 9100 of Test Methods for evaluation Solid Waste, Third Addition (SW-846) and in general accordance with ASTM D-5084-90.

Lab No. L-93-1010A Reviewed By: David D. McCray

6756 Buckles Cove • Memphis, TN 38133
(901) 386-1199 • Fax (901) 386-6614

Tri-State Testing Services, Inc.

Measurement of Hydraulic Conductivity

Client: Ensafe/Allen & Hoshall

Date of Report: 06/03/93

Project Name: Naval Air Station @ Millington, TN

Sample I.D.: Boring # N-126-SB9 Sample: ST 2, Depth 16'-18'

Soil Description: Gray Silty Clay

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	123.4	125.1
Dry Density (Lbs/ft^3)	99.6	101.0
Moisture (% Dry Wt)	24.0	24.0
Porosity (n)	.384	.384
Degree of Saturation (%)	100.0	100.0

Permeability

Temperature Correction, R_t = 1.000

$K_1 = 1.3 \times 10^{-6}$ cm/sec
$K_2 = 4.8 \times 10^{-6}$ cm/sec
$K_3 = 2.0 \times 10^{-6}$ cm/sec
$K_4 = 1.4 \times 10^{-6}$ cm/sec

Coefficient of Permeability, $K_{20} = 2.4 \times 10^{-6}$ cm/sec

Tested in accordance with Method 9100 of Test Methods for evaluation Solid Waste, Third Addition (SW-846) and in general accordance with ASTM D-5084-90.

Lab No. L-93-1010B Reviewed By: David D. McCray

6756 Buckles Cove • Memphis, TN 38133
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BTEX/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-1	Collection Date:	05/27/93
Lab Sample ID:	XX4840	Extraction Date:	NA
Sample Matrix:	WATER	Analysis Date:	06/07/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	1	U	1
toluene	1	U	1
ethyl benzene	1	U	1
xylenes (total)	1	U	1
.otal low boiling petroleum hydrocarbons, as gasoline range organics	100	U	100

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: WATER	(72-119%)	(65-129)
Lab Sample I.D.		
XX4840	100	101

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-1	Collection Date:	05/27/93
Lab Sample ID:	XX4830	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/12/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	100	U	100

Surrogate Recovery	C_{22}	C_{32}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4830	90	94

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-2	Collection Date:	05/27/93
Lab Sample ID:	XX4831	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/12/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	100	U	100

Surrogate Recovery	C_{22}	C_{23}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4831	116	126

BTEX/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-2 DUP	Collection Date:	05/27/93
Lab Sample ID:	XX4842	Extraction Date:	NA
Sample Matrix:	WATER	Analysis Date:	06/04/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	1	U	1
toluene	1	U	1
ethyl benzene	1	U	1
xylenes (total)	1	U	1
.otal low boiling petroleum hydrocarbons. as gasoline range organics	100	U	100

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: WATER	(72-119%)	(65-129)
Lab Sample I.D.		
XX4842	99	102

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-2 DUP	Collection Date:	05/27/93
Lab Sample ID:	XX4832	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/12/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	100	U	100

Surrogate Recovery	C_{29}	C_{32}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4832	95	100

BTEX/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-3	Collection Date:	05/27/93
Lab Sample ID:	XX4843	Extraction Date:	NA
Sample Matrix:	WATER	Analysis Date:	06/04/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	1	U	1
toluene	1	U	1
ethyl benzene	1	U	1
xylenes (total)	1	U	1
.otal low boiling petroleum hydrocarbons, as gasoline range organics	100	U	100

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: WATER	(72-119%)	(65-129)
Lab Sample I.D.		
XX4843	100	109

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-3	Collection Date:	05/27/93
Lab Sample ID:	XX4833	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/12/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons. as diesel range organics	100	U	100

Surrogate Recovery	C_{28}	C_{32}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4833	110	117

MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-3	Collection Date:	05/27/93
Lab Sample ID:	XX4843, XX4844, XX4845	Extraction Date:	NA
Sample Matrix:	WATER	Analysis Date:	06/04/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Sample Result		Conc. Spike Added	Conc. MS	% Rec.	Conc. MSD	% Rec.	RPD
total low boiling petroleum hydrocarbons, as gasoline range organics	100	U	1,000	700	70	730	73	4

Surrogate Recovery	Bromofluorobenzene (FID)
Acceptance Limits: WATER	(65-129%)
Lab Sample I.D.	
XX4844 MS	114
XX4845 MSD	114

MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54176
Client Sample ID:	N-MW-3	Collection Date:	05/27/93
Lab Sample ID:	XX4833, XX4834, XX4835	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/12/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Sample Result		Conc. Spike Added	Conc. MS	% Rec.	Conc. MSD	% Rec.	RPD
total high boiling petroleum hydrocarbons, as diesel range organics	100	U	1,200	1,700	142	1,600	133	7

Surrogate Recovery	C_{22}	C_{32}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4843 MS	98	100
XX4835 MSD	96	88

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BTEX/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-4	Collection Date:	05/27/93
Lab Sample ID:	XX4846	Extraction Date:	NA
Sample Matrix:	WATER	Analysis Date:	06/04/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	1	U	1
toluene	1	U	1
ethyl benzene	1	U	1
xylenes (total)	1	U	1
total low boiling petroleum hydrocarbons, as gasoline range organics	100	U	100

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: WATER	(72-119%)	(65-129)
Lab Sample I.D.		
XX4846	102	101

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-4	Collection Date:	05/27/93
Lab Sample ID:	XX4836	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/12/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	100	U	100

Surrogate Recovery	C_{25}	C_{32}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4836	95	103

BTEX/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-5	Collection Date:	05/27/93
Lab Sample ID:	XX4847	Extraction Date:	NA
Sample Matrix:	WATER	Analysis Date:	06/04/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	1	U	1
toluene	1	U	1
ethyl benzene	1	U	1
xylenes (total)	2	⊕	1
.al low boiling petroleum hydrocarbons. as gasoline range organics	170		100

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: WATER	(72-119%)	(65-129)
Lab Sample I.D.		
XX4847	103	110

⊕ - Analyte confirmed on secondary column on 06/09/93.

ity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	NAS MEMPHIS	Job Number:	ENFA 54185
Client Sample ID:	N-MW-5	Collection Date:	05/27/93
Lab Sample ID:	XX4837	Extraction Date:	06/01/93
Sample Matrix:	WATER	Analysis Date:	06/14/93
Concentration Units:	µg/liter (ppb)	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	17,000		1,000

Surrogate Recovery	C_{25}	C_{32}
Acceptance Limits: WATER	(23-132%)	(31-155%)
Lab Sample I.D.		
XX4837	96	78

ity I.D. # 0-791709

ITAS-KNOXVILLE

Job Number: [illegible] 54898

VOLATILE ORGANICS/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Results in ug/l (ppb) mg/kg (ppm) ug/l (ppb) (Circle One)

Sample Matrix: WATER

Client Sample I.D.: N-MW-6

Lab Sample I.D.: XX9895

Compound	Concentration
benzene	✓ 1u
toluene	✓ 1u
ethyl benzene	✓ 1u
xylenes (total)	✓ 1u
MTBE	—
total low boiling petroleum hydrocarbons as gasoline	—
total low boiling petroleum hydrocarbons, as gasoline range organics	✓ 100u

QC ✓ 8-12-93

SURROGATE RECOVERY	BFB (PID)	BFB (FID)
ACCEPTANCE LIMITS: WATER	(72-119)	(65-129)
SOIL	~~(78-124)~~	~~(30-120)~~
XX9895	✓ 98	✓ 100

D1 - Analyzed at _____ dilution on _____.
D2 - Analyzed at _____ dilution on _____.
D3 - Analyzed at _____ dilution on _____.
X - _____% of the GRO value was contributed by a single component tentatively identified as methyl tert-butyl ether.

Extraction Date: —

Analysis Date : 8-8-93

Comments: BTX

ity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name	: ITAS-KNOXVILLE	SDG Number	:
Contract Name	: NAS MEMPHIS	Job Number	: ENFA 54598
Client Sample I.D.	: N-MW-6	Collection Date	: 07/20/93
Lab Sample I.D.	: XX9901	Extraction Date	: 7/26/93
Sample Matrix	: WATER	Analysis Date(s)	: 8/5/93
Concentration Units:	ug/L or mg/Kg	Dryness Factor	: -

COMPOUND	RESULTS	QUALIFIERS	DETECTION LIMITS
total high boiling petroleum hydrocarbons, as diesel ~~fuel~~ Range Organics	2000		100

SURROGATE RECOVERY	C23	C32
ACCEPTANCE LIMITS: SOIL WATER LAB I.D.	(41 - 149) (23 - 132)	(59 - 179) (31 - 155)
XX9901	119 ~~143~~	179
~~Surrogate Signal off gasoline~~	~~119~~	

QC ✓ 8/12/93

DB = HRH.DTF
DP FORM = REPHRH
LAB FORM = MATHRH
BLANK SPIKE = HRHBS
MS/MSD = HRHMSMSD

y I.D. # 0-791709

ITAS-KNOXVILLE

Job Number: KNVA 54598

VOLATILE ORGANICS/LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Results in ug/l (ppb) mg/kg (ppm) ug/l (ppb) (Circle One)

Sample Matrix: WATER

Client Sample I.D.: N-MW-6-DUP

Lab Sample I.D.: XX9896

Compound	Concentration
benzene	✓ 1u
toluene	✓ 1u
ethyl benzene	✓ 1u
xylenes (total)	✓ 1u
MTBE	—
total low boiling petroleum hydrocarbons as gasoline	—
total low boiling petroleum hydrocarbons, as gasoline range organics	✓ 100u

QC ✓ JW 8/18.93

SURROGATE RECOVERY	BFB (PID)	BFB (FID)
ACCEPTANCE LIMITS: WATER	(72-119)	(65-129)
SOIL	~~(70-124)~~	~~(50-126)~~
XX9896	✓ 100	✓ 94

D1 - Analyzed at _____ dilution on _____.
D2 - Analyzed at _____ dilution on _____.
D3 - Analyzed at _____ dilution on _____.
X - _____% of the GRO value was contributed by a single component tentatively identified as methyl tert-butyl ether.

Extraction Date: —

Analysis Date : 8-2-93

Comments: BTX

ity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name	: ITAS-KNOXVILLE	SDG Number	:
Contract Name	: NAS MEMPHIS	Job Number	: ENFA 54598
Client Sample I.D.	: N-MW-6-DUP	Collection Date	: 07/20/93
Lab Sample I.D.	: XX9902	Extraction Date	: 7/26/93
Sample Matrix	: WATER	Analysis Date(s)	: 8/5/93
Concentration Units:	ug/L or mg/Kg	Dryness Factor	: --

COMPOUND	RESULTS	QUALIFIERS	DETECTION LIMITS
total high boiling petroleum hydrocarbons, as diesel ~~fuel~~ Large Organics	1500		100

SURROGATE RECOVERY	C23	C32
ACCEPTANCE LIMITS: SOIL	(41 - 149)	(59 - 179)
WATER	(23 - 132)	(31 - 155)
LAB I.D.		
XX9902	107	135

8/12/93

DB = HRH.DTF
DP FORM = REPHRH
LAB FORM = MATHRH
BLANK SPIKE = HBHBS
MS/MSD = HBHMSMSD

ty I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

iboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB1-13	Collection Date:	05/13/93
Lab Sample ID:	XX4256	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{25}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4256	81	110

ility I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

oratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB2-8	Collection Date:	05/13/93
Lab Sample ID:	XX4244	Extraction Date:	05/25/93
Sample Matrix:	SOIL	Analysis Date:	05/25/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
l low boiling petroleum ocarbons, as gasoline ge organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4244	102	104

lity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB2-8	Collection Date:	05/13/93
Lab Sample ID:	XX4257	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{25}	C_{31}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4257	71	110

ility I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

oratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB2-20	Collection Date:	05/13/93
Lab Sample ID:	XX4245	Extraction Date:	05/25/93
Sample Matrix:	SOIL	Analysis Date:	05/25/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
l low boiling petroleum ocarbons, as gasoline ge organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4245	113	115

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB2-20	Collection Date:	05/13/93
Lab Sample ID:	XX4258	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{20}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4258	82	110

lity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB3-13	Collection Date:	05/13/93
Lab Sample ID:	XX4246	Extraction Date:	05/25/93
Sample Matrix:	SOIL	Analysis Date:	05/25/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
'otal low boiling petroleum drocarbons, as gasoline ange organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4246	102	105

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

oratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB3-13	Collection Date:	05/13/93
Lab Sample ID:	XX4259	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{20}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4259	62	109

ity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB3-13 DUP	Collection Date:	05/13/93
Lab Sample ID:	XX4247	Extraction Date:	05/25/93
Sample Matrix:	SOIL	Analysis Date:	05/25/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
·····l low boiling petroleum rocarbons, as gasoline ange organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4247	101	104

ility I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

oratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB3-13 DUP	Collection Date:	05/13/93
Lab Sample ID:	XX4260	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{22}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4260	74	98

lity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB3-21	Collection Date:	05/13/93
Lab Sample ID:	XX4248	Extraction Date:	05/25/93
Sample Matrix:	SOIL	Analysis Date:	05/25/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
·····al low boiling petroleum ,rocarbons, as gasoline ange organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4248	114	117

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB3-21	Collection Date:	05/13/93
Lab Sample ID:	XX4261	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/28/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	110		10

Surrogate Recovery	C_{28}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4261	111	110

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB4-8	Collection Date:	05/14/93
Lab Sample ID:	XX4249	Extraction Date:	05/25/93
Sample Matrix:	SOIL	Analysis Date:	05/25/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
total low boiling petroleum hydrocarbons, as gasoline range organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4249	109	116

cility I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB4-8	Collection Date:	05/14/93
Lab Sample ID:	XX4262	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/28/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{25}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4262	89	114

lity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB4-18	Collection Date:	05/14/93
Lab Sample ID:	XX4250	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/26/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
total low boiling petroleum rocarbons, as gasoline ge organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4250	109	121

lity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB4-18	Collection Date:	05/14/93
Lab Sample ID:	XX4263	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	06/04/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	87	C	50

Surrogate Recovery	C_{25}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4263 D1:10	90	158

ity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB5-9	Collection Date:	05/14/93
Lab Sample ID:	XX4253	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/26/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
total low boiling petroleum hydrocarbons, as gasoline range organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4253	107	104

ility I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB5-9	Collection Date:	05/14/93
Lab Sample ID:	XX4266	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{23}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4266	84	101

ility I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

·boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
·ontract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB5-20	Collection Date:	05/14/93
Lab Sample ID:	XX4254	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/26/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
total low boiling petroleum ·rocarbons, as gasoline ·e organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4254	111	115

ility I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

·boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
·ontract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB5-20	Collection Date:	05/14/93
Lab Sample ID:	XX4267	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{22}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4267	66	103

ity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

' aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB6-12	Collection Date:	05/14/93
Lab Sample ID:	XX4255	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/26/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
total low boiling petroleum drocarbons, as gasoline ,ge organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL	(78-124%)	(50-126)
Lab Sample I.D.		
XX4255	97	106

cility I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

Laboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54106
Client Sample ID:	N-SB6-12	Collection Date:	05/14/93
Lab Sample ID:	XX4268	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{20}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4268	86	108

ility I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB7-17	Collection Date:	05/17/93
Lab Sample ID:	XX4334	Extraction Date:	05/27/93
Sample Matrix:	SOIL	Analysis Date:	05/27/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
'otal low boiling petroleum 'drocarbons, as gasoline ange organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL Lab Sample I.D.	(72-119%)	(65-129)
XX4334	108	101

lity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB7-17	Collection Date:	05/17/93
Lab Sample ID:	XX4339	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{23}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4339	95	126

ity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-9	Collection Date:	05/17/93
Lab Sample ID:	XX4335	Extraction Date:	05/27/93
Sample Matrix:	SOIL	Analysis Date:	05/27/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.2	⊕	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.5	⊕	0.1
total low boiling petroleum ocarbons, as gasoline ..ge organics	40		10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL Lab Sample I.D.	(72-119%)	(65-129)
XX4335	100	-

lity I.D. # 0-791709

⊕ - Analyte confirmed on secondary column.

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

oratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-9	Collection Date:	05/17/93
Lab Sample ID:	XX4340	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{20}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4340	86	113

ty I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-9 DUP	Collection Date:	05/17/93
Lab Sample ID:	XX4336	Extraction Date:	05/27/93
Sample Matrix:	SOIL	Analysis Date:	05/28/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.5	⊕	0.1
ethyl benzene	0.2	⊕	0.1
xylenes (total)	1.3	⊕	0.1
total low boiling petroleum trocarbons, as gasoline ıge organics	76		10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL Lab Sample I.D.	(72-119%)	(65-129)
XX4336	101	124

ıury I.D. # 0-791709

⊕ - Analyte confirmed on secondary column.

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-9 DUP	Collection Date:	05/17/93
Lab Sample ID:	XX4341	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	29		10

Surrogate Recovery	C_{20}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4341	83	116

ity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-13	Collection Date:	05/17/93
Lab Sample ID:	XX4337	Extraction Date:	05/27/93
Sample Matrix:	SOIL	Analysis Date:	05/27/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
·ˆtal low boiling petroleum ırocarbons, as gasoline .ange organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL Lab Sample I.D.	(72-119%)	(65-129)
XX4337	111	112

lity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-13	Collection Date:	05/17/93
Lab Sample ID:	XX4342	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	58		10

Surrogate Recovery	C_{20}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4342	89	118

ity I.D. # 0-791709

LOW BOILING PETROLEUM HYDROCARBONS ANALYSIS

boratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-20	Collection Date:	05/17/93
Lab Sample ID:	XX4338	Extraction Date:	05/27/93
Sample Matrix:	SOIL	Analysis Date:	05/27/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
benzene	0.1	U	0.1
toluene	0.1	U	0.1
ethyl benzene	0.1	U	0.1
xylenes (total)	0.1	U	0.1
total low boiling petroleum hydrocarbons, as gasoline range organics	10	U	10

Surrogate Recovery	Bromofluorobenzene (PID)	Bromofluorobenzene (FID)
Acceptance Limits: SOIL Lab Sample I.D.	(72-119%)	(65-129)
XX4338	111	105

ity I.D. # 0-791709

HIGH BOILING PETROLEUM HYDROCARBONS ANALYSIS

aboratory Name:	ITAS-KNOXVILLE	SDG Number:	NA
Contract Name:	ENSAFE NAS MEMPHIS	Job Number:	ENFA 54114
Client Sample ID:	N-SB8-20	Collection Date:	05/17/93
Lab Sample ID:	XX4343	Extraction Date:	05/26/93
Sample Matrix:	SOIL	Analysis Date:	05/29/93
Concentration Units:	mg/kg	Dryness Factor:	NA

Compound	Results	Qualifiers	Detection Limits
total high boiling petroleum hydrocarbons, as diesel range organics	10	U	10

Surrogate Recovery	C_{18}	C_{32}
Acceptance Limits: SOIL	(41-149%)	(59-179%)
Lab Sample I.D.		
XX4343	92	115

y I.D. # 0-791709

ATTACHMENT 3

WATER WELL SEARCH

MEMPHIS AND SHELBY COUNTY
HEALTH DEPARTMENT

RICHARD SWIGGART, M.P.A.
Director

SHERMAN KAHN, M.D.
Health Officer

DR. W. W. HERENTON
Mayor of Memphis

WILLIAM N. MORRIS, JR.
Mayor of Shelby County

August 6, 1992

EnSafe / Allen & Hoshall
5720 Summer Trees Drive, Suite 8
Memphis, Tennessee 38134

Attn: Lawson M. Anderson

RE: Environmental Site Assessment
Water Well Search
Millington Naval Air Station-Willis Gate
Intersection Of Navy Road And Third Avenue
Millington, Tennessee

Dear Mr. Anderson:

Please find enclosed a list of quasi-public, commercial, and residential wells located within an approximate two (2) mile radius of the above location that are contained in our files. This list does not contain the location of any public water supply wells that are operated by the Public Utility Division, nor does it contain wells used for groundwater monitoring. Public water well information may be obtained from Memphis Light, Gas, and Water Division, 245 South Main St., Memphis, Tennessee (901)528-4011. Information regarding monitoring wells associated with leaking petroleum storage tanks may be obtained from the Tennessee Department of Environment and Conservation, Division of Water Management, 2500 Mt. Moriah Road, (901)543-6695.

Our records indicate five (5) wells on the Naval Air Station property, however, information regarding the exact location, use, and depth of these wells is not included in our files. You may contact Lt. Ron Gruzesky, NAS Memphis, 873-5230 for additional information about these wells.

wp-0075I/115

ility I.D. # 0-791709

814 JEFFERSON AVENUE, MEMPHIS, TENNESSEE 38105
PHONE (901) 576-7600 FAX (901) 576-7832

I hope this clarifies the facts for which we have records on file in our office. If Pollution Control can be of further assistance, feel free to contact me at 576-7775.

Sincerely,

S. L. Sherrill, Jr., Asst. Manager
POLLUTION CONTROL

ENCLOSURE

wp-0075I/116
WAS/SLS
HK-199

WATER WELL LIST

 August 6, 1992

Water Well Number: 1
Owner of Well: James E. Krosp
Location of Well: 7378 Krosp Road
Mailing Address: James E. Krosp
7378 Krosp Road
Millington, TN 38053
Number of wells at this location: 1
Well Depth: 150 Feet
Well Classification: Residential

Water Well Number: 2
Owner of Well: Clifford O. Longmire
Location of Well: 7431 Krosp Road
Mailing Address: Clifford O. Longmire
7431 Krosp Road
Millington, TN 38053
Number of wells at this location: 1
Well Depth: 120 Feet
Well Classification: Residential

Water Well Number: 3
Owner of Well: Terry Longmire
Location of Well: 7473 Krosp Road
Mailing Address: Terry Longmire
7473 Krosp Road
Millington, TN 38053
Number of wells at this location: 1
Well Depth: 130 Feet
Well Classification: Residential

Water Well Number: 4
Owner of Well: Phoenix Zinc
Location of Well: 4525/4599 Big Creek Church Road
Mailing Address: 4525/4599 Big Creek Church Road
Millington, TN 38053
Number of wells at this location: 1
Well Depth: Not Listed
Well Classification: Commercial

Water Well Number: 5
Owner of Well: Shelby County Conservation Board
Location of Well: Edmond Orgill Park
Mailing Address: Shelby County Conservation Board
2599 Avery
Memphis, TN 38053
Attn: Ed Price
Number of wells at this location: 1
Well Depth: Depth Not Listed
Well Classification: Irrigation And To Maintain Lake Level

wp0075I/117

August 6, 1992

Water Well Number: 6
Owner of Well: Harold Bradley
Location of Well: 5230 Bateman Road
Mailing Address: Harold Bradley
5230 Batman Road
Millington, TN 38053
Number of wells at this location: 1
Well Depth: 150 Feet
Well Classification: Residential

ATTACHMENT 4

CHRIS DATA

GASOLINES: AVIATION (< 4.86g lead/gal)

GAV

Common Synonyms	Watery liquid	Red, blue, green, brown or purple	Gasoline odor
	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled will cause dizziness, headache, difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: Not pertinent
3.3 IMO/UN Designation: 3.1/1203
3.4 DOT ID No.: 1203
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Red, blue, green, brown, purple
4.3 Odor: Gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective goggles, gloves.
5.2 Symptoms Following Exposure: INHALATION causes irritation of upper respiratory tract; central nervous system stimulation followed by depression of varying degrees ranging from dizziness, headache, and incoordination to anesthesia, coma, and respiratory arrest; irregular heartbeat is dangerous complication. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression. INGESTION causes irritation of mucous membranes of throat, esophagus, and stomach; stimulation followed by depression of central nervous system; irregular heartbeat.
5.3 Treatment of Exposure: Seek medical attention. INHALATION: maintain respiration; give oxygen if needed. ASPIRATION: enforce bed rest; administer oxygen. INGESTION: do NOT induce vomiting; lavage carefully if appreciable quantity was ingested; guard against aspiration into lungs. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 300 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.25 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: -50°F C.C.
6.2 Flammable Limits in Air: 1.2%-7.1%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: None
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 824°F
6.8 Electrical Hazard: Class I, group D
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 ppm/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Grades 80/87, 100/130, and 115/145: Specification MIL-G-5572a
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 160—340°F = 71—171°C = 344—444°K
12.4 Freezing Point: <76°F = <24.4°C = <297.6°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.711 at 15°C (liquid)
12.8 Liquid Surface Tension: 19—23 dynes/cm = 0.019—0.023 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 49—51 dynes/cm = 0.049—0.051 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.054
12.12 Latent Heat of Vaporization: 130—150 Btu/lb = 71—81 cal/g = 3.0—3.4 X 10^5 J/kg
12.13 Heat of Combustion: —18,720 Btu/lb = —10,400 cal/g = —435.4 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

GAV	GASOLINES: AVIATION (< 4.86g lead/gal)

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot (estimate)	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F (estimate)	Temperature (degrees F)	Centipoise (estimate)
35	45.040	10	.466	40	.909	35	.519
40	44.880	15	.468	50	.900	40	.501
45	44.730	20	.471	60	.891	45	.485
50	44.570	25	.474	70	.883	50	.469
55	44.410	30	.476	80	.874	55	.454
60	44.260	35	.479	90	.865	60	.440
65	44.100	40	.482	100	.856	65	.426
70	43.950	45	.484	110	.847	70	.414
75	43.790	50	.487	120	.838	75	.401
80	43.630	55	.490	130	.829	80	.390
85	43.480	60	.492	140	.821	85	.379
90	43.320	65	.495	150	.812	90	.368
95	43.160	70	.498	160	.803	95	.358
100	43.010	75	.500	170	.794	100	.348
105	42.850	80	.503	180	.785	105	.339
110	42.700	85	.506	190	.776	110	.330
115	42.540	90	.508			115	.322
120	42.380	95	.511			120	.314
125	42.230	100	.514			125	.306
130	42.070	105	.516			130	.299
135	41.920					135	.291
140	41.760					140	.285
145	41.600					145	.278
150	41.450					150	.272
155	41.290					155	.266
160	41.140					160	.260

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE		DATA NOT AVAILABLE		NOT PERTINENT		DATA NOT AVAILABLE