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**Superfund Records Center**SITE: Wells G & HBREAK: 23OTHER: 455166**FILE COPY DO NOT MARK****ADDENDUM I TO HYDROGEOLOGIC
CHARACTERIZATION REPORT
(Volume 1 of 2)****MURPHY'S WASTE OIL SERVICE, INC.
252 SALEM STREET
WOBURN, MASSACHUSETTS**

January 31, 1995

Prepared for:

Murphy's Waste Oil Service, Inc.
252 Salem Street
Woburn, MA 01801

Prepared by:

Clean Harbors Environmental Services, Inc.
325 Wood Road
Braintree, MA 02184

CHES Job No. EN-170



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January 31, 1995

Mr. John A. Carrigan
Department of Environmental Protection
Hazardous Waste Regulatory Program
1 Winter Street
Boston, Massachusetts 02108

Re: Murphy's Waste Oil Service, Inc.
Addendum I to Hydrogeologic
Characterization Report

Dear Mr. Carrigan:

Enclosed please find two (2) copies of a document entitled "Addendum I to Hydrogeologic Characterization Report" which is hereby submitted pursuant to the requirements of Section 10.b of the Facility's RCRA Part B Permit. This report, consisting of two (2) volumes, contains the results of subsurface investigation performed in the fall of 1994, incorporates data obtained from the Wells G&H Superfund Site PRP Group, and supplements the Hydrogeologic Characterization Report which was previously submitted on February 1, 1994.

If you have any questions regarding the technical aspects of this report, please call Jay McCreery at (617) 849-1800, extension 1399.

Very truly yours,

A handwritten signature in black ink, appearing to read "Jules B. Selden".

Jules B. Selden
Corporate Attorney

Enclosures



Mr. John A. Carrigan
Department of Environmental Protection
January 31, 1995
Page 2

cc: Charles J. McCreery (enc)
Stephen Applebaum (enc)
Dana Simpson
Norman Nelhuebel
Joan Murphy (enc)
Woburn Conservation Commission (enc)

ADDENDUM I TO HYDROGEOLOGIC CHARACTERIZATION REPORT

Murphy's Waste Oil Service, Inc.
252 Salem Street
Woburn, MA 01801

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ADDENDUM I TO HYDROGEOLOGIC CHARACTERIZATION REPORT

Murphy's Waste Oil Service, Inc.
252 Salem Street
Woburn, MA 01801

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INTRODUCTION

Clean Harbors Environmental Services, Inc. (CHES) has prepared this *Addendum I to Hydrogeologic Characterization Report* of the property located at 252 Salem Street and 252 Rear Salem Street in Woburn, Massachusetts (the site). The site is owned by Old Oil Realty Trust and is leased by Murphy's Waste Oil Service, Inc. (Murphy's), a transfer, storage and disposal facility for waste oil and solvent-contaminated oil.

This *Addendum I to Hydrogeologic Characterization Report* was prepared pursuant to the requirements of the RCRA Part B Permit issued by the Massachusetts Department of Environmental Protection (DEP) to Murphy's effective October 19, 1993. Section 10 of the Part B Permit requires a hydrogeologic characterization of the site and site area. An initial *Hydrogeologic Characterization Report*, dated February 1, 1994, was prepared by CHES and submitted to DEP to document three subsurface investigations which were performed on the site by CHES between December 1987 and February 1989. The *Hydrogeologic Characterization Report* included results of the previous investigations, a summary of the geology and hydrogeology of the site area, and descriptions of pertinent site features, petroleum use, past spills and a Short-Term Remedial Measure which was performed on the site in March 1989 to remove 1,100 cubic yards of petroleum-contaminated soil during construction of the waste oil facility building and tank farm.

Although the *Hydrogeologic Characterization Report* satisfied some requirements of the RCRA Part B Permit, additional work was deemed necessary to fulfill all requirements. A *Scope of Work for Subsurface Investigation*, dated June 30, 1994, was subsequently prepared to address remaining requirements of Section 10.b.1 of the RCRA Part B Permit. The *Scope of Work* was prepared following review of the report *Draft Remedial Investigation, Southwest Properties, Wells G&H Superfund Site, Woburn, Massachusetts* (Ref. 1), which was prepared by Remediation Technologies, Inc. (ReTec) for Beatrice Corporation in February 1994. The Murphy's site is located in the southwest corner of the area under investigation for the Central Area Remedial Investigation/Feasibility Study (RI/FS) of the Wells G&H Superfund Site. Some of the information contained in the ReTec report relates to the Murphy's site and was considered

in development of the *Scope of Work*. The *Hydrogeologic Characterization Report* and the *Scope of Work for Subsurface Investigation* were approved by DEP on August 29, 1994.

This *Addendum I to Hydrogeologic Characterization Report* includes a summary of findings of the ReTec investigation as they relate to the Murphy's site, requirements of the RCRA Part B Permit, and development of the *Scope of Work* for additional investigation. This report documents results of the additional investigation performed on the site by CHES as proposed in the *Scope of Work* and addresses remaining requirements of the RCRA Part B Permit.

SITE DESCRIPTION

The site is located at 252 Salem Street and 252 Rear Salem Street in the eastern portion of the City of Woburn, Massachusetts. Figure 1 is a Locus Map showing the site location. Properties surrounding the site are shown in Figure 2. The site is located approximately 1,000 feet west of and upgradient from the Aberjona River. The site consists of one parcel of land zoned as industrial and has a total area of approximately 3.4 acres. The City of Woburn Assessor's Office designates the site as Parcel 41, Block 005 on Map 16.

Throughout most of its history, the site has been used primarily as a waste oil and/or virgin oil temporary storage facility. In the 1920s, the Woburn Oil Company reportedly began operations by storing virgin oils on the northern portion of the site. Waste oils were additionally accepted onto the site in the mid-1950s. Murphy's Waste Oil Service, Inc. acquired the site facility on July 7, 1977. As many as 20 aboveground storage tanks installed by Murphy's Waste Oil Service, Inc. were located on the site in 1986. The current owner of the site land is Old Oil Realty Trust, to whom the land was deeded in 1980. In February 1989, Clean Harbors purchased the stock (i.e., the facility and assets) of Murphy's Waste Oil Service, Inc. and has continued to operate the facility under the latter name and leases the land from Old Oil Realty Trust.

The operating portion of the site is surrounded by a chain-link fence which restricts access to the site. Vehicular access to the site is via Salem Street. Figure 3 is a Site Plan illustrating site details. The site is described in three sections, the Northern, Central and Southern Sections. The Northern Section is not paved and is referred to by previous site occupants and on site plans (dated in the 1920s) as the "Oil Yard." A gravel parking area is currently located in the Northern Section of the site. A two-foot high concrete dike, which was constructed in September 1986, is

also located in the Northern Section of the site. The dike surrounded seven aboveground oil storage tanks, which were subsequently relocated to another area of the site in 1990.

The City of Woburn has a sanitary sewer easement across the Northern Section of the site in an east-west orientation. The sewer which traverses the site originates at the westerly abutting property, the former John J. Riley Company tannery, and discharges into a main line of the City of Woburn sanitary sewer system.

The Central Section of the site is occupied by the waste oil facility which contains eleven aboveground storage tanks, an office, a laboratory and a rest room. The facility was constructed between March 1989 and January 1990. The tanks in the facility are located within a concrete containment area which is surrounded by a concrete dike and covered with a canopy. The area surrounding the facility is surfaced with crushed gravel, as is most of the Central Section of the site. Underground utilities which service the oil storage facility include City water and sewer.

A garage is located in the Southern Section of the site. The garage is constructed of steel siding over a four-foot concrete foundation. The floor is also constructed of concrete and does not contain any floor drains. From 1979 to the Summer of 1987, Murphy's Waste Oil Service, Inc. used the garage as an office and for company truck maintenance. The garage is heated by oil which is stored in a 1,000-gallon underground storage tank located off the southeast corner of the building. The areas west and south of the garage are vegetated with grass.

Topographically, the ground surface in the Southern Section of the site slopes down gently to the north from Salem Street. The ground surface is relatively level within the fenced area of the Central and Northern Sections of the site (50 feet National Geodetic Vertical Datum). Properties on Salem Street adjacent to the site are located on high ground, and a steep embankment approximately 30 feet high slopes down to the north outside of the fence. A low wetland area is located outside of the fenced area in the eastern portions of the Central and Northern Sections of the site.

ADJACENT PROPERTIES

Properties surrounding the Murphy's site are shown in Figure 2. The Boston and Maine Railroad is adjacent to the west side of the site. Properties west of the railroad tracks include the former

John J. Riley Company tannery (currently a vacant lot and undergoing new site construction) and land currently used as offices and warehouse space for Butterworth/Heinemann Company and other tenants. The adjacent property north of the Murphy's site is undeveloped land owned by the Wildwood Conservation Trust. The land east of Murphy's is an industrial property occupied by Whitney Barrel Company. Three residential properties are located south of the site along Salem Street.

The John J. Riley Company began tannery operations in 1909. The property consisted of one developed parcel (228 Salem Street) with two buildings (a process plant and offices) and an additional undeveloped parcel east of the railroad tracks (referred to here as the Wildwood property). The two parcels of land were sold to Beatrice Foods, Inc. in 1978. In 1983, ownership of the undeveloped parcel was transferred to the Wildwood Conservation Trust.

The John J. Riley tannery was supplied process water from two private wells, one located 110 feet west of the Murphy's site (Production Well No. 1) and one on the Wildwood property 130 feet northeast of Murphy's (Production Well No. 2). The locations of both supply wells are shown in Figure 2. Production Well No. 2 began operation in 1958. Both wells were shut down in 1989 after chlorinated VOCs were identified in groundwater samples from Well No. 2.

Previous site investigations performed at the John J. Riley tannery during the early 1980s identified two chromium and benzidine dye waste lagoons and piles of unprocessed hides north of the process building. Sludge material from process sedimentation tanks were buried next to the lagoons (Ref. 2).

During the early 1980s, miscellaneous debris, piles of rusted 55-gallon drums and pesticide container caps were found on the Wildwood property. Between 200 and 500 five-gallon drums of arsenic trioxide were also found just north of the property (Ref. 2). Based on these findings, the Wildwood property was added to the Wells G&H Superfund Site RI/FS.

Subsequent investigations of the Wildwood property identified surface accumulations of sludge (chemical and petroleum residues), mixed contaminant soils (including polycyclic aromatic hydrocarbon compounds [PAHs], polychlorinated biphenyl compounds [PCBs] and pesticides) and volatile organic compound (VOC) contaminated soils (including trans-1,2-dichloroethene [DCE], trichloroethene [TCE], tetrachloroethene [PCE], 1,1,1-trichloroethane [TCA] and chloroform). Most of the surface accumulations were located directly adjacent to a dirt road

which enters the Wildwood property from Salem Street (through the Aberjona Auto Parts property). Chlorinated VOCs, primarily TCE, have been found to be widely distributed in groundwater on the Wildwood property with the highest concentrations (92,000 micrograms per liter [ug/l]) observed in bedrock fractures (Ref. 3).

The Murphy's site and two other properties north of Salem Street and east of the railroad tracks were added to the Wells G&H Superfund Site investigation in 1989. Murphy's Waste Oil Service, Inc., Whitney Barrel and Aberjona Auto Parts are known as the Southwest Properties of the Central Area which are currently part of the RI/FS. Regional geologic information presented herein was obtained from the ReTec report (Ref. 1) and a subsequent report, *Wells G&H Site, Central Area, Remedial Investigation Phase IA Report*, which was prepared by GeoTrans, Inc. for Beatrice Corporation in February 1994 (Ref. 4).

PREVIOUS CHES INVESTIGATIONS

Based upon the data collected during two structural boring programs and an environmental investigation completed on the Murphy's site between December 1987 and February 1989, the following conclusions were made:

- Groundwater data collected on the site during the period of 1988 through 1989 indicated that a persistent plume of chlorinated VOCs existed in groundwater in the Northern Section of the site. The presence of this plume was not evident in the Central Section. The source of the chlorinated VOCs in groundwater on the site was not identified.
- Chlorinated VOCs were also detected in some soil samples analyzed during the structural boring programs and environmental investigation. Elevated levels of chlorinated VOC contamination were more evident in soil at greater depths.
- Significant petroleum contamination was identified within the Central Section of the site in the area of the new facility. During construction of the new facility, 1,100 cubic yards of petroleum-contaminated soils within the facility footprint were subsequently removed and disposed as a DEP-approved Short-Term Measure.

- A less significant level of petroleum contamination was detected in the Northern Section of the site, west of the diked area.
- The petroleum contamination identified in the site soils appeared to be residual waste oil contamination associated with previous site activities. These activities included incidental releases and more importantly, historical use of petroleum as dust control and historic dumping of petroleum in a waste pit.

PREVIOUS RETEC INVESTIGATION

The ReTec report (Ref. 1) documented investigation of the three Southwest Properties, including Murphy's Waste Oil Service, Inc., Whitney Barrel and Aberjona Auto Parts. The ReTec investigation involved sampling and analysis of surface and subsurface soils and groundwater. Figures from the ReTec report showing sample locations and analytical results are presented in Appendix A.

Surface Samples

During the ReTec investigation, six surface soil samples were obtained in locations shown with summary sample results in Figures 5-1 through 5-4 in Appendix A. Three of the samples were obtained in the wetland area located between Murphy's Waste Oil and the Whitney Barrel property. Surface soil samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), PCBs, pesticides, total metals and cyanide.

Analysis of surface soil samples detected chlorinated VOCs, specifically 1,1-DCE and 1,2-DCE, at concentrations up to 4.9 micrograms per kilogram (ug/kg). Gasoline-related VOCs, including benzene, toluene, ethylbenzene and xylenes (BTEX), were detected in two surface soil samples on the Murphy's site at concentrations up to 31.2 ug/kg (Figure 5-1 in Appendix A). Chlorinated VOCs and BTEX compounds were also detected in surface soils at Whitney Barrel and Aberjona Auto Parts at similar concentrations.

PAHs (a sub-class of SVOCs) were detected in surface soil samples on the Murphy's site at total concentrations ranging from 170 ug/kg to 13,964 ug/kg (Figure 5-2 in Appendix A). The highest

levels of PAHs were observed in surface soils at boring MR-2SS, which is located at the northwest corner of the waste oil facility tank farm. The presence of PAHs in this location is attributed to historic soil contamination which was encountered during construction of the building and tank farm. PAHs were also detected in surface soils at Whitney Barrel (up to 11,267 ug/kg) and Aberjona Auto Parts (up to 20,711 ug/kg).

PCB compounds were detected in three surface soil samples collected from the wetland on the Murphy's site at concentrations ranging from 1,096 ug/kg to 13,330 ug/kg (Figure 5-3 in Appendix A). Outside of the wetland, PCBs were detected in surface soils on the Murphy's site only in sample MR-3SS (53 ug/kg), which was obtained at the south end of the concrete dike. PCBs were also detected in surface soils at Whitney Barrel (up to 551 ug/kg) and Aberjona Auto Parts (up to 296 ug/kg). Chlorinated pesticide compounds including endrin and chlordane were also detected in the wetland surface soil samples on the Murphy's site at total concentrations ranging up to 2.89 milligrams per kilogram (mg/kg). These compounds were detected in surface soils outside of the wetland on the Murphy's site at total concentrations up to 0.08 mg/kg. Endrin and chlordane were detected in surface soils at Whitney Barrel at total concentrations up to 1.39 mg/kg.

Elevated concentrations of some metals, including arsenic (up to 17.0 mg/kg), cadmium (up to 4.8 mg/kg), chromium (up to 8,193 mg/kg) and lead (up to 1,245 mg/kg), were detected in the three surface soil samples from the wetland on the Murphy's site, with the highest concentrations observed in sample MR-SS7 which was obtained at the northeast corner of the site (Figure 5-4 in Appendix A). Relatively low concentrations of these metals were detected in surface soil samples collected outside of the wetland on the Murphy's site. Cyanide was also detected in two of the wetland samples at concentrations up to 4.7 mg/kg. Cyanide was not detected in surface soils elsewhere on the Murphy's site, however, low concentrations of cyanide below the Practical Quantitation Limit (PQL) were detected in surface soils at Whitney Barrel.

Subsurface Samples

During the ReTec investigation, four subsurface soil samples were obtained on the Murphy's site at locations shown with summary sample results in Figures 5-5 through 5-8 in Appendix A. Subsurface soil samples were obtained at the groundwater interface (approximately three to four feet below grade) and analyzed for VOCs, SVOCs, PCBs, pesticides, total metals and cyanide.

Elevated concentrations of VOCs were detected in subsurface sample MR-SS2D, which is located at the northwest corner of the waste oil facility tank farm (Figure 5-5 in Appendix A). Chlorinated VOCs, including 1,2-DCE and TCE, were detected in the sample at a total concentration of 3,633 ug/kg; BTEX compounds were detected at a total concentration of 15,311 ug/kg. Concentrations of chlorinated VOCs and BTEX compounds in other subsurface samples obtained at Murphy's, Whitney Barrel and Aberjona Auto Parts were comparatively low.

PAHs were detected in subsurface sample MR-SS2D at a total concentration of 3,745 ug/kg and are attributed to historic soil contamination which was encountered during construction of the waste oil facility building and tank farm (Figure 5-6 in Appendix A). PAHs were otherwise not detected in subsurface soils on the Murphy's site. Elevated concentrations of PAHs were detected in subsurface soils at Whitney Barrel (up to 21,686 ug/kg).

PCBs were not detected in subsurface soils at any of the four sampling locations on the Murphy's site (Figure 5-7 in Appendix A). PCBs were detected in subsurface soils at Whitney Barrel (up to 1,414 ug/kg) and Aberjona Auto Parts (515 ug/kg). Pesticides were detected in subsurface soils on the Murphy's site at total concentrations up to 0.20 mg/kg and at Whitney Barrel at total concentrations up to 0.23 mg/kg.

Metals were detected in subsurface soils at the Murphy's site at levels which were typical of most other subsurface samples obtained at Whitney Barrel and Aberjona Auto Parts (Figure 5-8 in Appendix A). Moderate concentrations of cadmium (1.2 mg/kg) and lead (485 mg/kg) were detected in sample MR-SS2D obtained at the northwest corner of the waste oil facility tank farm, and are attributed to historic soil contamination. Cyanide was not detected in any of the subsurface soil samples obtained on the Murphy's site.

Groundwater Samples

During the ReTec investigation, groundwater samples were obtained from two monitoring wells on the Murphy's site in locations shown with summary sample results in Figures 5-9 and 5-10 in Appendix A. Both of the wells are screened across the water table to monitor water quality in the upper portion of the aquifer. Well MR-1SS is located in the northern portion of the site near the concrete dike and adjacent to the sewer line; well MR-2SS is located at the northwest corner of

the waste oil facility tank farm (see Site Plan, Figure 3). Groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, dissolved metals and cyanide.

Chlorinated VOCs, including 1,1 dichloroethane (DCA), 1,1,1-TCA, PCE and TCE were detected in groundwater from well MR-1SS at a total concentration of 11.5 ug/l; chlorinated VOCs (primarily 1,2-DCE) were detected in well MR-2SS at a total concentration of 483.6 ug/l (Figure 5-9 in Appendix A). Gasoline-related BTEX compounds were also detected in well MR-2SS at a total concentration of 345.5 ug/l.

Low concentrations of SVOCs were detected in groundwater from well MR-2SS, including the PAHs naphthalene (21 ug/l), 2-methylnaphthalene (19 ug/l), and pyrene (3 ug/l). PAHs were not detected in groundwater from well MR-1SS.

Analysis of groundwater samples from wells MR-1SS and MR-2SS by ReTec did not detect any PCB or pesticide compounds.

Dissolved lead (0.029 milligrams per liter [mg/l]) and zinc (0.025 mg/l) were detected in groundwater from well MR-2SS (Figure 5-10 in Appendix A). No other dissolved metals or cyanide were detected in groundwater samples from the two wells.

SCOPE OF WORK

In order to satisfy the requirements of the RCRA Part B Permit for the Murphy's facility, a *Scope of Work for Subsurface Investigation*, dated June 30, 1994, was submitted to DEP. The *Scope of Work* included the following proposed tasks:

- installation of new groundwater monitoring wells on the site upgradient and downgradient of the waste oil facility building, including one deep well to be continued to the lower-boundary of the uppermost aquifer;
- collection, characterization and field-screening of samples from the soil borings, and laboratory analysis of select samples;

- collection of surface soil samples from the wetland on the east side of the site for laboratory analysis;
- collection and laboratory analysis of groundwater samples from new and existing wells on the site, and surface water from the wetland on the east side of the site;
- determination of aquifer characteristics at each well location using a rising-head slug test; and
- documentation of findings of the subsurface investigation in a report with other regional information.

The *Scope of Work* was approved by DEP in a letter dated August 29, 1994 (Appendix B) with minor modifications which were incorporated into the investigation.

CHES SUBSURFACE INVESTIGATION METHODOLOGY

Applicable Permits

Prior to drilling, the locations of all known subsurface utilities were determined and DIGSAFE was notified. Since drilling was proposed within 100 feet of the wetland, a Request for Determination of Applicability of the Woburn Wetlands Ordinance was filed with the City of Woburn Conservation Commission. The Conservation Commission determined that the Wetlands Ordinance was not applicable to the planned drilling operations.

Soil Borings/Monitoring Wells

Seven groundwater monitoring wells were installed on the site during the period of October 12 - 18, 1994 by Environmental Drilling, Inc. in locations shown on Figure 3 (Site Plan). Wells MW-1 and MW-2 were installed along the west site boundary; wells MW-3, MW-4 and MW-5S were installed east of the dike wall and facility building adjacent to the wetland; well MW-6 was installed southeast of the waste oil facility building. One deep well (MW-5D) was installed east of the facility building adjacent to shallow well MW-5S. Soil borings for wells MW-1, MW-2,

MW-3, MW-4, MW-5S and MW-6 were continued to depths of 15 to 20 feet below grade; deep well MW-5D was continued to bedrock refusal at 83 feet below grade.

Soil borings for the shallow wells were performed using 4¹/₄-inch hollow-stem auger. Boring MW-5D was installed using drive and wash methodology. Soil samples were collected continuously in the shallow borings; samples were collected at a five-foot interval in boring MW-5D below the zone characterized in adjacent boring MW-5S. The soil borings were performed in accordance with ASTM D1586, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained using a two-inch diameter split-spoon sample tube advanced ahead of the auger (or driven casing) according to a standard penetration test using a 30-inch drop from a 140-pound hammer. Hollow-stem auger was decontaminated by steam prior to each soil boring. Split-spoon sample tubes were washed with Liquinox detergent and then rinsed with methanol and deionized water. Drill cuttings were containerized for later characterization and proper disposal. The Uniform Hazardous Waste Manifest for disposal of soil cuttings generated during this investigation is presented in Appendix C.

All soil samples were visually described noting grain size, apparent water saturation, and color. Soil boring logs containing sample descriptions and other pertinent information are presented in Appendix D. All soil samples were split vertically and prepared for field-screening and laboratory analysis. Samples for field-screening were placed in clean 16-ounce glass jars and covered with aluminum foil prior to replacing the lid. Samples for laboratory analysis were transferred into clean glass jars with Teflon-lined lids and stored in a cooler.

Soil samples for field-screening were allowed to equilibrate for a minimum of 15 minutes for headspace development, and then were screened using a flame ionization detector (Foxboro Model 128 Organic Vapor Analyzer [OVA]). This instrument measures the total VOCs in vapor and reports in terms of parts per million (ppm) referenced to methane. Total VOC headspace measurements are presented in the soil boring logs and are summarized in Table 1.

Based on results of field-screening and/or evidence of possible soil staining, select samples from the borings were laboratory-analyzed for VOCs (by EPA Method 8260), SVOCs (by EPA Method 8270), total petroleum hydrocarbons (TPH by GC/FID), PCB/pesticide compounds (by EPA Method 8080), 13 priority pollutant total metals and total cyanide. In each of the shallow borings, a soil sample was obtained from the surface interval (0 - 2 feet below grade) for laboratory analysis of TPH. In addition to analytical testing, one soil sample from each of the

borings was composited over the screened interval for determination of grain size distribution by sieve analysis (by ASTM Method D422).

Monitoring Well Installation

The seven soil borings were completed with installation of groundwater monitoring wells. The wells were constructed of two-inch diameter Schedule 40 flush-joint threaded polyvinyl chloride (PVC) factory slotted (0.01-inch) well screen. The shallow wells were screened across the groundwater table in the upper aquifer; deep well MW-5D was screened at the bedrock surface at the lower boundary of the aquifer. The annular space around the well screen was packed with #2 silica sand to a depth of approximately one foot above the top of the well screen. A subsurface seal of at least one foot of bentonite was placed above the sand pack. The shallow wells were backfilled to grade with Portland cement; deep well MW-5D was backfilled with powdered bentonite/cement grout conveyed through a tremie tube. Locking guard pipes were installed over all of the wells and protective bumper posts were installed adjacent to the guard pipes in traffic areas. Schematic construction diagrams for the monitoring wells are presented in Appendix D.

Wetland Soil Sampling

Soil samples were obtained on October 13 - 14, 1994 in four locations at the edge of the wetland area, designated as SW-1, SW-2, SW-3, and SW-4 (Figure 3). In each location, a grab sample was obtained of the upper six inches of wetland soils. Samples from each location were laboratory-analyzed for VOCs, SVOCs, TPH, PCB/pesticides, 13 priority pollutant metals and total cyanide. Wooden stakes were placed at each of the locations so they could be reoccupied for water sampling.

Well Development and Stadia Survey

All of the wells were developed on October 31, 1994 using a surface pump. Groundwater was purged from each well until clear. A slow pumping rate was used to avoid de-watering of the screened interval. Purged groundwater was containerized for characterization and proper disposal. Based on the results of the analytical data, the purged groundwater was batched

together with other oily wastewater from the Murphy's oil recycling facility and shipped off-site for proper treatment and disposal.

A stadia survey was performed on October 31, 1994 to determine the well rim elevations to the nearest one-hundredth of a foot relative to the National Geodetic Vertical Datum of 1929. Wooden reference stakes placed in the wetland were also surveyed for use in measuring surface water elevations.

Groundwater Sampling

The newly-installed wells and existing wells MR-1SS and MR-2SS (installed during the ReTec investigation) were sampled on November 9, 1994. Prior to purging the wells, water level was measured in each of the wells and surface water location SW-3. Surface water was not present at locations SW-1, SW-2 and SW-4 in the wetland at the time of sampling. After measurement of water levels, the wells were purged by removal of at least three casing volumes of groundwater to assure that representative samples were obtained. Field measurements were then recorded in each of the locations for pH, temperature and specific conductance.

Water samples from each of the wells were obtained using pre-cleaned Teflon bailers; surface water samples at location SW-3 were obtained by direct filling of the sample containers. Groundwater and surface water samples were laboratory-analyzed for VOCs (by EPA Method 624), SVOCs (by EPA Method 625), TPH (by GC/FID), PCB/pesticide compounds (by EPA Method 608), 13 priority pollutant dissolved metals and total cyanide. In addition, a trip blank was prepared to accompany the sample jars to and from the site which was analyzed with the other samples for VOCs.

Installation of monitoring wells and sampling was performed in accordance with DEP Policy #WSC-310-91, *Standard References for Monitoring Wells*. All analyses were performed by CHES' laboratory in Braintree, Massachusetts (Massachusetts Registration No. M-MA00032).

Determination of Aquifer Characteristics

Hydraulic conductivity was measured in new and existing wells on the site on November 21, 1994 using a rising-head slug test. To conduct the test, a weighted slug was lowered into each of monitoring wells to displace water upward in the well. After equilibration of the water level, the slug was withdrawn and recovery of the water level was recorded utilizing a pressure transducer and environmental data logger (In-Situ Model SE-1000B). Vertically-averaged values of hydraulic conductivity over the screened interval in each well were calculated by the Hvorslev Method. Results of the aquifer testing are presented in Appendix E and are summarized in Table 2.

Site-Specific Health and Safety Plan

All operations associated with the investigation were performed by workers specifically trained in the handling of hazardous materials under OSHA regulations at 29 CFR 1910.120. All safety equipment and work procedures were conducted in accordance with a site-specific Health and Safety Plan. The Health and Safety Plan included specifications of the level of personal protection, designation of work zones and decontamination procedures.

CHES SUBSURFACE INVESTIGATION RESULTS

Soil Boring Results

Shallow soil types encountered during installation of wells MW-1 through MW-6 consisted of approximately eight feet of fill material, including fine to coarse sand with little silt and gravel, overlying native sand with varying amounts of gravel. The transition from fill to native materials was not readily apparent in most of the borings because native materials were used to fill the property. The transition was most clear in boring MW-3, in which a thin (two-inch) layer of peat was noted at the contact. The peat was encountered in MW-3 at a depth of 7.5 feet below grade and is presumed to represent wetland deposits which were covered by fill during site construction. A geologic cross-section oriented north-south through the site is shown in Figure 4 which shows the spatial relationship of the fill material to the wetland.

Appendix F contains regional maps and cross-sections from the ReTec and GeoTrans reports which are pertinent to the site. Figure 3-2 in Appendix F is a Surficial Geologic Map of the Wells G&H Central Area adjacent to the site. Although coverage on the map does not extend to the Murphy's site, the map shows that Aberjona Auto Parts and Whitney Barrel are located on filled land within the Aberjona River Basin similar to Murphy's.

The native sand and gravel aquifer was penetrated by the soil boring for well MW-5D, which was continued to refusal at a depth of 83 feet below grade. The lower portion of the aquifer consisted of well-sorted fine sand with little to no gravel. A confining layer marking the lower boundary of the aquifer was not reached prior to refusal, which was presumed to be the bedrock surface. A ten-foot well screen was used in well MW-5D due to the anticipated slow groundwater recharge from the fine sands.

Refusal was encountered in boring MW-5D at a depth which was slightly deeper than the anticipated depth to bedrock, based on a regional cross-section presented in the ReTec report. Figure 4-4 in Appendix F shows the regional cross-section which has been modified to show the depth at which refusal was encountered in boring MW-5D. The location of the cross-section is shown in Figure 4-3 in Appendix F. A Bedrock Contour Map presented in Figure 4-6 in Appendix F indicates the bedrock surface underlying the site slopes down to the southeast. The Bedrock Contour Map presented in Figure 4-6 agrees closely with the depth at which refusal was encountered in boring MW-5D.

Field-Screening Results

Field-screening headspace measurements are shown on the soil boring logs and are summarized in Table 1. Profiles of field-screening results (in ppm) with depth in each of the borings are presented in Figure 5. Headspace measurements of soil samples obtained from borings MW-1, MW-5S, MW-5D and MW-6 were less than 10 ppm. Elevated measurements were obtained during field-screening of samples from borings MW-2 (to greater than 1,000 ppm), MW-3 (up to 460 ppm) and MW-4 (up to 92 ppm). Elevated headspace measurements in boring MW-2 were observed in shallow samples (0 - 6 feet below grade) and are attributed to the presence of VOCs in the unsaturated fill material. In contrast, the maximum headspace measurements in borings MW-3 and MW-4 were observed at depth (10 - 12 feet below grade) in saturated samples below the water table. These elevated headspace measurements are attributed to methane from the

adjacent wetland. A hydrogen sulfide odor was noted in soil samples obtained below the groundwater table in both borings MW-3 and MW-4.

Soil Analytical Results

Analytical results of the soil boring samples are presented in Appendix G and are summarized in Tables 3, 4 and 5. Low concentrations of acetone (210 ug/kg) and 2-butanone (50 ug/kg) were detected in shallow soils (2 - 4 feet below grade) in boring MW-2 (Table 3), in which elevated headspace measurements were obtained in the same depth interval. A low concentration of acetone (23 ug/kg) was also detected in one soil sample from boring MW-4 below the water table at a depth of 10 to 12 feet below grade. VOCs were detected in only one of the four wetland soil samples obtained on the site. Xylenes were detected at a concentration of 1,300 ug/kg in sample SW-2. VOCs were not detected in any of the other soil boring or wetland samples.

Fluoranthene, a PAH compound, was detected in one surface soil sample (0 - 2 feet below grade) from boring MW-6 at a concentration of 3,300 ug/kg (Table 4). Soil in this sample was stained black and contained a trace of brick debris. Fluoranthene was also detected in surface soils in the wetland at location SW-1 (640 ug/kg) and SW-4 (2,000 ug/kg). Other SVOCs which were detected in wetland samples SW-1 and SW-4 include the PAHs benzo(b)fluoranthene (up to 2,000 ug/kg), benzo(a)pyrene (340 ug/kg), and pyrene (430 ug/kg).

TPH was detected at concentrations ranging from non-detectable levels up to 470 mg/kg in the soil boring samples (Table 4). TPH was detected in the wetland soil samples at concentrations from 72 mg/kg (at SW-1) to 97,000 mg/kg (at SW-2). PCB compounds were also detected in wetland samples SW-2 (220 mg/kg), SW-3 (15 mg/kg) and SW-4 (0.8 mg/kg). PCBs detected in the wetland samples were of two different types. Aroclor 1254 was detected at locations SW-2 and SW-3; Aroclor 1260 was detected at location SW-4. Organochlorine pesticide compounds were not detected in any of the soil boring or wetland samples obtained during this investigation.

Low concentrations of the 13 priority pollutant total metals were detected in the soil boring samples obtained during this investigation (Table 5). Elevated concentrations of some metals were detected in the wetland soil samples, including antimony (up to 80 mg/kg), chromium (up to 5,700 mg/kg), lead (up to 35,100 mg/kg) and zinc (up to 5,200 mg/kg). The highest concentrations of metals were observed at location SW-2. Low concentrations of total cyanide

were also detected in wetland soil samples SW-1 (2.2 mg/kg) and SW-2 (3.6 mg/kg). Cyanide was not detected in any of the other soil boring or wetland samples obtained during this investigation.

Hydrogeologic Observations

Groundwater and surface water elevations measured on the site on November 9 and December 13, 1994 are presented with other field data in Tables 6 and 7, respectively. The depth to groundwater on the site was observed to vary from five to eight feet below grade in the Northern and Central Sections of the site and up to ten feet below grade in the Southern Section. The data indicate that the groundwater and surface water levels were up to 1.7 feet higher during the December 13 sample event. A portion of the rise in water levels is attributed to a storm over the period of December 10 - 11, which resulted in 0.7 inch of rain (precipitation data supplied by National Weather Service, Logan International Airport, Boston, Massachusetts).

Groundwater contour plans constructed using elevation data collected on November 9, 1994 and December 13, 1994 are presented in Figures 6 and 7, respectively. Both contour plans show a very low hydraulic gradient across the site. During the November sample event, water elevations varied by up to 0.36 foot and no distinct horizontal hydraulic gradient (groundwater flow direction) was observed. Water levels in December were higher and a low hydraulic gradient (0.18%) to the south had developed, with variation in observed water elevations up to 0.55 feet. Regional groundwater contour plans presented in the ReTec report (Figures 4-7 and 4-8 in Appendix F) also show a very low horizontal hydraulic gradient in the site area. The groundwater level in well MR-1SS appeared to be anomalously low compared to other wells on the site during both monitoring events. Well MR-1SS is located directly adjacent to the sewer line which traverses the site and may not be representative of actual groundwater levels.

The vertical hydraulic gradient on the site was calculated using groundwater elevation data from wells MW-5S and MW-5D. During the November sample event, a downward (negative) vertical hydraulic gradient of - 0.50% was measured. A similar value (- 0.53%) was measured during the December monitoring event.

Aquifer Characteristics

Rising-head slug tests yielded an average value of hydraulic conductivity of 3.3×10^{-2} centimeter per second (cm/sec) in shallow wells screened in the fill material and the underlying native soils which is a typical value for clean sand (Ref. 5). Well MW-6 yielded the highest value of hydraulic conductivity (8.7×10^{-2} cm/sec), indicating the coarsest material. Well MW-3 yielded the lowest value (1.0×10^{-2} cm/sec) of the newly-installed shallow wells. The slug test data for deep well MW-5D yielded a value of 1.9×10^{-4} cm/sec, which is a typical value for silty sand.

Results of grain size analyses of composite soil samples obtained from the screened interval in each of the new borings are presented in Appendix H. These data were consistent with visual observations made during drilling and with soil types predicted by the slug test data. Based on the grain size analyses, soil samples from the screened interval in the shallow borings are characterized as poorly-sorted sand with up to 60% fine gravel and less than 10% silt and clay. The sample from boring MW-6 contained the highest percentage of coarse material; samples from MW-3 and MW-4 yielded the lowest percentage of coarse material in the shallow borings. Significantly finer material was indicated in the sample from deep boring MW-5D, which contained 35% poorly-sorted sand and 65% silt and clay.

The average linear velocity of groundwater flow at each well was calculated using measured values of hydraulic conductivity and hydraulic gradient and an assumed value of effective porosity of the soil matrix (25%). Using these values, the average horizontal linear velocity in the shallow aquifer was 9.9×10^{-11} foot per day (ft/d). The average vertical linear velocity is 7.0×10^{-10} ft/d in the upper aquifer and 1.5×10^{-12} ft/d in the lower aquifer. As such, groundwater flow on the site is considered to be nearly stagnant. Calculated values of average linear velocity are listed in Table 2.

Groundwater and Surface Water Analytical Results

Analytical results of the groundwater and surface water samples obtained during this investigation are presented in Appendix I and are summarized with previous data in Tables 8, 9 and 10. VOCs were detected only in shallow wells MW-3, MR-1SS and MR-2SS (Table 8). Chlorinated VOCs, including trans,1-2-DCE, TCE, 1,1-DCA and 1,1,1-TCA, were detected in well MW-3 at a total concentration of 1,342 ug/l. Trans-1,2-DCE was the primary VOC detected

in well MW-3 (1,100 ug/l). Trans-1,2-DCE was also detected in well MR-2SS (240 ug/l), which is located adjacent to the facility tank farm. Other VOCs detected in well MR-2SS during this investigation included vinyl chloride (15 ug/l) and the gasoline-related BTEX compounds benzene, toluene and xylenes (each 9 ug/l). No VOCs were detected in deep well MW-5D or the surface water sample obtained in the wetland at location SW-3.

Di-n-butylphthalate, an SVOC, was detected in groundwater in wells MW-6, MR-1SS and MR-2SS and in surface water sample SW-3 at concentrations ranging from 12 ug/l to 220 ug/l. Di-n-butylphthalate was not detected in any of the soil samples collected during the investigation. Di-n-butylphthalate is a plasticizer which is not normally associated with petroleum products. Plastics used in underground utility lines on the site may be one possible source of the compound. No other SVOCs were detected in groundwater or surface water on the site. PCBs and organochlorine pesticide compounds were not detected in any of the groundwater or surface water samples (Table 9). TPH was detected in each of the samples at very low concentrations (up to 3.4 mg/l).

Dissolved metals, including antimony, arsenic, cadmium, lead, and zinc, were detected in groundwater samples from several of the wells at concentrations equal to or just above the PQLs (Table 10). Dissolved lead was detected in well MR-2SS at a slightly higher concentration (up to 0.029 mg/l). Dissolved lead was also detected in surface water sample SW-3 at a concentration of 0.028 mg/l. Total cyanide was not detected in any of the groundwater or surface water samples.

SUMMARY AND DISCUSSION

This *Addendum I to Hydrogeologic Characterization Report* was prepared to satisfy requirements stipulated in the RCRA Part B Permit for Murphy's Waste Oil Service, Inc. in Woburn, Massachusetts and includes a characterization of the geology and hydrogeology of the site. This report includes a summary of findings of previous subsurface investigations performed at the site and documents results of the current investigation which was performed by CHES between September and November 1994.

Previous subsurface investigations performed by CHES between December 1987 and February 1989 identified oil-impacted soil in two areas of the Murphy's site. TPH was detected in shallow

soils (2 - 4 feet below grade) at concentrations up to 16,000 mg/kg in the Northern Section of the site where aboveground oil storage tanks were formerly located. TPH concentrations up to 21,000 mg/kg were also detected in soils in the Central Section of the site in the area of the former oil pit. 1,100 cubic yards of oil-contaminated soils were subsequently removed from the Central Section of the site as a Short-Term Measure during construction of the new waste oil facility building in 1989. In 1994, a subsurface investigation of the site area performed by ReTec identified PAHs in soil adjacent to the Murphy's facility building at concentrations up to 9,087 ug/kg, indicating that some residual oil-impacted soils remained after implementation of the Short-Term Measure.

The ReTec investigation also identified impacted soils in the wetland between the Murphy's site and Whitney Barrel, which were found to contain PAHs (up to 6,162 ug/kg), pesticides (up to 2.89 mg/kg), arsenic (up to 17.0 mg/kg), cadmium (up to 4.8 mg/kg), chromium (up to 8,193 mg/kg), and cyanide (up to 4.7 mg/kg). Analytical results obtained during the current CHES investigation confirmed the ReTec results, and detected TPH (up to 97,000 mg/kg), VOCs (up to 1,300 ug/kg), PCBs (up to 220 mg/kg), and lead (up to 35,100 mg/kg) in the wetland soils. Analytical results obtained during the ReTec investigation and the current investigation did not suggest an on-site source of contaminants in the wetland soils. Elevated concentrations of PCBs, pesticides, metals and cyanide were not detected elsewhere on the Murphy's site outside the wetland during either of the investigations. Of the contaminants identified in the wetland, only low concentrations of TPH (up to 470 mg/kg), and chromium (up to 4.9 mg/kg) were identified in adjacent borings MW-3, MW-4 and MW-5S.

During the current subsurface investigation, horizontal and vertical hydraulic gradients on the site were observed to be very low. Although shallow soils (less than 20 feet) were found to consist of relatively coarse sand and gravel, the low measured hydraulic gradients indicate that groundwater flow on the site is nearly stagnant. Since the vertical hydraulic gradient on the site was observed to be slightly greater and more persistent than the horizontal gradient, a very slow net groundwater flow downward is anticipated.

Prior to 1989, groundwater flow on the site was likely influenced by the John J. Riley Company Production Wells No. 1 (depth unknown) and No. 2 (screened from 36 to 51 feet below grade). Only one private water supply well is known to exist in the site area. A shallow well is located at Woburn Concrete Products approximately $\frac{1}{4}$ -mile south of the site (Figure 2). The well, which was installed approximately 30 years ago, is screened at an estimated depth of 40 feet below

grade and is currently used for mixing concrete only. It is not anticipated that this well influences groundwater flow on the Murphy's site.

Analytical data collected on the site during the current investigation detected chlorinated VOCs in shallow groundwater in the Northern Section of the site. Elevated concentrations of chlorinated VOCs, including trans-1,2-DCE, TCE, 1,1-DCA and 1,1,1-TCA were detected in well MW-3 in the Northern Section of the site at a total concentration of 1,342 ug/l. Elevated concentrations of chlorinated VOCs were also detected in the Northern Section during the previous subsurface investigation performed by CHES (Ref. 6). The source of chlorinated VOCs in shallow groundwater in the Northern Section of the site has not been determined. Analytical data collected during this investigation and previous investigations performed by ReTec and CHES have not detected chlorinated VOCs in soils above the groundwater table on the site at concentrations which would indicate a source area.

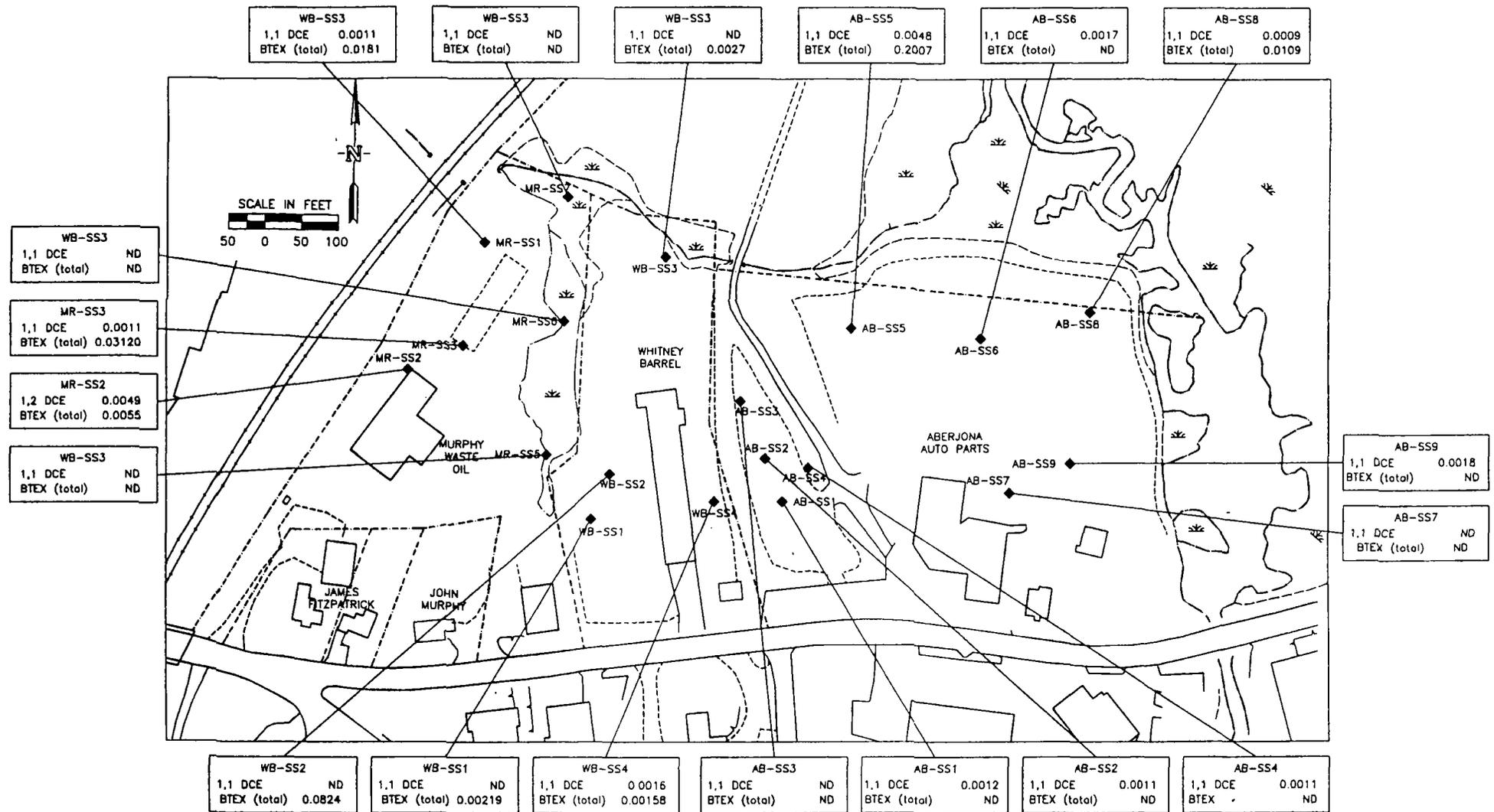
Chlorinated VOCs were also detected in shallow groundwater adjacent to the facility tank farm. Trans-1,2-DCE and vinyl chloride were detected in well MR-2SS adjacent to the tank farm at a total concentration of 255 ug/l. The origin of VOCs at well MR-2SS is unknown, however, analytical data from other shallow wells do not suggest widespread occurrence of chlorinated VOCs in groundwater between wells MR-2SS and MW-3.

Groundwater quality in the lower portion of the aquifer was evaluated in deep well MW-5D. The lower boundary of the aquifer was found to be the bedrock surface, which was encountered at a depth of 83 feet below grade. Well MW-5D was screened at the bedrock surface in a location which is structurally down-dip from the waste oil facility building and tank farm (Figure 4-6 in Appendix F). Except for TPH (detected at 0.2 mg/l), groundwater analyses from well MW-5D did not indicate the presence of any contaminants which have been observed in shallow groundwater on the site.

REFERENCES

1. Draft Remedial Investigation, Southwest Properties, Wells G&H Superfund Site, Woburn, Massachusetts, by Remediation Technologies, Inc., February 1994.
2. Wells G&H Site Remedial Investigation Report, NUS Corporation, Superfund Division, October 17, 1986.
3. Draft Predesign Investigation Report, Wildwood Property, Wells G&H Superfund Site, Woburn, Massachusetts, by Remediation Technologies, Inc., March 1993.
4. Wells G&H Site, Central Area, Remedial Investigation Phase IA Report, by GeoTrans, Inc., February 1994.
5. Freeze, R.A. & J.A. Cherry, "Groundwater." Prentice-Hall, Inc. 1979.
6. Hydrogeologic Characterization Report, Murphy's Waste Oil Service, Inc., by Clean Harbors Environmental Services, Inc., February 1994.

APP. A

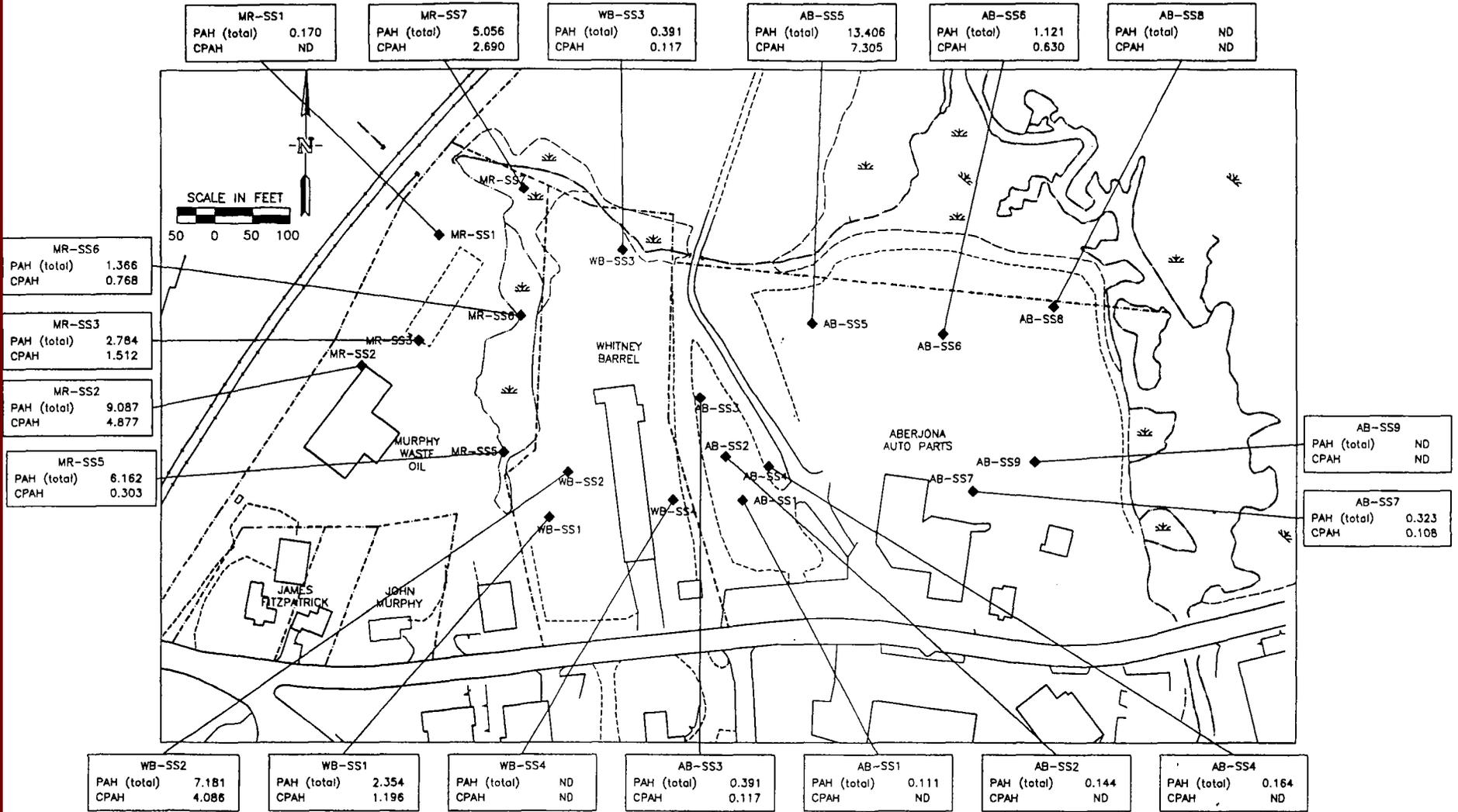


SURFACE SOIL VOC RESULTS
All Values are in mg/kg

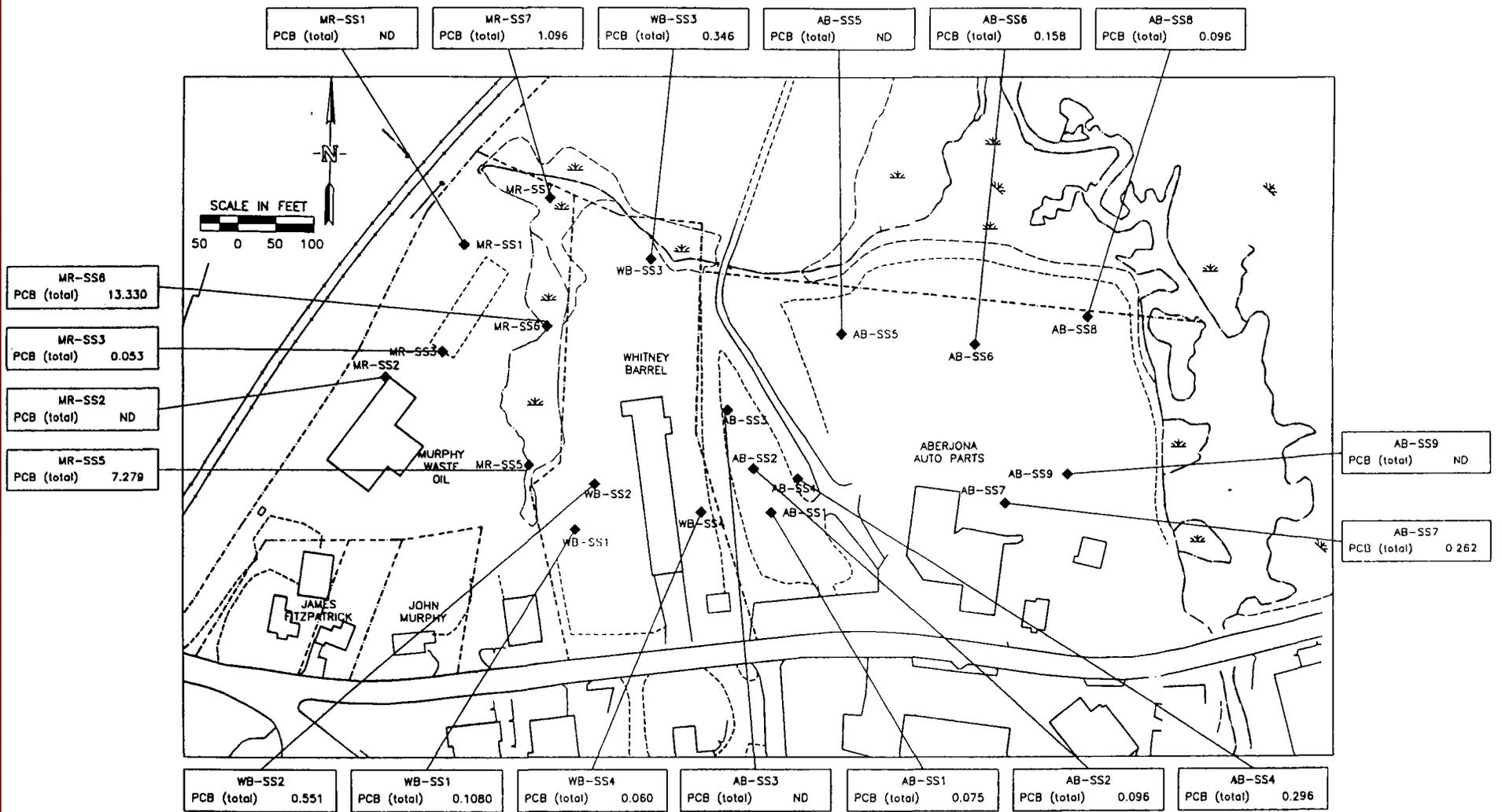
0681S003

FIGURE

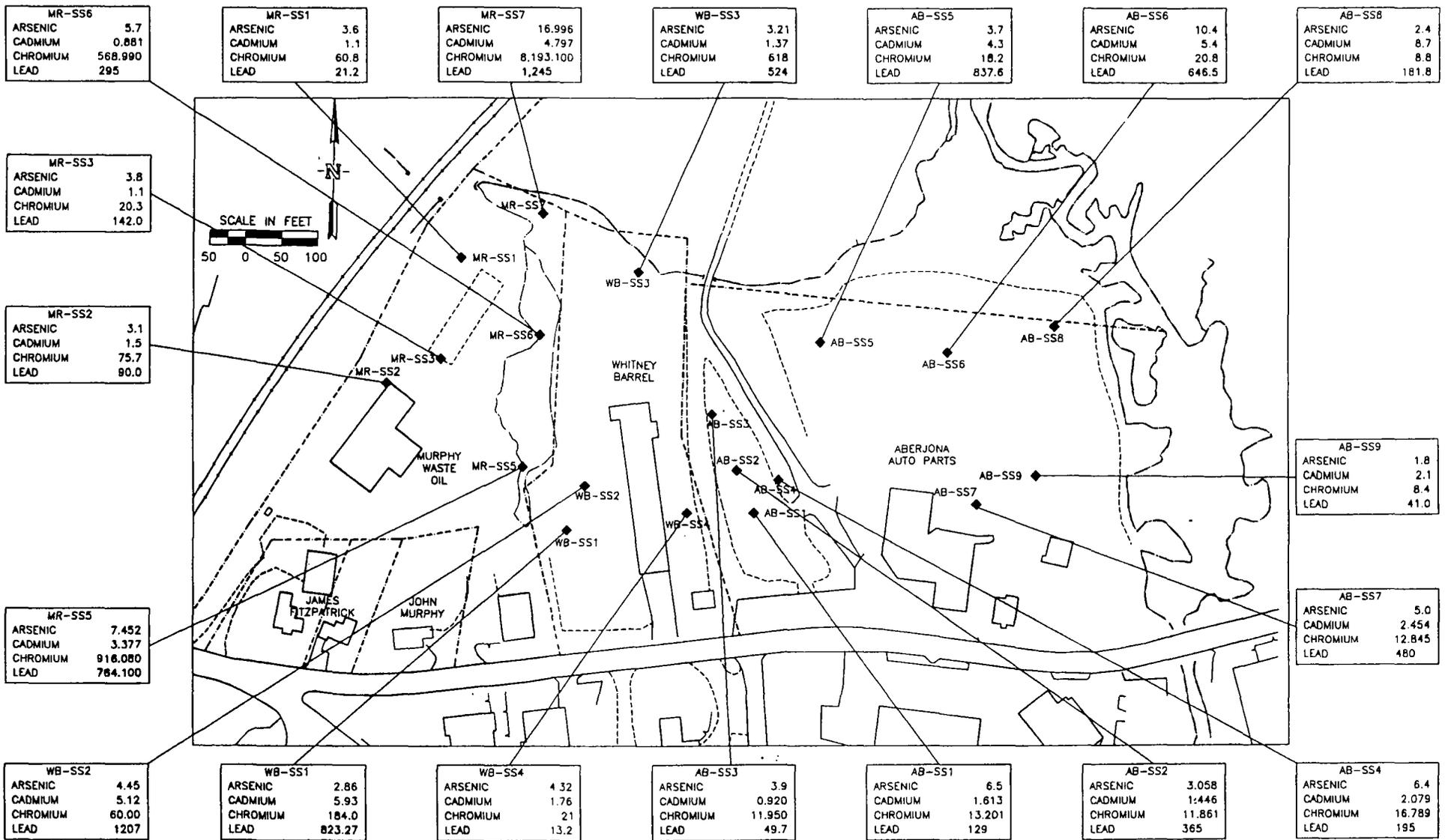
5-1



SURFACE SOIL SVOC RESULTS
All Values are in mg/kg



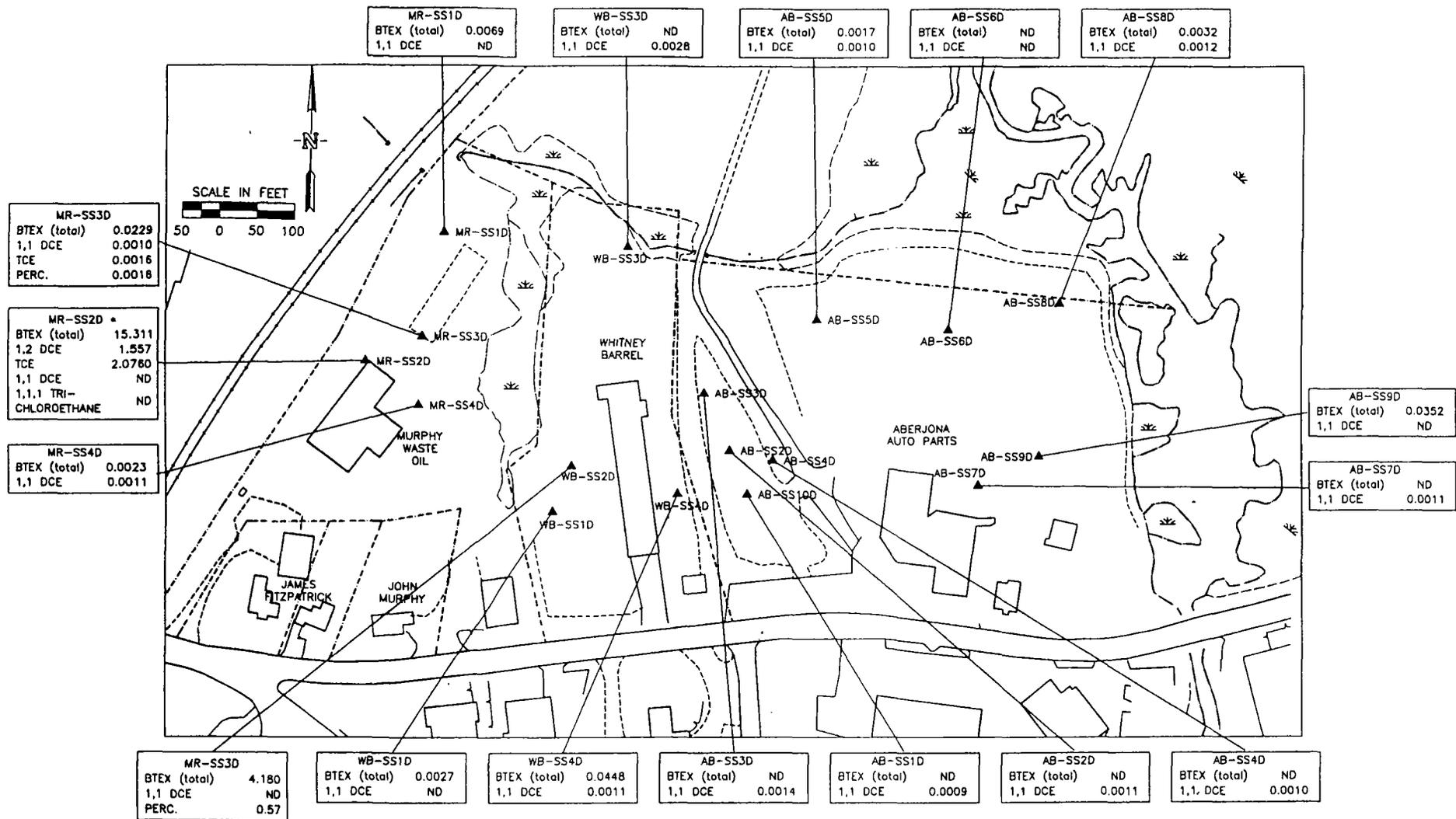
SURFACE SOIL PCB RESULTS
 All Values are in mg/kg



SURFACE SOIL METALS RESULTS
All Values are in mg/kg

0681S003

FIGURE
5-4

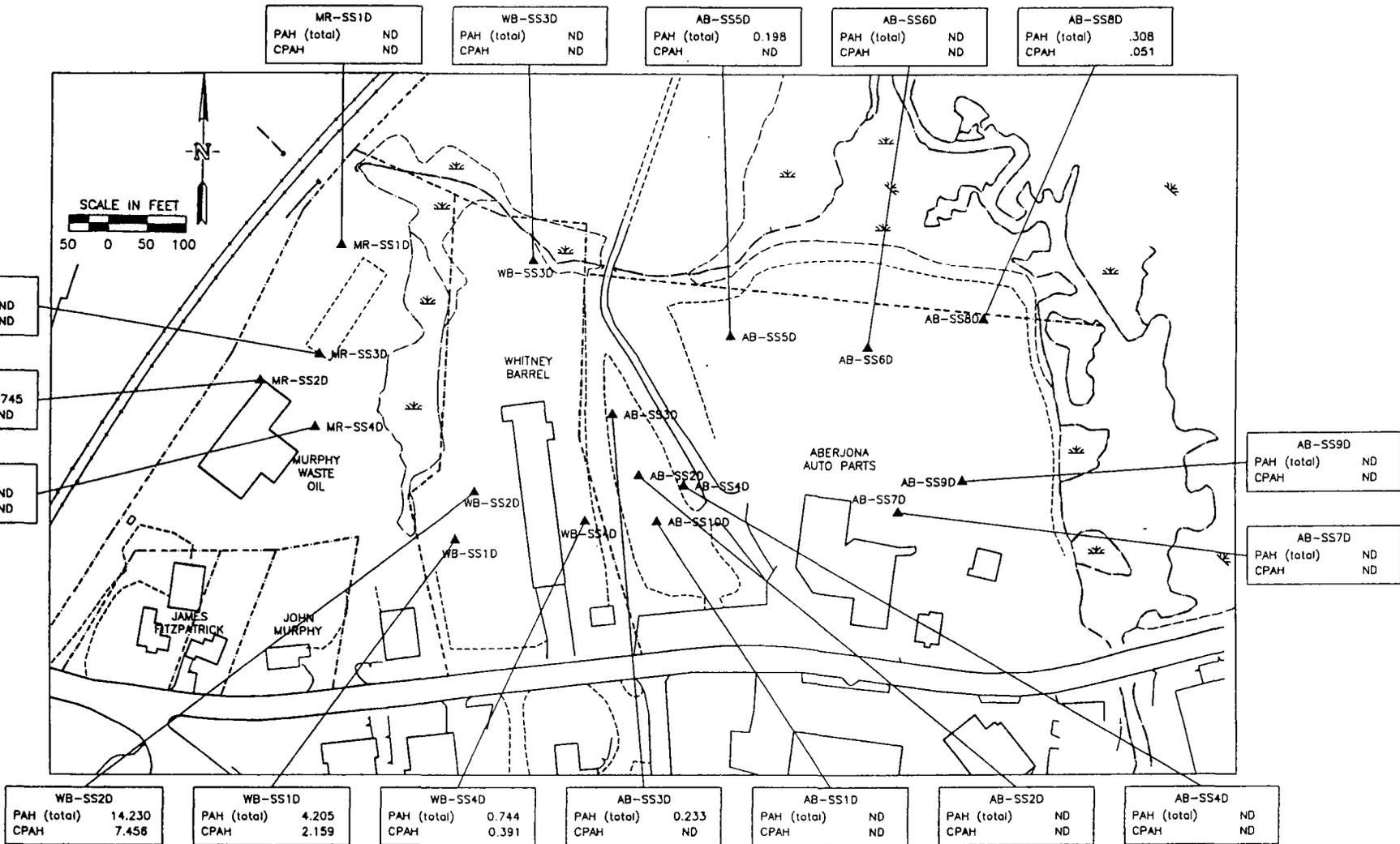


* 1,2 DCE & TCE Not detected except as noted

SUBSURFACE SOIL VOC RESULTS
All Values are in mg/kg

0681S003

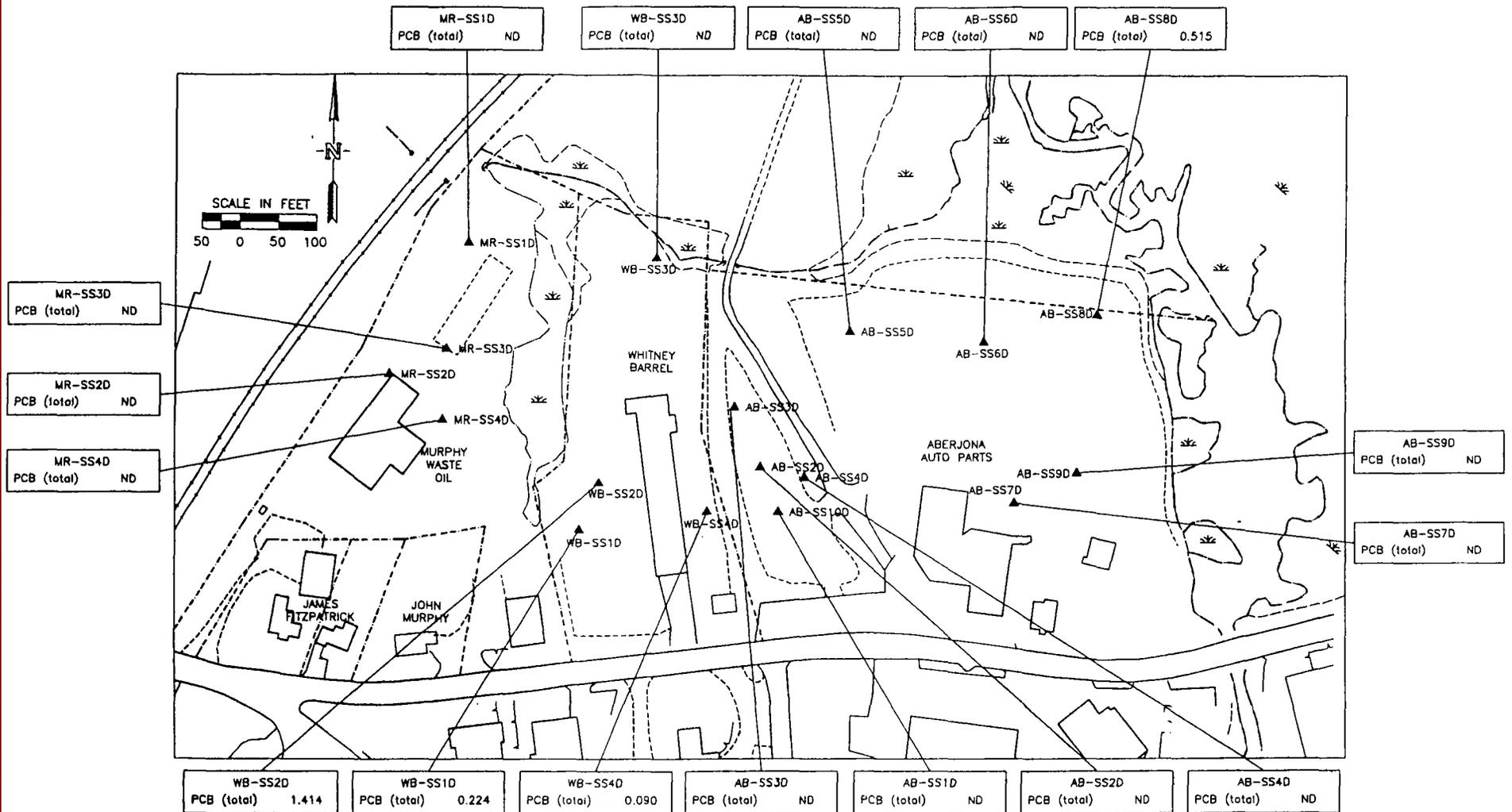
FIGURE
5-5



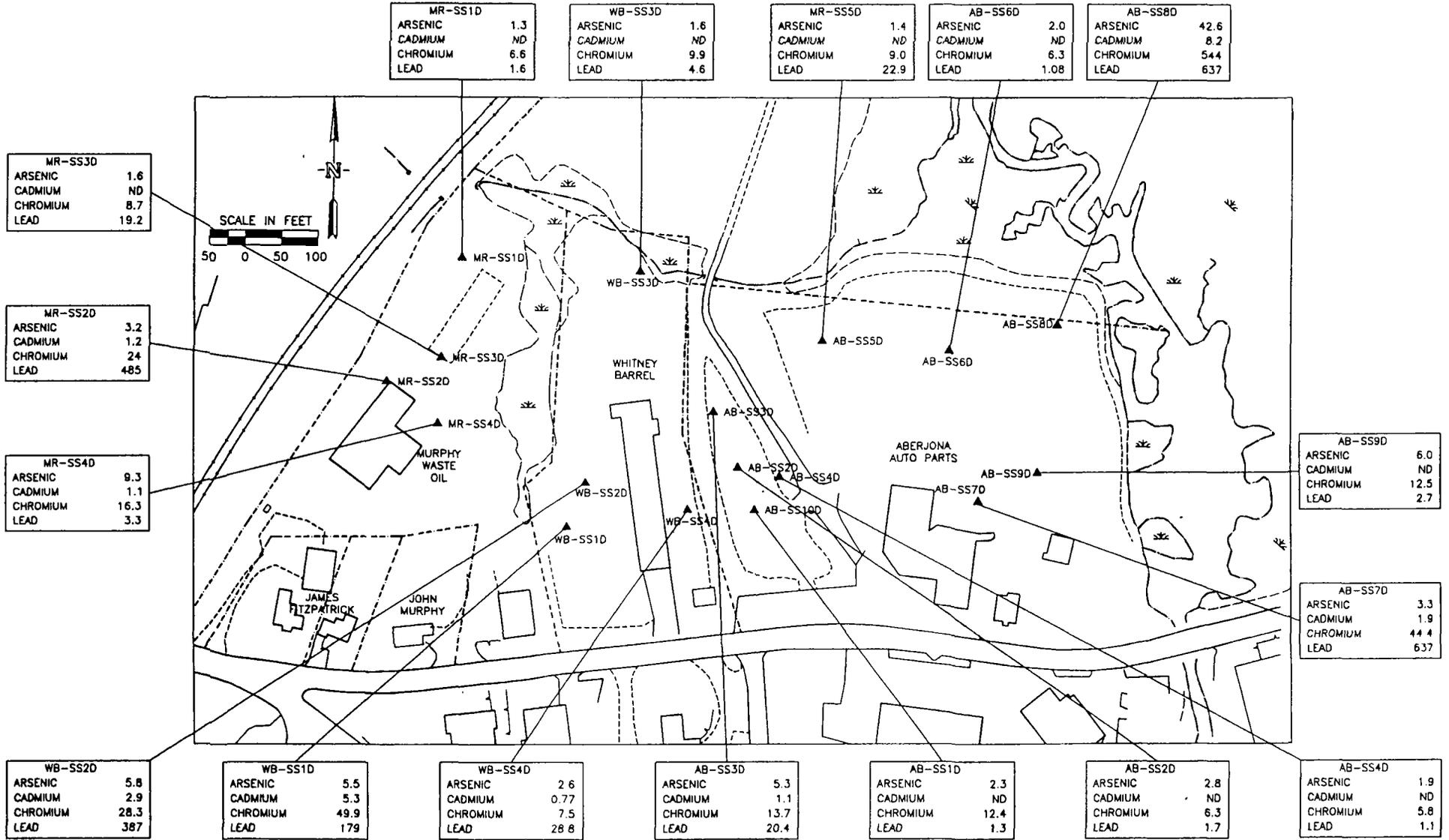
SUBSURFACE SOIL SVOC RESULTS
All Values are in mg/kg

0681S003

FIGURE
5-6



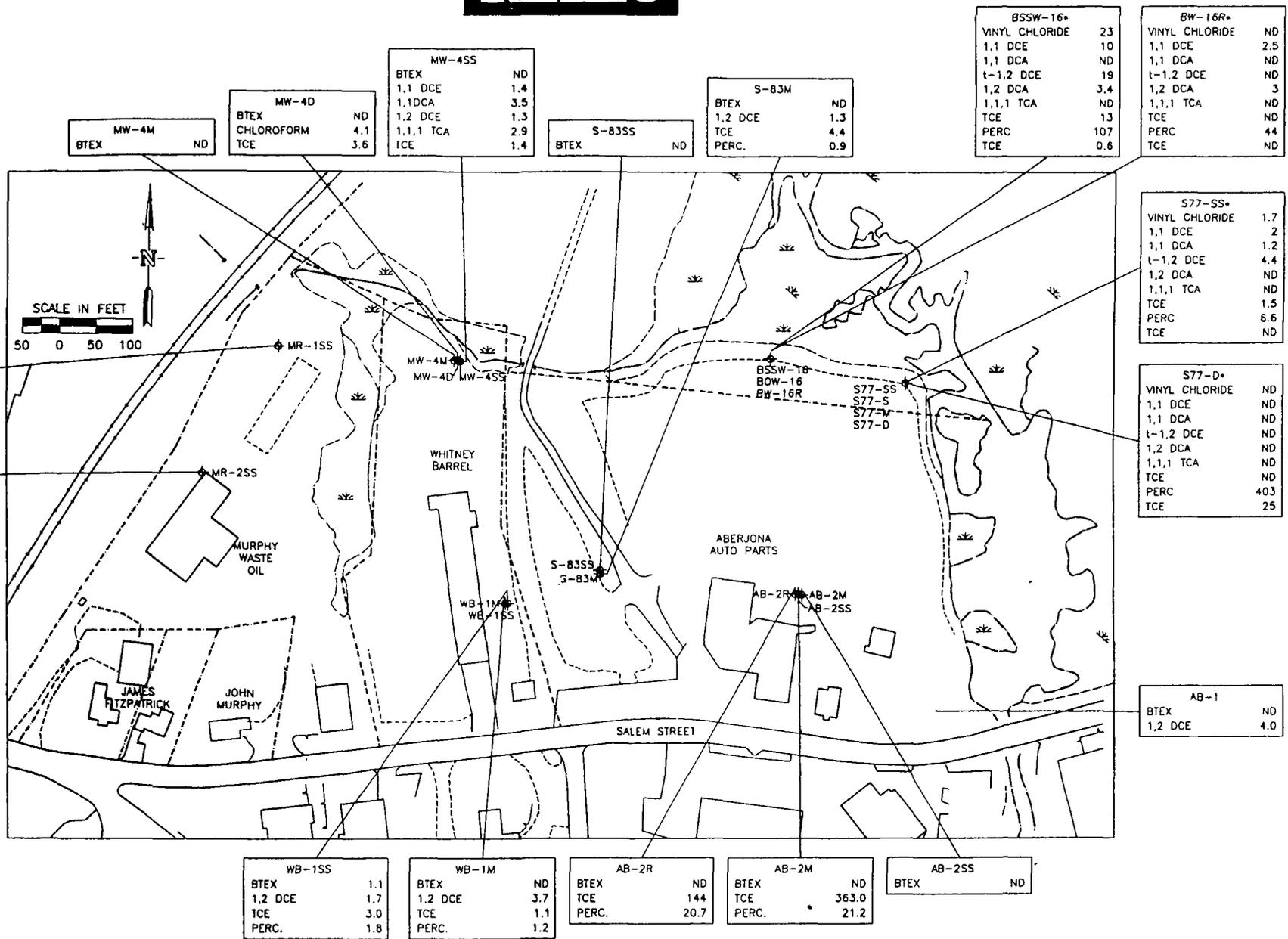
SUBSURFACE SOIL PCB RESULTS
All Values are in mg/kg



SUBSURFACE SOIL METALS RESULTS
All Values are in mg/kg

0681S003

FIGURE
5-8



* From Wildwood property RD/RA August 1993

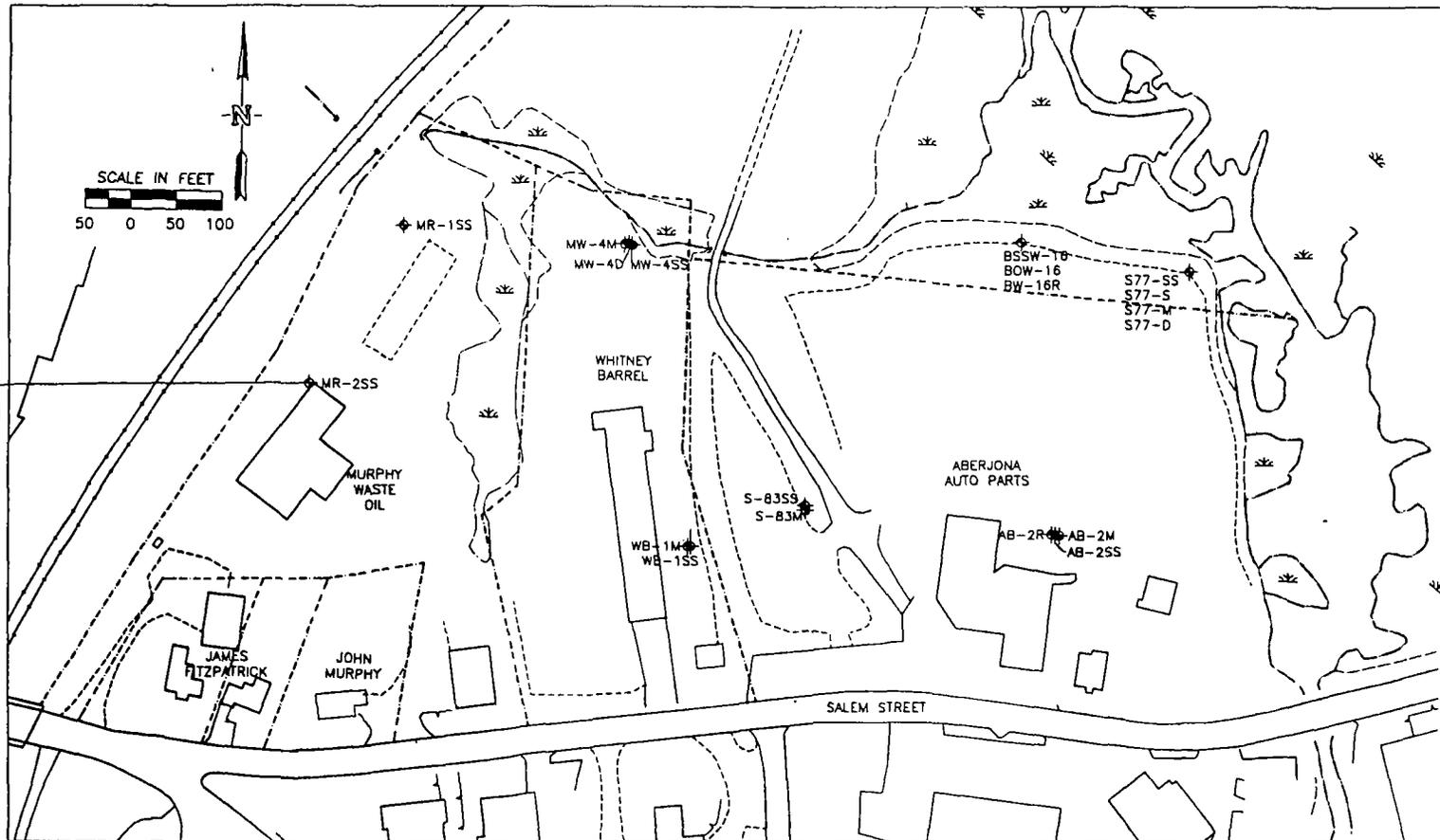
GROUNDWATER VOC RESULTS

All Values are in ug/L

0681S003

FIGURE

5-9



MR/2SS	
1,2-DCB	9
TOTAL PAH	43

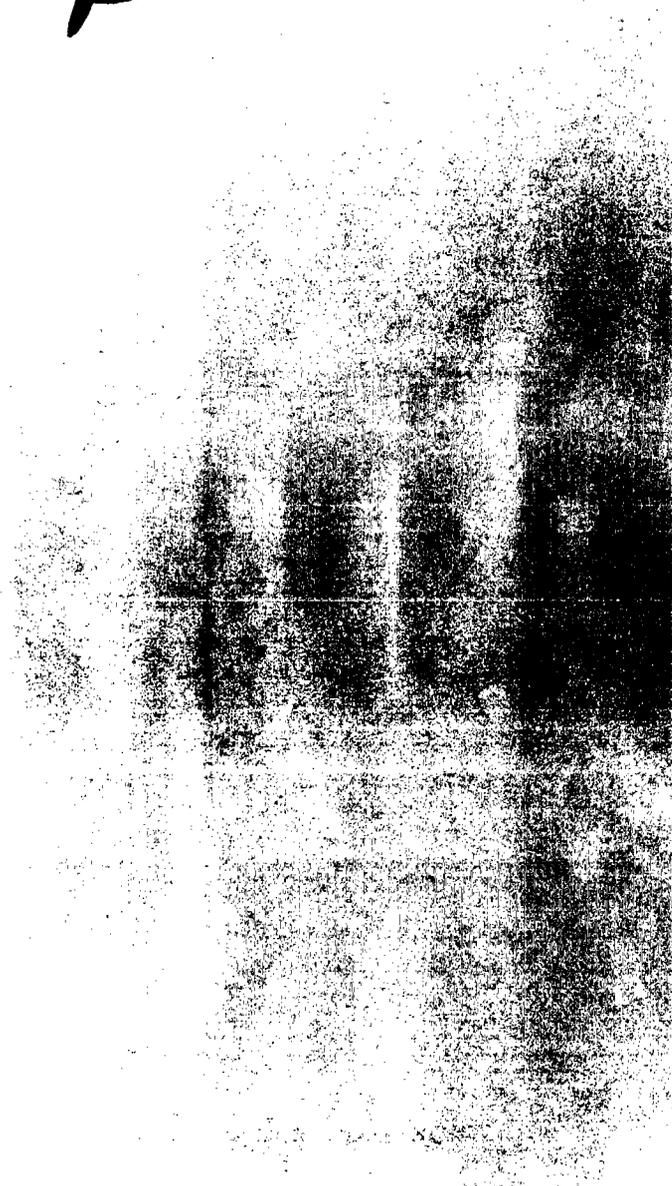
* Pesticides not detected except as noted.

DETECTED GROUNDWATER SVOC AND PESITICIDE RESULTS
 All Values are in ug/L

0681S003

FIGURE
 5-10

AP? B





Commonwealth of Massachusetts
Executive Office of Environmental Affairs

Department of Environmental Protection

William F. Weld
Governor
Trudy Cox
Secretary, EOEA
Thomas B. Powers
Acting Commissioner

August 29, 1994

Certified Mail No. # P 328 155 920

Mr. Jules Selden, Esq.
Clean Harbors Environmental Services, Inc.
PO Box 9137
Quincy MA 02269-9137

Re: **Approval Report Submittal Date Extension Request - M.G.L. c.
21C - Murphy's Waste Oil Service, Inc. MAD066588005**

Dear: Mr. Selden

The Massachusetts Department of Environmental Protection, Bureau of Waste Prevention, Division of Hazardous Materials (hereinafter in this document referred to as the Department) has reviewed the following documents:

- Hydrogeologic Characterization Report, Murphy's Waste Oil Service, Inc. 252 Salem Street, Woburn, MA 01801, February 1, 1994 (Report); and
- Scope of Work for Subsurface Investigation, Murphy's Waste Oil Service, Inc. 252 Salem Street, Woburn, MA 01801, June 30, 1994 (Scope).

These documents were submitted to the Department on behalf of Murphy's Waste Oil Service, Inc. 252 Salem Street, Woburn, Massachusetts (Facility) by Clean Harbors Environmental Services, Inc. of Braintree Massachusetts in compliance with License Condition (10)(b) of the Facility's Part B Hazardous Waste Facility License.

The Department **APPROVES** the Report and Scope in accordance with Permit Condition (10)(i)(a) with the following modifications:

1. Any existing W89 series monitoring wells shown on Figure 6 of the Report shall be incorporated into the scope of work for purposes of groundwater elevation data and sampling. Such monitoring wells

MURPHSCOPE.APV
August 29, 1994

- need not be sampled for the entire suite of parameters described on page 7, paragraph 2 of the Scope but shall be sampled for volatile organic compounds (EPA Method 8240). In addition, such monitoring wells shall be resurveyed for purposes of elevation control to the same datum as the proposed new monitoring wells; and redeveloped prior to sampling.
2. The Facility shall either install an additional shallow monitoring well in the eastern portion of the facility in the area of monitoring well W89-S16 or may utilize either monitoring well W89-S16 or W89-S3 in lieu of such a monitoring well. The monitoring well shall be sampled for the parameters listed on page 7, paragraph 2 of the Scope.
 3. Proposed monitoring well MW-4 shall be relocated off the vehicular travel area to a location northeast of that shown in Figure 2 of the Scope in the area east of the dike wall adjacent to the fence.
 4. The Facility shall avoid using road boxes to the maximum extent possible by relocating monitoring wells to the edge or outside of vehicular traffic areas. Monitoring wells shall be constructed with outer steel protective casings extending above the ground surface with concrete surface seals. Monitoring wells installed adjacent to vehicular travel areas shall also be protected by protective bumpers.
 5. Page 5, paragraphs two through four of the Scope describe the procedures and criteria for selection of soil samples. In addition to the soil samples proposed in the Scope:
 - a. Surface soil samples shall be collected from the 0 to 2 foot interval in each monitoring well boring except at monitoring well couplet locations. A surface (0-2 foot) soil sample need be collected from only one boring at locations where monitoring well couplets are to be installed (eg. MW-5 S&D). At locations where the monitoring wells are to be installed either through pavement or graveled areas the surface sample shall be collected from beneath the base of gravel or pavement to 2 feet;

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August 29, 1994

- b. An additional at depth soil sample shall be collected in the natural deposits beneath the fill per borehole (or monitoring well couplet) from the highest head space screened sample. If the head space screen samples in the natural soils are non-detect the soil sample shall be collected from the lowest 2-foot interval immediately above the water table. If stained soils are encountered beneath the fill a soil sample from the stained depth shall be collected in lieu of the above; and
 - c. Total Petroleum Hydrocarbon analysis (TPH) shall be performed using the GC/FID methodology, as described in the Department's Policy # WSC-401-91, rather than the proposed IR method.
6. Page 6, paragraph three of the Scope describes the procedures and locations for collection of wetland sediment samples. The proposed wetland sampling shall be modified to reflect the following:
 - a. Sampling station SW-2 shall be relocated within the wetland approximately 60-70 feet northwest of the proposed location shown on Figure 2 of the Scope; and
 - b. An additional wetland sediment sample shall be collected at a location approximately midway between SW-2 and SW-3.
7. All activities shall be conducted in a manner consistent with the following Department policies:

DEP Policy #WSC-310-91 Standard References for Monitoring Wells - April 1991; and

DEP Policy #WSC-401-91 Policy for the Investigation, Assessment, and Remediation of Petroleum Releases - Interim Site Investigation Protocol Document - April 1991.
8. All activities conducted at the Facility under this approval shall comply with the requirements of 310 CMR 40.0113 RCRA Authorized State Hazardous Waste Program (M.G.L.c. 21C and 310 CMR 30.000), as applicable.

MURPHSCOPE.APV
August 29, 1994

License Condition 10(i)(a) allows the Department to approve the Report and Scope with modifications with the Facility's concurrence. If the Facility does not concur (accept) the modifications than the Scope shall be considered **Disapproved** by the Department pursuant to License Condition 10(i)(b) and the Facility shall submitted a new or modified Scope in compliance with License Condition 10(i)(c).

Should you have any questions regarding this matter please contact Mr. John A. Carrigan of my staff at (617) 292 - 5584.

Sincerely,



Mr. Al Nardone, EEVI
Hazardous Waste Program

AN/JAC/RF/jac

Attachment

cc: Health Agent
City Hall
Woburn, MA

Dick Chalpin
DEP/BWSC
NERO
Woburn, MA

Ed Pawlowski
DEP/BWP-DHM
NERO
Woburn, MA

Ana Stern
DEP/BWP-DHM
Boston, MA

Anna Mayor
DEP/BWSC
Boston, MA

APP. C



DEPARTMENT OF ENVIRONMENTAL AFFAIRS
DIVISION OF HAZARDOUS WASTE
One Winter Street Boston, Massachusetts 02108

Please print or type (Form designed for use on elite (12-prich) typewriter.)

MU6693

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. MAD066588005
 2. Manifest Document No. 196305

3. Manifest Date: 01/11/95
 4. Manifest by Federal Title:

Generator's Name and Mailing Address
 MURPHY'S WASTE OIL SERVICE INC
 252 SALEM STREET
 WOBURN, MA 01801

A. State Manifest Document Number
 MA H 696305

B. 252 SALEM STREET
 WOBURN, MA 02155

4. Generator's Phone (617) 935-9066

C. State Trans. ID
 MA 13299

5. Transporter 1 Company Name
 CLEAN HARBORS ENV. SERVICES, INC.

6. US EPA ID Number
 MAD039322250

D. Transporter's Phone
 6178491800

7. Transporter 2 Company Name
 Clean Harbors Env. Services, Inc.

8. US EPA ID Number
 MAD039322250

E. State Trans. ID
 MA13299

9. Designated Facility Name and Site Address
 CLEAN HARBORS OF BRAINTREE, INC
 385 QUINCY AVE
 BRAINTREE, MA 02184

10. US EPA ID Number
 MAD053452637

F. Transporter's Phone
 617 849-1800

G. State Facility's ID NOT REQUIRED

H. Facility's Phone (617) 849-1807

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers	13. Total	14. Waste No.
NO.	Type	Quantity	
a. OILY DEBRIS, NON D.O.T. REGULATED, NONE, N/A	002 DM 500 P		MA01

J. Additional Regulatory Data Listed Above (Include physical state and hazard code.)

SOIL

11b U19717 IN CASE OF EMERGENCY CALL CHI AT 1-800-OIL-TANK

11c Social Handling Instructions and Additional Information

WO#: MU6693

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment. OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and selected the best available treatment method that is available to me and that I can afford.

Printed/Typed Name: **CHRIS MORAN** Signature: *[Signature]* Date: **01/13/95**

17. Transporter 1 Acknowledgement of Receipt of Materials
 Printed/Typed Name: **JOE SMITH** Signature: *[Signature]* Date: **01/17/95**

18. Transporter 2 Acknowledgement of Receipt of Materials
 Printed/Typed Name: **TAYLOR SUTHERLAND** Signature: *[Signature]* Date: **01/18/95**

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in item 19.
 Printed/Typed Name: **ANDREW S. HUDSON** Signature: *[Signature]* Date: **01/10/95**

In case of emergency or spill, immediately call the National Response Center (800) 424-8802.

Clean Harbors has appropriate permits for and will accept the waste the generator is shipping

FACILITY MAILES TO GENERATOR

APP. D

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By:
Project Name: Murphy's Waste Oil Service, Inc.		Boring No: MW-1
Project Location: Salem Street, Woburn, MA		Page: 1 of 1
Client Name: Same		CHES Job #: EN-170
Boring Location: Northwest portion of site		Field Book No. 93-029
Drilling Contractor: Environmental Drilling, Inc.		Well Elevation: 53.29'
Drilling Method: Hollow Stem Auger		Driller: A. Caron
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		CHES Personnel: S. Applebaum
		Start Date: 10/13/94
		Finish Date: 10/13/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen/rec. (in)	Blows per 6 (in) on split spoon						
5	SS-1	0 - 2	24/6	116-20-17-11	7 ppm		Brown, dense, medium to fine SAND; little Silt; little medium to fine Gravel. Dry. Glass in sample.			
	SS-2	2 - 4	24/3	11-13-12-16	0.2 ppm		Same.			
	SS-3	4 - 6	24/13	15-17-14-16	3.6 ppm	FILL	Dense, coarse to fine SAND; some coarse to fine Gravel; little Silt. Dry.	3		
	SS-4	6 - 8	24/11	30-34-85-92	0.4 ppm	6'	Brown, very dense, medium to fine (+) SAND; and coarse to medium Gravel; little Silt. Wet.			
	SS-5	8 - 9.2'	24/12	65-82-100	5.4 ppm		Tan, very dense, coarse to fine SAND; and coarse to fine Gravel; little Silt.	4		
10	SS-6	10 - 11	10/9	61-100	5.3 ppm	SAND and GRAVEL	Same.			
15						15'				
							Bottom of Boring	5		

SAMPLE TYPES SS - split spoon ST - shelly tube AF - auger flight RC - rock core		PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%		NOTES: (1) OVA { ppm = parts per million } (2) The Burmister System is used for field classification of soils. (3) Color change from tan to black at 4' 8". (4) Gravel is angular igneous and metamorphic rock; may be Till. (5) Set 2" PVC well at 15'. See Well Completion Report for details.
GRANULAR SOILS N-value Density		COHESIVE SOILS N-value Density		
< 4 very loose 5 - 10 loose 11 - 30 medium 31 - 50 dense > 50 very dense		< 2 very soft 2 - 4 soft 4 - 8 medium stiff 8 - 15 stiff 15 - 30 very stiff		

Disk Name: 3490

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By: Boring No: MW-2 Page: 1 of 1
Project Name: Murphy's Waste Oil Service, Inc.		CHES Job #: EN-170
Project Location: Salem Street, Woburn, MA		Field Book No. 93-029
Client Name: Same		Well Elevation: 53.77'
Boring Location: Southwest Corner Of Site		Driller: A. Caron
Drilling Contractor: Environmental Drilling, Inc.		CHES Personnel: S. Applebaum
Drilling Method: Hollow Stem Auger		Start Date: 10/12/94
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		Finish Date: 10/12/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen./rec. (in)	Blows per 6 (in) on split spoon						
5	SS-1	0 - 2	24/16	8-21-36-100	700 ppm		Brown and dark gray, very dense coarse to fine SAND; some Silt, little coarse to fine Gravel. Dry.			
	SS-2	2 - 4	24/18	22-18-12-12	>1,000 ppm		Dark gray, medium dense coarse to fine SAND; some Silt; little coarse to fine Gravel. Dry.			
	SS-3	4 - 6	24/11	6-16-30-46	720 ppm	FILL	Brown-gray, dense, coarse to fine SAND; some Silt; little coarse to fine Gravel; little Clay. Moist. Some roots in tip of spoon.			
	SS-4	6 - 6.6	6/6	120			Spoon empty.			
10	SS-4A	7.5 - 9.5	24/15	8-17-17-15	260 ppm	7.5'	Brown-gray, dense, coarse to fine SAND; and coarse to fine Gravel; trace Silt.			
	SS-5	10 - 12	24/10	20-18-20-18	220 ppm		Same.			
	SS-6	12 - 14	24/16	14-18-20-18	185 ppm		Brown, dense, coarse to fine SAND; little medium to fine Gravel; trace Silt.			
	SS-7	14 - 16	24/15	12-14-9-13			Brown, medium dense, coarse to fine SAND; little medium to fine Gravel; trace Silt.			
15						15'				
							Bottom of Boring	3		

SAMPLE TYPES SS - split spoon ST - shelly tube AF - auger flight RC - rock core	PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%	NOTES: (1) OVA { ppm = parts per million } (2) The Burmister System is used for field classification of soils. (3) Set 2" PVC well at 15'. See Well Completion Report for details.
GRANULAR SOILS N-value Density	COHESIVE SOILS N-value Density	
< 4 very loose 5 - 10 loose 11 - 30 medium 31 - 50 dense > 50 very dense	< 2 very soft 2 - 4 soft 4 - 8 medium stiff 8 - 15 stiff 15 - 30 very stiff	

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617 849-1800)		QC Checked By:
Project Name: Murphy's Waste Oil Service, Inc.		Boring No: MW-3
Project Location: Salem Street, Woburn, MA		Page: 1 of 1
Client Name: Same		CHES Job #: EN-170
Boring Location: Northern portion of site		Field Book No.: 93-029
Drilling Contractor: Environmental Drilling, Inc.		Well Elevation: 52.87'
Drilling Method: Hollow Stem Auger		Driller: A. Caron
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		CHES Personnel: S. Applebaum
		Start Date: 10/18/94
		Finish Date: 10/18/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen./rec. (in)	Blows per 6 (in) on split spoon						
5	SS-1	0 - 2	24/16	12-15-13-12	2.0 ppm	FILL	Tan, medium dense, coarse to fine SAND; some Silt; some coarse to medium Gravel. Dry.			
	SS-2	2 - 4	24/15	12-10-10-8	2.2 ppm					
	SS-3	4 - 6	24/0	16-18-16-20						
	SS-4	6 - 8	24/16	24-36-14-18	26 ppm					
	SS-5	8 - 10	24/21	28-44-43-47	100 ppm					
	SS-6	10 - 12	24/24	8-14-25-33	460 ppm					
	SS-7	12 - 14	24/24	16-29-41-33	140 ppm					
10						8'	Brown, very dense medium SAND; trace Silt.	3		
							Same.	3		
15						14'	Tan, very dense, medium SAND; trace Silt.	3		
							Bottom of boring	4		

SAMPLE TYPES SS - split spoon ST - shelby tube AF - auger flight RC - rock core		PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%		NOTES: (1) OVA (ppm = parts per million) (2) The Burmister System is used for field classification of soils. (3) Hydrogen Sulfide odor in sample. (4) Set 2" PVC well at 14'. See Well Completion Report for details.
GRANULAR SOILS		COHESIVE SOILS		
N-value	Density	N-value	Density	
< 4 5 - 10 11 - 30 31 - 50 > 50	very loose loose medium dense very dense	< 2 2 - 4 4 - 8 8 - 15 15 - 30	very soft soft medium stiff stiff very stiff	

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By:
		Boring No: MW-4
		Page: 1 of 1
Project Name: Murphy's Waste Oil Service, Inc.		CHES Job #: EN-170
Project Location: Salem Street, Woburn, MA		Field Book No. 93-029
Client Name: Same		Well Elevation: 52.23'
Boring Location: Northeast portion of site		Driller: A. Caron
Drilling Contractor: Environmental Drilling, Inc.		CHES Personnel: S. Applebaum
Drilling Method: Hollow Stem Auger		Start Date: 10/12/94
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		Finish Date: 10/12/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen/rec. (in)	Blows per 6 (in) on split spoon						
5	SS-1	0 - 2	24/22	19-24-30-26	0.2 ppm	FILL 6' 8'	Dark brown/gray, very dense, medium to fine SAND; some coarse to	3		
	SS-2	2 - 4	24/15	75-35-36-34	ND		Dark brown, very dense coarse to fine SAND; some coarse to fine Gravel; some Silt; trace Clay. Dry. Roots in sample.			
	SS-3	4 - 6	24/9	29-23-13-7	2.2 ppm		Dark brown, very dense coarse to fine SAND; some coarse to fine Gravel; some Silt; trace Clay. Dry.			
	SS-4	6 - 8	24/17	10-18-21-28	28 ppm		Dark brown, dense coarse to fine SAND; some coarse to fine Gravel; little Silt. Wet.			
	SS-5	8 - 10	24/18	8-18-22-25	46 ppm		Light brown, dense medium to fine SAND; trace Silt.			
10	SS-6	10 - 12	24/24	13-22-29-36	92 ppm	SAND AND GRAVEL 15'	Light brown, very dense medium to fine(+) SAND; trace Gravel; trace Silt.	4		
	SS-7	12 - 14	24/24	11-19-23-29	53 ppm		Light brown, dense coarse to fine(+) SAND; trace medium to fine Gravel; trace Silt.			
15							Bottom of Boring	5		

SAMPLE TYPES SS - split spoon ST - shelly tube AF - auger flight RC - rock core	PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%	NOTES: (1) OVA { ppm = parts per million } (2) The Burmister System is used for field classification of soils. (3) Color change from dark to light brown at 7'. H ₂ S odor in sample. (4) H ₂ S odor in sample. (5) Set 2" PVC well at 15'. See Well Completion Report for details.
GRANULAR SOILS	COHESIVE SOILS	
N-value Density < 4 very loose 5 - 10 loose 11 - 30 medium 31 - 50 dense > 50 very dense	N-value Density < 2 very soft 2 - 4 soft 4 - 8 medium stiff 8 - 15 stiff 15 - 30 very stiff	

Disk Name: 3490

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By:
Project Name: Murphy's Waste Oil Service, Inc.		Boring No: MW-5S
Project Location: Salem Street, Woburn, MA		Page: 1 of 1
Client Name: Same		CHES Job #: EN-170
Boring Location: Eastern portion of site		Field Book No. 93-029
Drilling Contractor: Environmental Drilling, Inc.		Well Elevation: 53.97'
Drilling Method: Hollow Stem Auger		Driller: A. Caron
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		CHES Personnel: S. Applebaum
		Start Date: 10/12/94
		Finish Date: 10/12/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen/rec. (in)	Blows per 6 (in) on split spoon						
5	SS-1	0 - 2	24/15	23-19-27-36	ND		Brown/gray, dense, coarse to fine SAND; some coarse to fine Gravel; trace Silt. Brick in sample. Dry.			
	SS-2	2 - 4	24/20	35-67-46-64	0.4 ppm		Brown, very dense, coarse to fine SAND; and coarse to fine Gravel; trace Silt. Dry.			
	SS-3	4 - 6	24/16	24-40-30-53	ND	FILL	Brown, very dense, (+) coarse to fine SAND; some coarse to fine Gravel; trace Silt. Dry.			
	SS-4	6 - 8	24/12	69-59-65-39	0.4 ppm		Brown, very dense (+) coarse to fine SAND; and coarse to fine Gravel; trace Silt. Wet at tip.			
	SS-5	8 - 10	24/9	24-25-25-20	1.2 ppm	8'	Brown, dense, coarse to fine SAND; some medium to fine Gravel; trace Silt. Wet.			
10	SS-6	10 - 12	24/17	6-9-11-13	2.3 ppm	10'	SAND Brown, medium dense, coarse to fine SAND; little coarse to fine Gravel, trace Silt.			
	SS-7	12 - 14	24/24	13-12-13-14	2.4 ppm		Same.			
15						15'				
							Bottom of Boring			
								3		

SAMPLE TYPES SS - split spoon ST - shelby tube AF - auger flight RC - rock core		PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%		NOTES: (1) OVA { ppm = parts per million} (2) The Burmister System is used for field classification of soils. (3) Set 2" PVC well at 15'. See Well Completion Report for details.
GRANULAR SOILS		COHESIVE SOILS		
N-value	Density	N-value	Density	
< 4 5 - 10 11 - 30 31 - 50 > 50	very loose loose medium dense very dense	< 2 2 - 4 4 - 8 8 - 15 15 - 30	very soft soft medium stiff stiff very stiff	

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By: Boring No: MW-5D Page: 1 of 2
Project Name: Murphy's Waste Oil Service, Inc.		CHES Job #: EN-170
Project Location: Salem Street, Woburn, MA		Field Book No.: 93-029
Client Name: Same		Well Elevation: 53.79'
Boring Location: Eastern portion of site		Driller: A. Caron
Drilling Contractor: Environmental Drilling, Inc.		CHES Personnel: S. Applebaum
Drilling Method: Hollow Stem Auger		Start Date: 10/14/94
Casing/Auger Size: 4 1/4"		Finish Date: 10/18/94
Sampler: Split Spoon		

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen./rec. (in)	Blows per 6 (in) on split spoon						
20	SS-1	19 - 21	24/8	38-33-26-30	4.2 ppm	SAND	Tan, very dense, coarse to fine SAND; some coarse to fine Gravel; trace Silt.	3		
25	SS-2	24 - 26	24/6	25-33-33-30	1.2 ppm		Tan, very dense, coarse to fine SAND; and coarse to fine Gravel; little Silt.			
30	SS-3	29 - 31	24/5	24-24-34-26	2.6 ppm		Tan, very dense, coarse to fine SAND; and coarse to fine Gravel; trace Silt.			
35	SS-4	34 - 26	24/0	38-18-18-27			Coarse Gravel in tip.			
40	SS-5	39 - 41	24/15	19-24-32-27	6.2 ppm		Tan, very dense, medium to fine SAND; some Silt.			
45	SS-6	44 - 46	24/6	24-25-30-25	3.3 ppm		Tan, very dense, coarse to fine SAND; and coarse to fine Gravel, trace Silt.			

SAMPLE TYPES SS - split spoon ST - shelby tube AF - auger flight RC - rock core	PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%	NOTES: (1) OVA { ppm = parts per million } (2) The Burmister System is used for field classification of soils. (3) 0 - 19' characterized on boring log for MW-5S.
GRANULAR SOILS N-value Density	COHESIVE SOILS N-value Density	
< 4 very loose 5 - 10 loose 11 - 30 medium 31 - 50 dense > 50 very dense	< 2 very soft 2 - 4 soft 4 - 8 medium stiff 8 - 15 stiff 15 - 30 very stiff	

Disk Name: 3490

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By: Boring No: MW-5D Page: 2 of 2
Project Name: Murphy's Waste Oil Service, Inc.		CHES Job #: EN-170
Project Location: Salem Street, Woburn, MA		Field Book No. 93-029
Client Name: Same		Well Elevation: 53.79'
Boring Location: Eastern portion of site		Driller: A. Caron
Drilling Contractor: Environmental Drilling, Inc.		CHES Personnel: S. Applbaum
Drilling Method: Hollow Stem Auger		Start Date: 10/14/94
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		Finish Date: 10/18/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen. /rec. (in)	Blows per 6 (in) on split spoon						
55	SS-7	49 - 51	24/24	14-17-27-46	2.0 ppm	SAND	Tan, dense, coarse to fine SAND; trace fine Gravel; trace Silt.	4		
	SS-8	54 - 56	24/17	35-24-32-52	2.0 ppm		Tan, very dense, coarse to fine SAND; some Silt; trace coarse Gravel.			
	SS-9	59 - 61	24/22	14-22-22-41	3.0 ppm		Dark tan/gray, dense, coarse to fine SAND; little medium Gravel; trace Silt.			
65	SS-10	64 - 66	24/15	8-13-20-32	0.6 ppm	FINE SAND	Tan, dense, fine SAND; trace Silt.			
	SS-11	69 - 71	24/16	14-16-17-17	0.8 ppm		Gray, dense, very fine SAND.			
	SS-12	74 - 76	24/19	14-23-22-30	1.6 ppm		Same; trace Clay.			
80	SS-13	79 - 81	24/18	21-24-31-32	0.3 ppm	Refusal	Gray, very dense, coarse to fine SAND; trace Silt; trace coarse Gravel.	5		

SAMPLE TYPES SS - split spoon ST - shelby tube AF - auger flight RC - rock core		PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%		NOTES: (1) OVA { ppm = parts per million } (2) The Burmister System is used for field classification of soils. (3) 0 - 19' characterized on boring log for MW-5S. (4) Iron staining at 56'. (5) Set 2" PVC well at 83.5'. See Well Completion Report for details.
GRANULAR SOILS		COHESIVE SOILS		
N-value	Density	N-value	Density	
< 4 5 - 10 11 - 30 31 - 50 > 50	very loose loose medium dense very dense	< 2 2 - 4 4 - 8 8 - 15 15 - 30	very soft soft medium stiff stiff very stiff	

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC. 325 Wood Road Braintree, MA 02184 (617) 849-1800		QC Checked By:
Project Name: Murphy's Waste Oil Service, Inc.		Boring No: MW-6
Project Location: Salem Street, Woburn, MA		Page: 1 of 1
Client Name: Same		CHES Job #: EN-170
Boring Location: Southeast portion of site		Field Book No. 93-029
Drilling Contractor: Environmental Drilling, Inc.		Well Elevation: 55.55'
Drilling Method: Hollow Stem Auger		Driller: A. Caron
Casing/Auger Size: 4 1/4" Sampler: Split Spoon		CHES Personnel: S. Applebaum
		Start Date: 10/13/94
		Finish Date: 10/13/94

DEPTH (ft)	SAMPLE				Headspace Field (1) Screening Reading	Strata Change Depth	FIELD CLASSIFICATION AND DRILLING INFORMATION (2)	Notes	well screen	Strata
	Type & No.	Depth (from - to) (ft)	pen. / rec. (in)	Blows per 6 (in) on split spoon						
5	SS-1	0 - 2	24/17	14-18-20-14	3.8 ppm	FILL	Black, dense, medium to fine SAND; some coarse to fine Gravel; trace Brick. Dry.			
	SS-2	2 - 4	24/20	69-74-85-79	1.8 ppm		Brown, very dense, coarse to fine SAND; some coarse to fine Gravel; little Silt. Dry.			
	SS-3	4 - 6	24/16	25-31-30-40	0.8 ppm		Tan, very dense, coarse to fine SAND; some coarse to fine Gravel; trace Silt. Dry.			
	SS-4	6 - 8	24/15	31-41-38-41	0.7 ppm		Same. Dry.			
	SS-5	8 - 10	24/14	41-50-44-44	1.3 ppm		Tan, very dense, coarse to fine SAND; some coarse to fine Gravel; trace Silt. Dry.			
10	SS-6	10 - 12	24/12	23-26-23-17	3.5 ppm	▼ 10'	Tan, very dense, (+) coarse to fine SAND; and coarse to fine Gravel; little Silt. Wet.			
	SS-7	12 - 14	24/4	19-22-28-31	4.7 ppm	12.5'	Same.			
	SS-8	18 - 20	24/14	23-19-25-27	6.3 ppm	SAND & GRAVEL	Tan, dense, coarse to fine SAND; little medium to fine Gravel; trace Silt.			

SAMPLE TYPES SS - split spoon ST - shelly tube AF - auger flight RC - rock core		PERCENTAGE BY WEIGHT and = 35-50% some = 20-35% little = 10-20% trace = 1-10%		NOTES: (1) OVA { ppm = parts per million} (2) The Burmister System is used for field classification of soils. (3) Set 2" PVC well at 20'. See Well Completion Report for details.
GRANULAR SOILS		COHESIVE SOILS		
N-value	Density	N-value	Density	
< 4 5 - 10 11 - 30 31 - 50 > 50	very loose loose medium dense very dense	< 2 2 - 4 4 - 8 8 - 15 15 - 30	very soft soft medium stiff stiff very stiff	

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

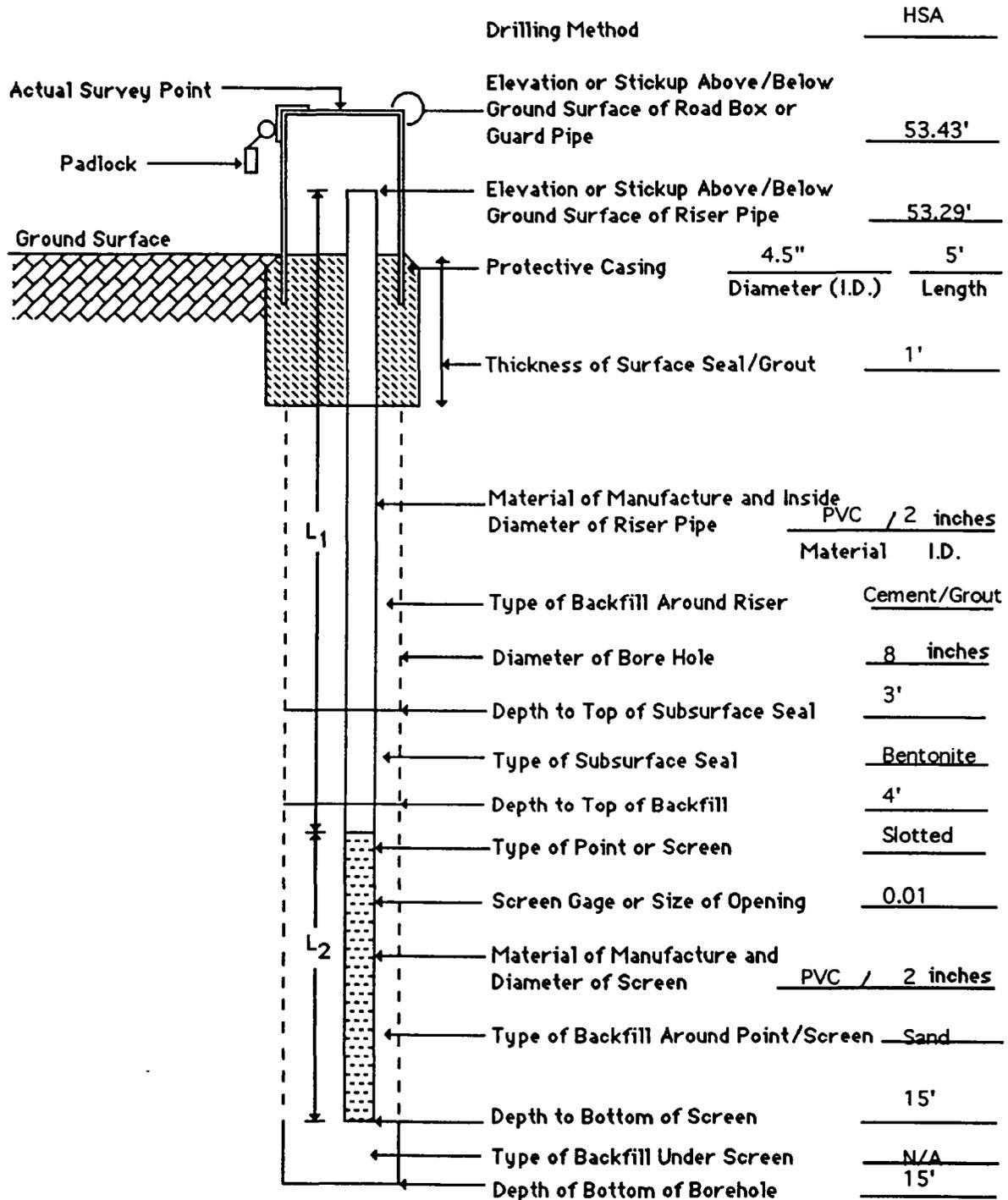
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/13/94

WELL NO.: MW-1

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)

(L₁) Length of Riser (ft) 7.5 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 50.75'

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

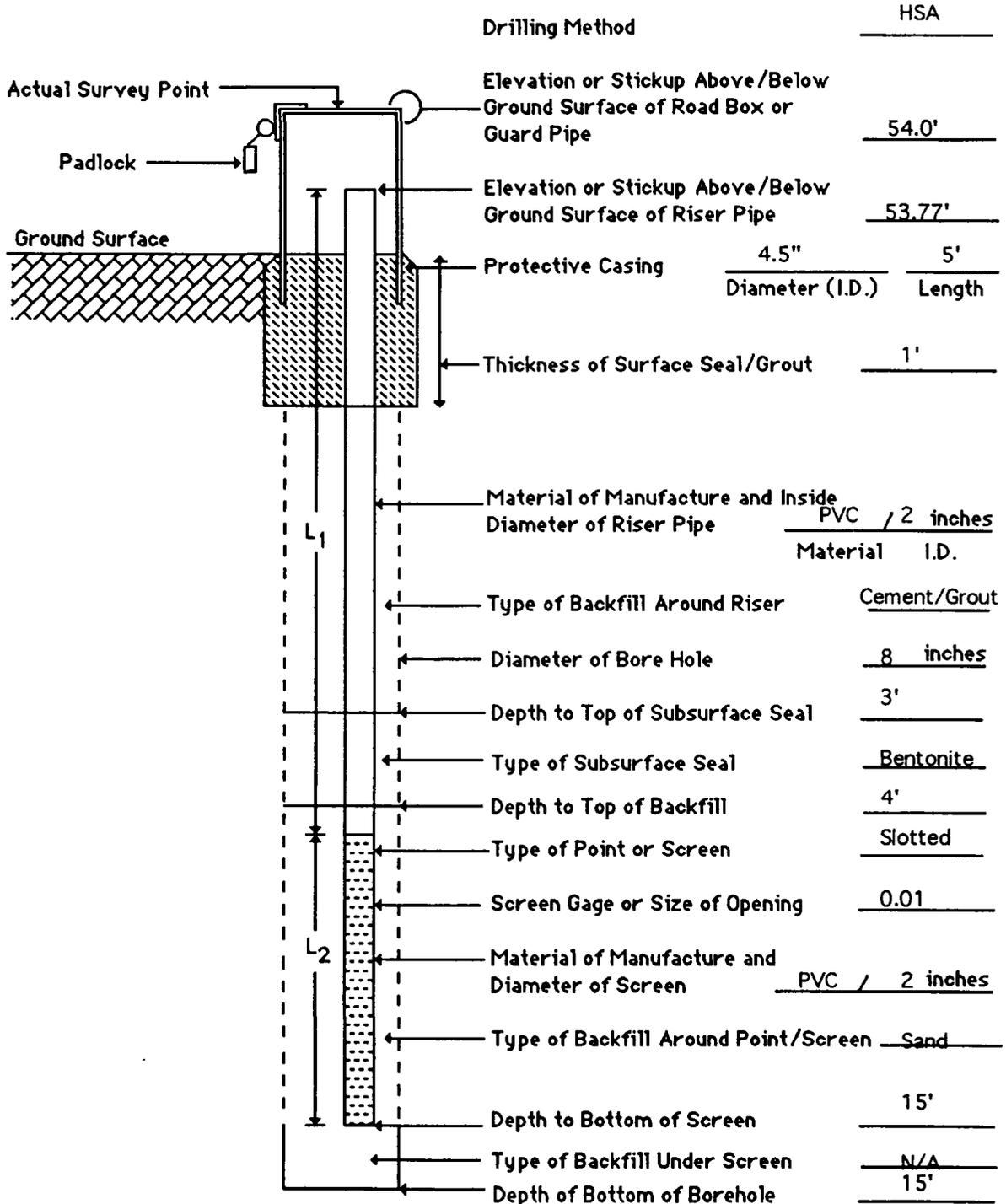
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/12/94

WELL NO.: MW-2

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)

(L₁) Length of Riser (ft) 7.5 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 51.47'

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

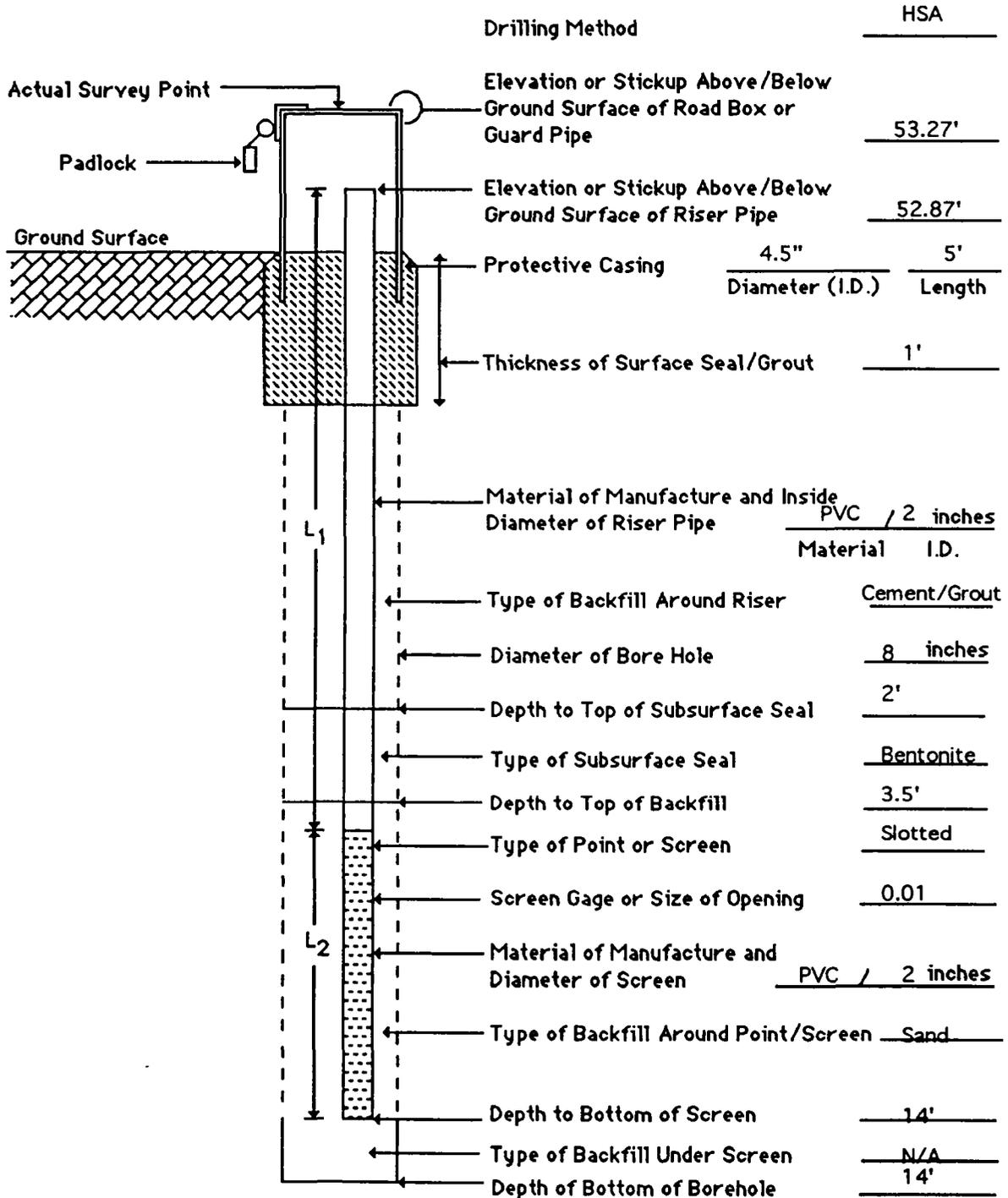
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/18/94

WELL NO.: MW-3

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)

(L₁) Length of Riser (ft) 6 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 50.74'

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

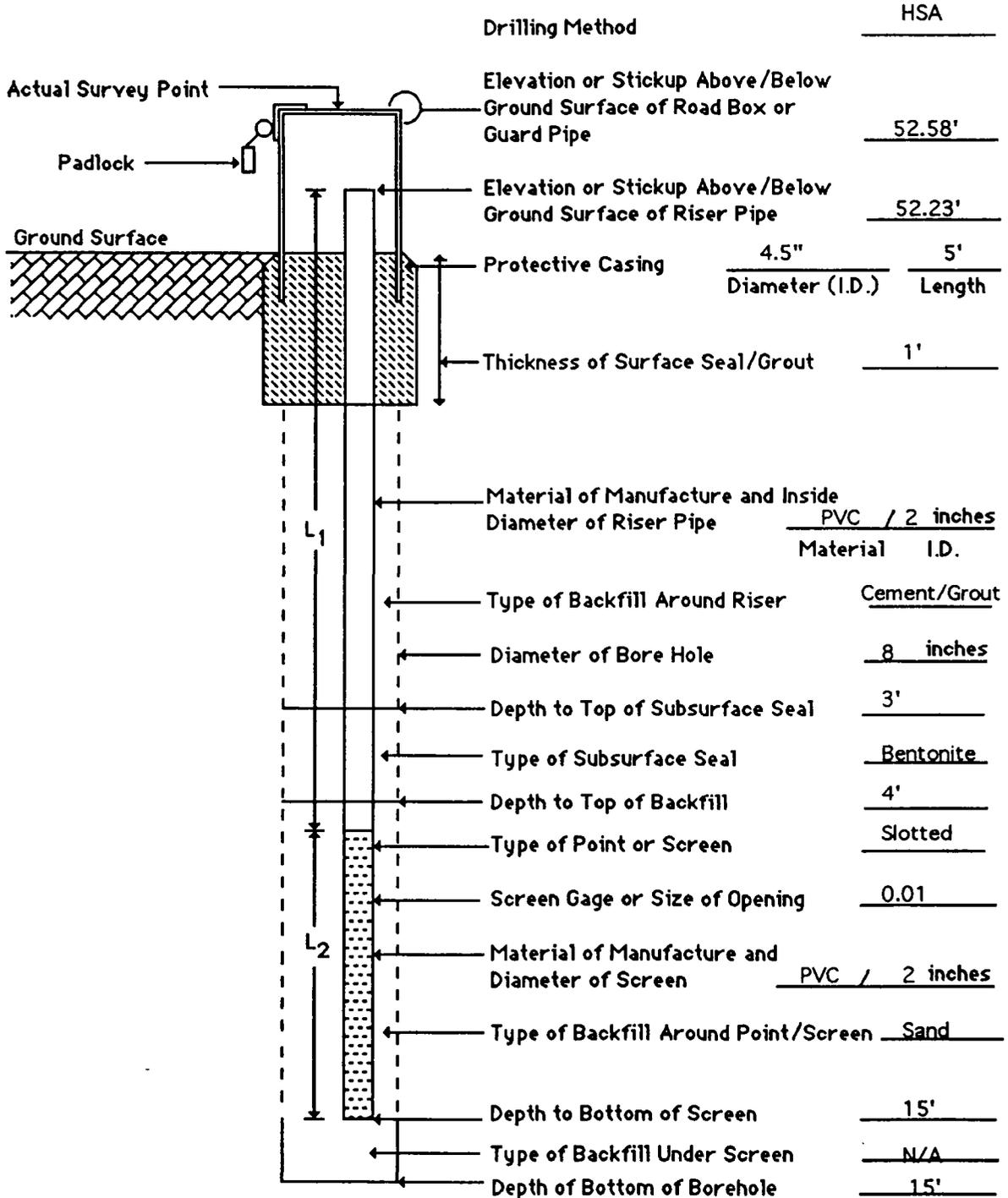
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/12/94

WELL NO.: MW-4

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)

(L₁) Length of Riser (ft) 7.5 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 49.99'

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

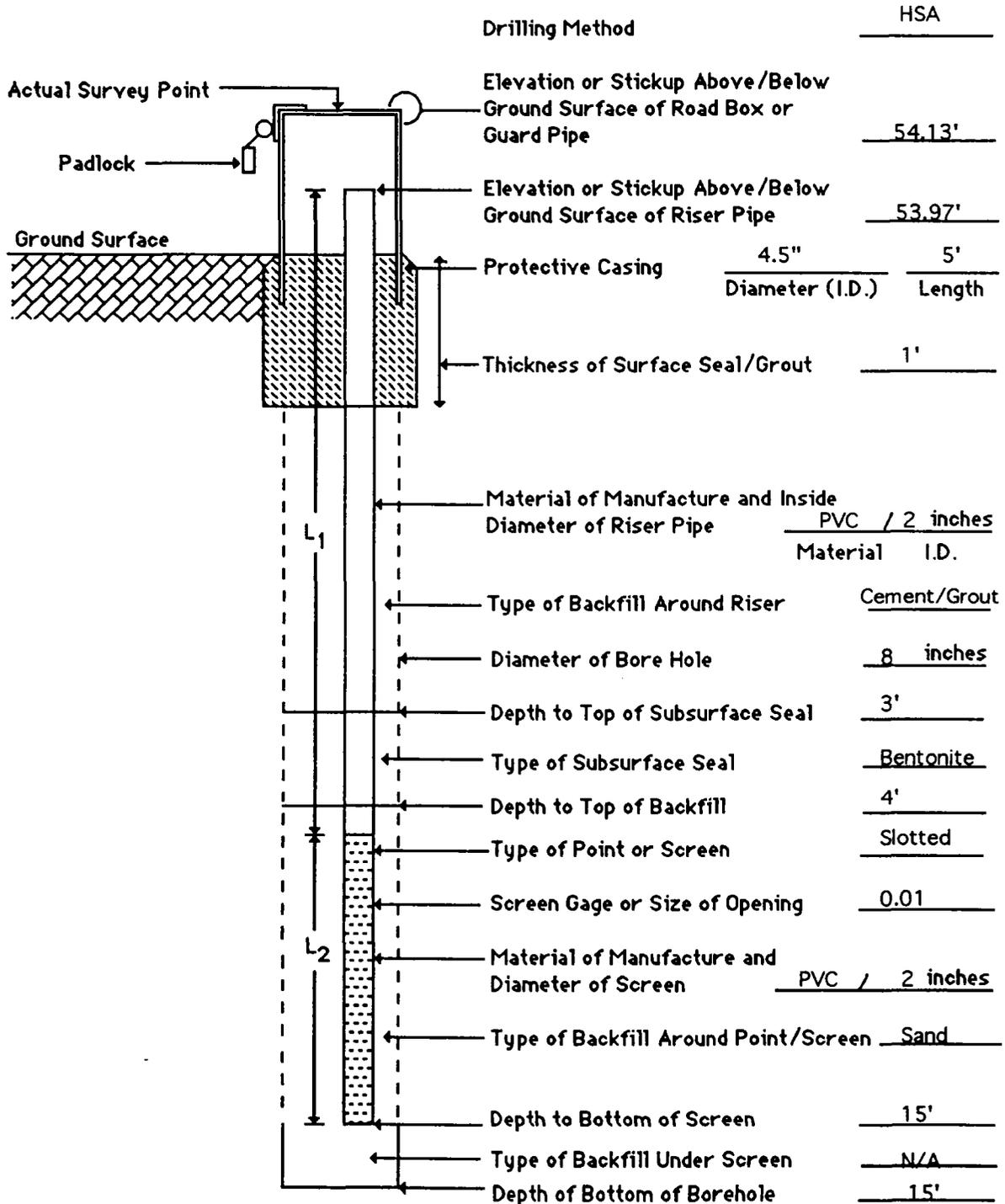
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/12/94

WELL NO.: MW-5S

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)

(L₁) Length of Riser (ft) 7.5 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 51.77'

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

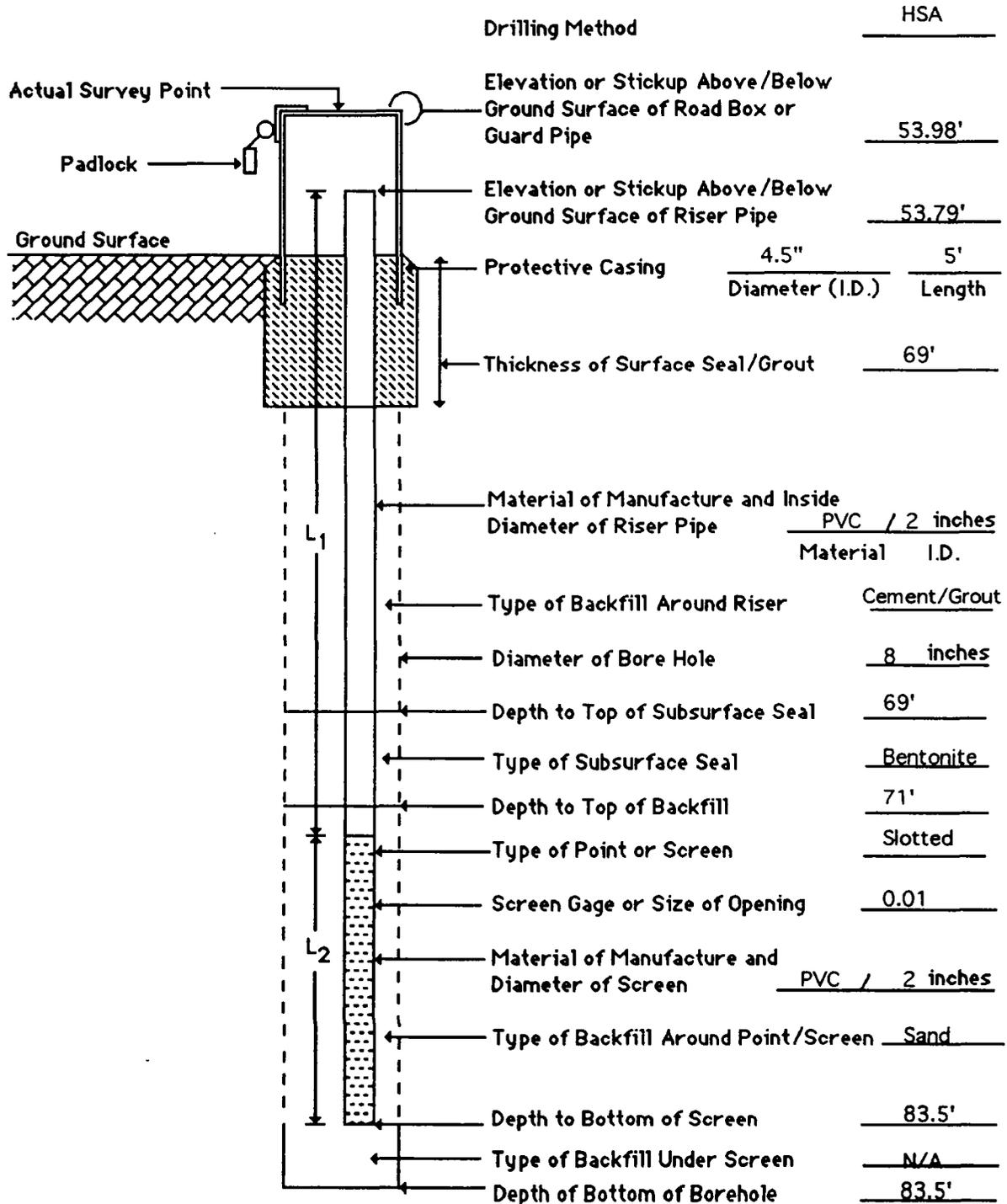
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/18/94

WELL NO.: MW-5D

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)
 (L₁) Length of Riser (ft) 7.5 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 51.65'

GROUNDWATER MONITORING WELL REPORT

SITE: Murphy's Waste Oil Service, Inc.

PROJECT NO.: EN-170

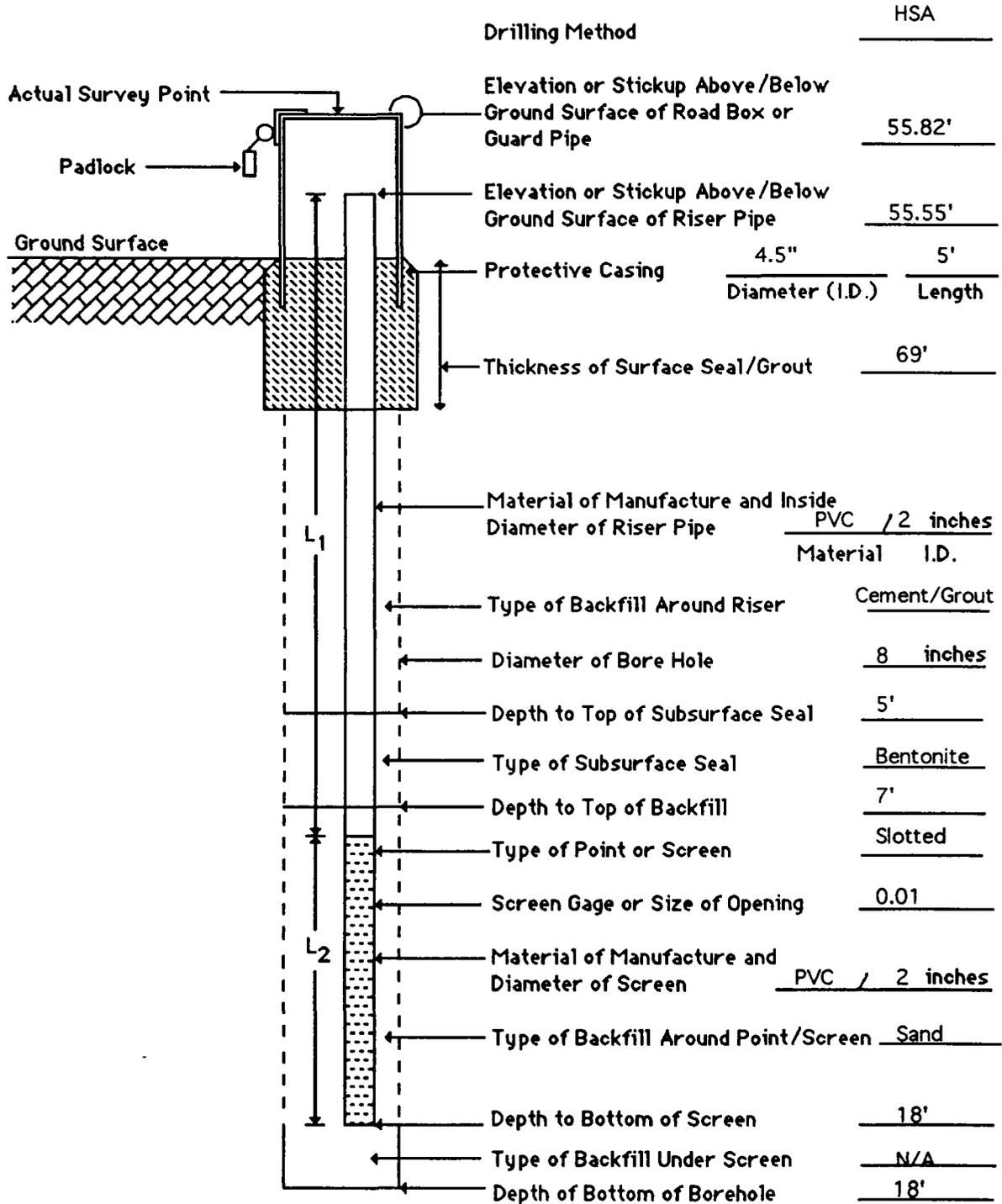
CONTRACTOR: Environmental Drilling

INSTALLATION DATE: 10/13/94

WELL NO.: MW-6

DRILLER: A. Caron

INSPECTOR: S. Applebaum



Actual Elevation (where available)

(L₁) Length of Riser (ft) 10 (L₂) Length of Screen (ft) 10 Reference Point NGVD Ground Elev. 53.73'

REMEDICATION
TECHNOLOGIES, INC.

WELL INSTALLATION LOG
Monitoring Well MR-1SS

9 Pond Lane
Concord, MA 01742
(508)371-1422

PROJECT NO: 3-0681-332	DRILLING CO.: SOIL EXPLORATION	MP ELEV.: 50.01' (MSL) (TOP OF PVC)
CLIENT: BEATRICE	DRILLER: JIM CAMPBELL	TOTAL DEPTH: 13'
LOCATION: NOBURN, MA	BORING ID: 0	SURFACE ELEV.: 48.60' (MSL)
START DATE: 8/16/93 TIME: 0800	CASING ID: NA	WATER LEVEL DURING DRILLING: 4.92'
COMPLETION DATE: 8/16/93 TIME: 1020	METHOD: HSA	PVC STICK-UP: 1.41'
WELL LOCATION: MURPHY WASTE OIL	LOGGED BY: MICHAEL T. COON	

DEPTH (feet)	RECOVERY (%)	SAMPLE DEPTH	PTO HEADSPACE (ppm)	BLOW CTS. / 6"	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION	
							Diagram	Labels
0-5	50	0-2	0	12		<p>FILL Dry light brown medium to fine SAND. Little medium to fine angular Gravel. Trace Silt.</p>		<p>PROTECTIVE STEEL WELL MONUMENT w/ LOCKING COVER</p> <p>CONCRETE</p> <p>2" SCH. 40 PVC</p> <p>0.010 SLOTTED PVC SCREEN FROM 3' to 13'</p> <p>BENTONITE SEAL FROM 1' to 2'</p> <p>GROUT FROM 0' to 1'</p> <p>SAND FROM 2' to 13'</p>
5-10	44	5-7	0	12 12 13 15				
10-13	40	10-12	0	13 10 17 19		<p>Saturated fine to medium blonde SAND and fine angular GRAVEL.</p>		<p>BENTONITE SEAL FROM 1' to 2'</p> <p>GROUT FROM 0' to 1'</p> <p>SAND FROM 2' to 13'</p>
13-15								

REMARKS:

REMEDIATION TECHNOLOGIES, INC.

WELL INSTALLATION LOG
Monitoring Well MR-2SS

9 Pond Lane
Concord, MA 01742
(508)371-1422

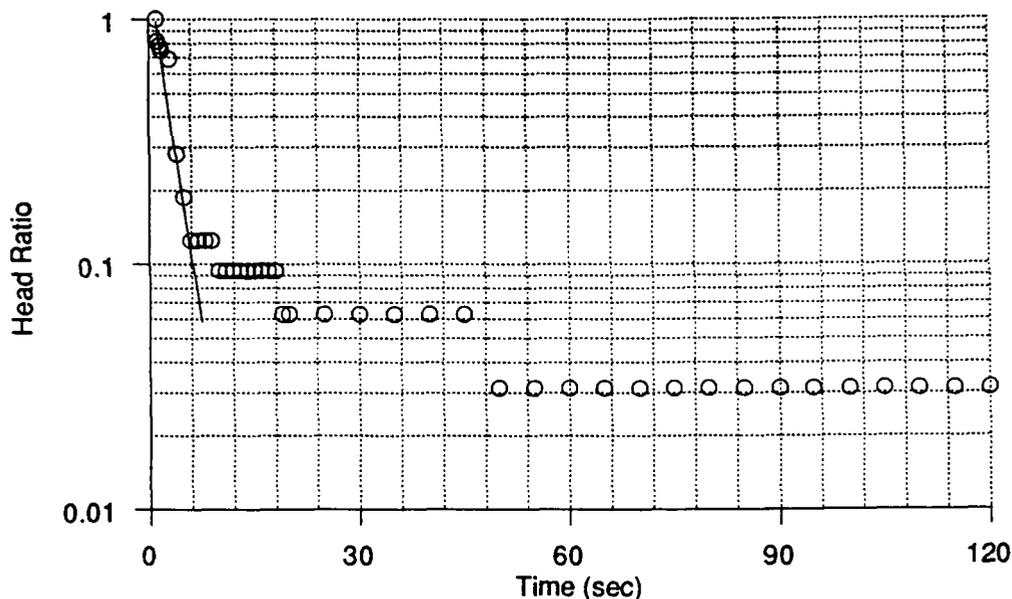
PROJECT NO: 3-0681-332	DRILLING CO.: SOIL EXPLORATION	MP ELEV.: 50.37' (MSL) (TOP OF PVC)
CLIENT: BEATRICE	DRILLER: JIM CAMPBELL	TOTAL DEPTH: 15'
LOCATION: NOBURN, MA	BORING ID: 6	SURFACE ELEV.: 50.80' (MSL)
START DATE: 8/13/93 TIME: 0830	CASING ID: NA	WATER LEVEL DURING DRILLING: 5.91'
COMPLETION DATE: 8/13/93 TIME: 1030	METHOD: HSA	PVC STICK-UP: 0.00'
WELL LOCATION: MURPHY WASTE OIL	LOGGED BY: MICHAEL T. COON	

DEPTH (feet)	RECOVERY (%)	SAMPLE DEPTH	P10 HEADSPACE (ppm)	BLO# CTS. / 6"	LITHOLOGY	DESCRIPTION	WELL CONSTRUCTION
45	0-2	0	0	19 23 20 18		<p>FILL</p> <p>Dry light gray fine grained SAND and SILT and angular medium GRAVEL.</p> <p>Dry dark brown fine SAND. Little Silt, Trace subangular medium to fine Gravel. Trace Clay.</p>	<p>PROTECTIVE ROADBOX</p> <p>2" SCH. 40 PVC</p> <p>GROUT FROM 0' to 2'</p> <p>BENTONITE SEAL FROM 2' to 3'</p> <p>SAND FROM 3' to 15'</p> <p>0.010 SLOTTED PVC SCREEN FROM 5' to 15'</p>
5	60	5-7	0	6 7 11 6		<p>OUTWASH</p> <p>Saturated Dark brown CLAY and SAND. Trace subangular medium Gravel.</p>	
10	60	10-12	0.6	10 13 10 7		<p>Saturated black to steel gray fine SAND and medium angular GRAVEL. Heavy petroleum odor.</p> <p>Saturated light brown medium SAND with rounded medium Gravel. Petroleum odor.</p>	
15	44	15-17	0.2	11 15 15 20		<p>Saturated well rounded fine to medium GRAVEL. Little light brown Sand. Slight petroleum odor.</p>	
20						Bottom of Boring 17'.	

REMARKS:

APP. E

Well MW-1



$L = 238 \text{ cm}$
 $T_0 = 1.6 \text{ sec}$
 $K = 2.7 \times 10^{-2} \text{ cm/sec}$

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T_0 is time of recovery to 37 percent of initial change ($h/h_0 = 0.37$), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



Environmental Services Companies

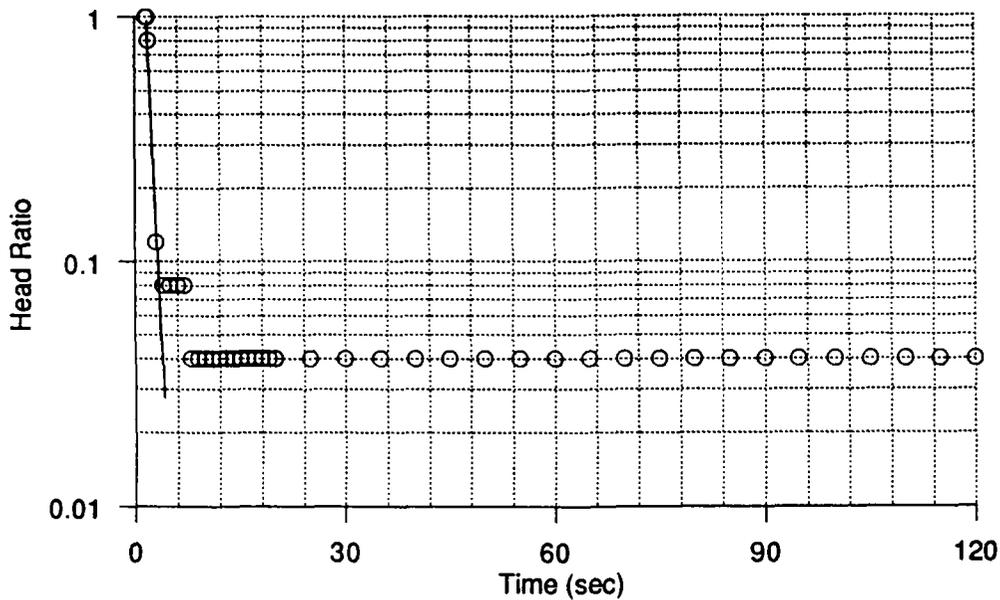
325 WOOD ROAD
 BRAINTREE, MASSACHUSETTS 02184
 (617) 849-1200

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS

WELL MW-1 SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MW-2



L = 213 cm
 T₀ = 1.0 sec
 K = 4.6 x 10⁻² cm/sec

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T₀ is time of recovery to 37 percent of initial change (h/h₀ = 0.37), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS
WELL MW-2 SLUG TEST

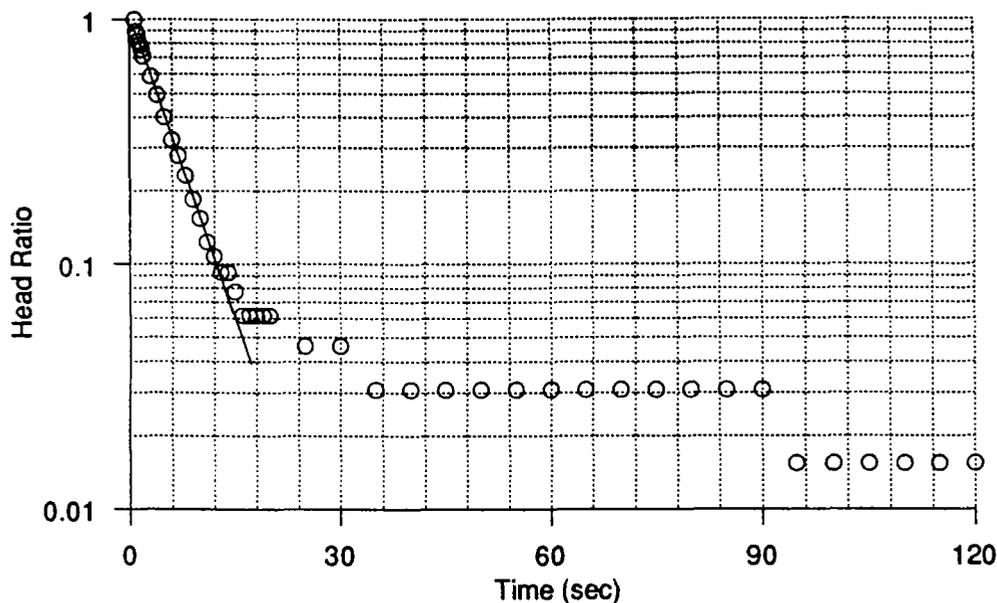
PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	



Clean Harbors
Environmental Services Companies

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 (617) 849-1200

Well MW-3



L = 207 cm
 T₀ = 4.6 sec
 K = 1.0 x 10⁻² cm/sec

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T₀ is time of recovery to 37 percent of initial change (h/h₀ = 0.37), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



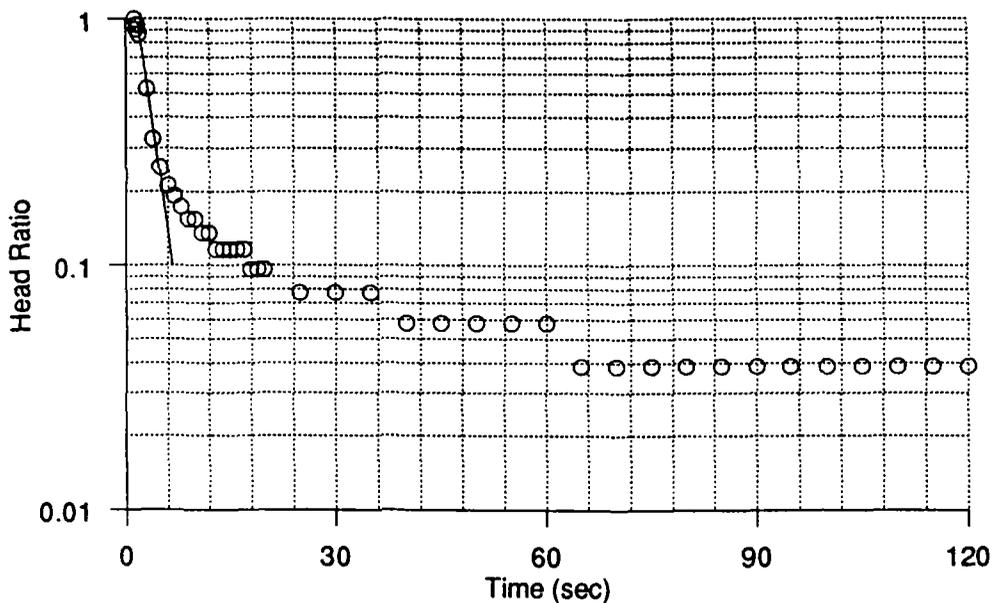
Environmental Services Companies

325 WOOD ROAD
 BRAINTREE, MASSACHUSETTS 02184
 (617) 849-1200

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS
WELL MW-3 SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MW-4



$L = 256 \text{ cm}$
 $T_0 = 2.4 \text{ sec}$
 $K = 1.7 \times 10^{-2} \text{ cm/sec}$

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T_0 is time of recovery to 37 percent of initial change ($h/h_0 = 0.37$), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



Environmental Services Companies

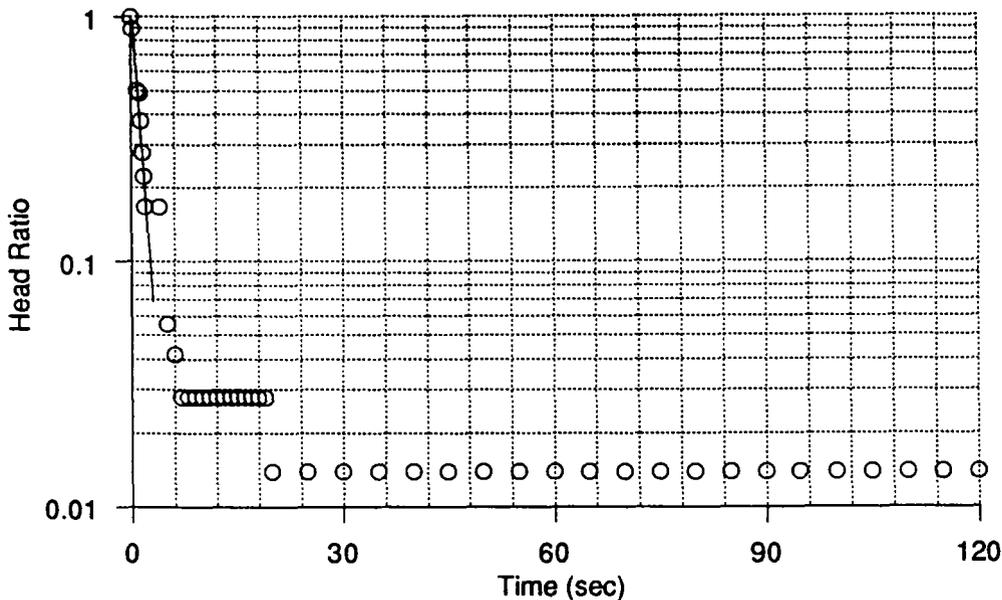
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 (617) 849-1200

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS

WELL MW-4 SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MW-5S



L = 207 cm
 T₀ = 1.4 sec
 K = 3.4 x 10⁻² cm/sec

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T₀ is time of recovery to 37 percent of initial change (h/h₀ = 0.37), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



Environmental Services Companies

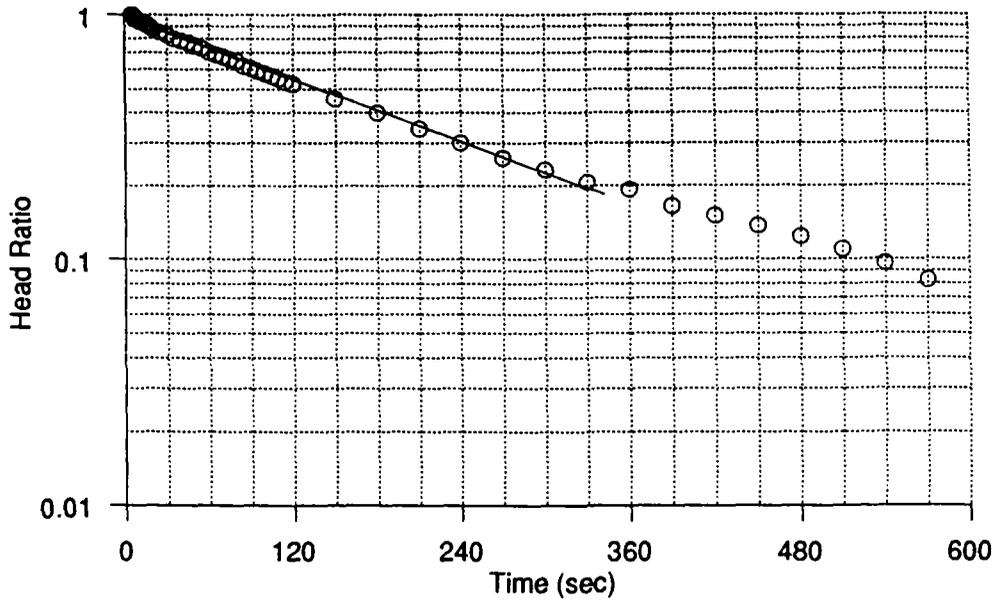
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 BRAINTREE, MASSACHUSETTS 02184
 (617) 849-1200

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS

WELL MW-5S SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MW-5D



$L = 305 \text{ cm}$
 $T_o = 190 \text{ sec}$
 $K = 1.9 \times 10^{-4} \text{ cm/sec}$

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T_o is time of recovery to 37 percent of initial change ($h/h_o = 0.37$), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



Environmental Services Companies

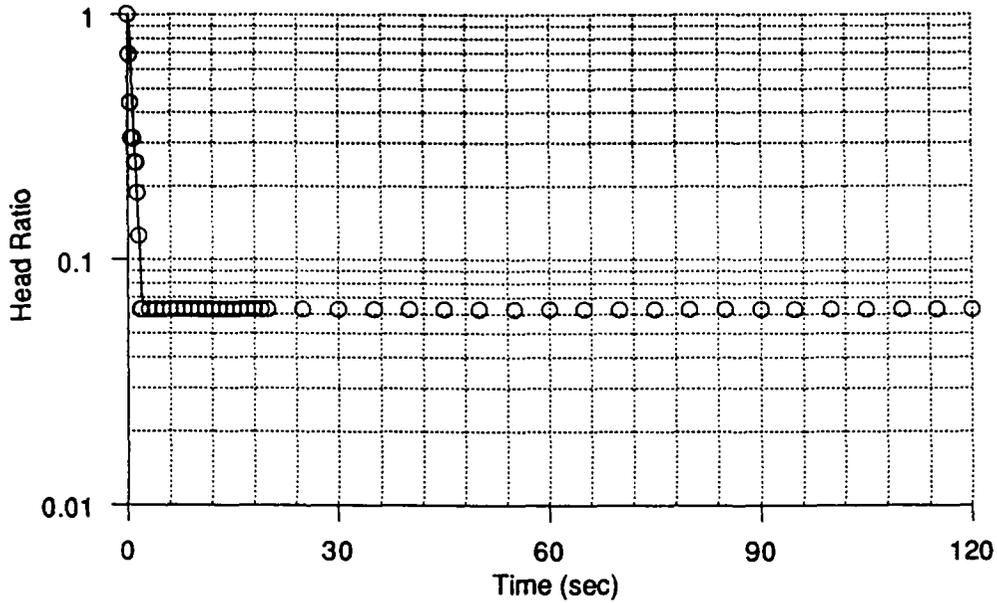
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 252 SALEM STREET
 WOBURN, MASSACHUSETTS

WELL MW-5D SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MW-6



$L = 232 \text{ cm}$
 $T_0 = 0.5 \text{ sec}$
 $K = 8.7 \times 10^{-2} \text{ cm/sec}$

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T_0 is time of recovery to 37 percent of initial change ($h/h_0 = 0.37$), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



Environmental Services Companies

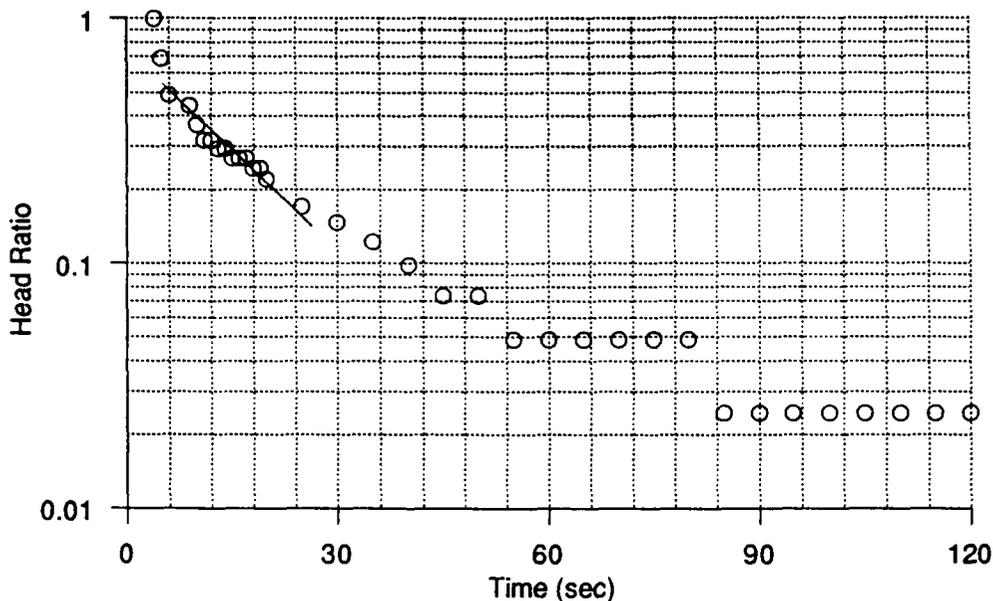
325 WOOD ROAD
 BRAINTREE, MASSACHUSETTS 02184
 (617) 849-1200

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS

WELL MW-6 SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MR-1SS



$L = 183 \text{ cm}$
 $T_0 = 5.9 \text{ sec}$
 $K = 8.6 \times 10^{-3} \text{ cm/sec}$

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T_0 is time of recovery to 37 percent of initial change ($h/h_0 = 0.37$), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE



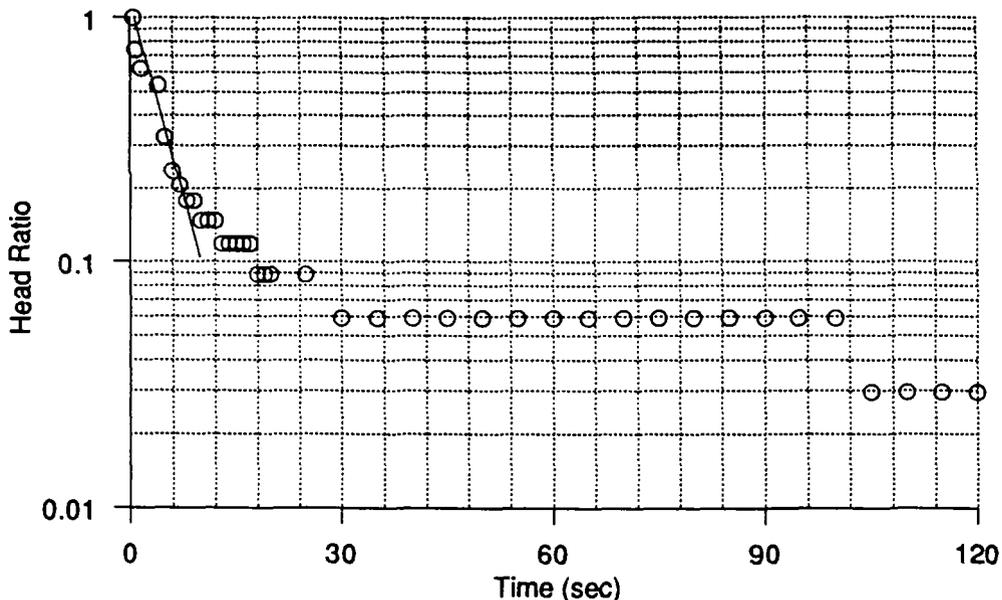
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 (617) 849-1200

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS
WELL MR-1SS SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	

Well MR-2SS



$L = 238 \text{ cm}$
 $T_0 = 4.2 \text{ sec}$
 $K = 1.0 \times 10^{-2} \text{ cm/sec}$

NOTES:

1. Rising head slug test performed by Clean Harbors on November 21, 1994.
2. L is average length of screen through which water passed during the test.
3. T_0 is time of recovery to 37 percent of initial change ($h/h_0 = 0.37$), corrected for test start time.

A	PRELIMINARY				
ISSUE	DESCRIPTION	DRWN	CHKD	APPR	DATE

MURPHY'S WASTE OIL SERVICE, INC.
 252 SALEM STREET
 WOBURN, MASSACHUSETTS

WELL MR-2SS SLUG TEST

PROJECT NO. EN - 170	DWG. NO.
SCALE: NA	



Clean Harbors
Environmental Services Companies

325 WOOD ROAD
 BRAINTREE, MASSACHUSETTS 02184
 (617) 849-1200

SLUG TEST DATA - WELL MW-1

Performed November 21, 1994

Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0200	1.200	2.39	43.23	0.3200	1.0000
0.0233	1.398	2.45	43.29	0.2600	0.8125
0.0266	1.596	2.46	43.30	0.2500	0.7813
0.0300	1.800	2.47	43.31	0.2400	0.7500
0.0500	3.000	2.49	43.33	0.2200	0.6875
0.0666	3.996	2.62	43.46	0.0900	0.2813
0.0833	4.998	2.65	43.49	0.0600	0.1875
0.1000	6.000	2.67	43.51	0.0400	0.1250
0.1166	6.996	2.67	43.51	0.0400	0.1250
0.1333	7.998	2.67	43.51	0.0400	0.1250
0.1500	9.000	2.67	43.51	0.0400	0.1250
0.1666	9.996	2.68	43.52	0.0300	0.0937
0.1833	10.998	2.68	43.52	0.0300	0.0937
0.2000	12.000	2.68	43.52	0.0300	0.0937
0.2166	12.996	2.68	43.52	0.0300	0.0937
0.2333	13.998	2.68	43.52	0.0300	0.0937
0.2500	15.000	2.68	43.52	0.0300	0.0937
0.2666	15.996	2.68	43.52	0.0300	0.0937
0.2833	16.998	2.68	43.52	0.0300	0.0937
0.3000	18.000	2.68	43.52	0.0300	0.0937
0.3166	18.996	2.69	43.53	0.0200	0.0625
0.3333	19.998	2.69	43.53	0.0200	0.0625
0.4167	25.002	2.69	43.53	0.0200	0.0625
0.5000	30.000	2.69	43.53	0.0200	0.0625
0.5833	34.998	2.69	43.53	0.0200	0.0625
0.6667	40.002	2.69	43.53	0.0200	0.0625
0.7500	45.000	2.69	43.53	0.0200	0.0625
0.8333	49.998	2.70	43.54	0.0100	0.0312
0.9167	55.002	2.70	43.54	0.0100	0.0312
1.0000	60.000	2.70	43.54	0.0100	0.0312
1.0833	64.998	2.70	43.54	0.0100	0.0312
1.1667	70.002	2.70	43.54	0.0100	0.0312
1.2500	75.000	2.70	43.54	0.0100	0.0312
1.3330	79.980	2.70	43.54	0.0100	0.0312
1.4166	84.996	2.70	43.54	0.0100	0.0312
1.5000	90.000	2.70	43.54	0.0100	0.0312
1.5800	94.800	2.70	43.54	0.0100	0.0312
1.6667	100.002	2.70	43.54	0.0100	0.0312
1.7500	105.000	2.70	43.54	0.0100	0.0312
1.8333	109.998	2.70	43.54	0.0100	0.0312
1.9167	115.002	2.70	43.54	0.0100	0.0312
2.0000	120.000	2.70	43.54	0.0100	0.0312

SLUG TEST DATA - WELL MW-2

Performed November 21, 1994

Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0266	1.596	2.10	43.24	0.2500	1.0000
0.0300	1.800	2.10	43.24	0.2500	1.0000
0.0333	2.000	2.15	43.29	0.2000	0.8000
0.0500	3.000	2.32	43.46	0.0300	0.1200
0.0666	3.996	2.33	43.47	0.0200	0.0800
0.0833	4.998	2.33	43.47	0.0200	0.0800
0.1000	6.000	2.33	43.47	0.0200	0.0800
0.1166	6.996	2.33	43.47	0.0200	0.0800
0.1333	7.998	2.34	43.48	0.0100	0.0400
0.1500	9.000	2.34	43.48	0.0100	0.0400
0.1666	9.996	2.34	43.48	0.0100	0.0400
0.1833	10.998	2.34	43.48	0.0100	0.0400
0.2000	12.000	2.34	43.48	0.0100	0.0400
0.2166	12.996	2.34	43.48	0.0100	0.0400
0.2333	13.998	2.34	43.48	0.0100	0.0400
0.2500	15.000	2.34	43.48	0.0100	0.0400
0.2666	15.996	2.34	43.48	0.0100	0.0400
0.2833	16.998	2.34	43.48	0.0100	0.0400
0.3000	18.000	2.34	43.48	0.0100	0.0400
0.3166	18.996	2.34	43.48	0.0100	0.0400
0.3333	19.998	2.34	43.48	0.0100	0.0400
0.4167	25.002	2.34	43.48	0.0100	0.0400
0.5000	30.000	2.34	43.48	0.0100	0.0400
0.5833	34.998	2.34	43.48	0.0100	0.0400
0.6667	40.002	2.34	43.48	0.0100	0.0400
0.7500	45.000	2.34	43.48	0.0100	0.0400
0.8333	49.998	2.34	43.48	0.0100	0.0400
0.9167	55.002	2.34	43.48	0.0100	0.0400
1.0000	60.000	2.34	43.48	0.0100	0.0400
1.0833	64.998	2.34	43.48	0.0100	0.0400
1.1667	70.002	2.34	43.48	0.0100	0.0400
1.2500	75.000	2.34	43.48	0.0100	0.0400
1.3330	79.980	2.34	43.48	0.0100	0.0400
1.4166	84.996	2.34	43.48	0.0100	0.0400
1.5000	90.000	2.34	43.48	0.0100	0.0400
1.5800	94.800	2.34	43.48	0.0100	0.0400
1.6667	100.002	2.34	43.48	0.0100	0.0400
1.7500	105.000	2.34	43.48	0.0100	0.0400
1.8333	109.998	2.34	43.48	0.0100	0.0400
1.9167	115.002	2.34	43.48	0.0100	0.0400
2.0000	120.000	2.34	43.48	0.0100	0.0400

SLUG TEST DATA - WELL MW-3

Performed November 21, 1994

Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0133	0.798	1.69	42.90	0.6500	1.0000
0.0166	0.996	1.76	42.97	0.5800	0.8923
0.0200	1.200	1.78	42.99	0.5600	0.8615
0.0233	1.398	1.81	43.02	0.5300	0.8154
0.0266	1.596	1.83	43.04	0.5100	0.7846
0.0300	1.800	1.85	43.06	0.4900	0.7538
0.0333	2.000	1.88	43.09	0.4600	0.7077
0.0500	3.000	1.96	43.17	0.3800	0.5846
0.0666	3.996	2.02	43.23	0.3200	0.4923
0.0833	4.998	2.08	43.29	0.2600	0.4000
0.1000	6.000	2.13	43.34	0.2100	0.3231
0.1166	6.996	2.16	43.37	0.1800	0.2769
0.1333	7.998	2.19	43.40	0.1500	0.2308
0.1500	9.000	2.22	43.43	0.1200	0.1846
0.1666	9.996	2.24	43.45	0.1000	0.1538
0.1833	10.998	2.26	43.47	0.0800	0.1231
0.2000	12.000	2.27	43.48	0.0700	0.1077
0.2166	12.996	2.28	43.49	0.0600	0.0923
0.2333	13.998	2.28	43.49	0.0600	0.0923
0.2500	15.000	2.29	43.50	0.0500	0.0769
0.2666	15.996	2.30	43.51	0.0400	0.0615
0.2833	16.998	2.30	43.51	0.0400	0.0615
0.3000	18.000	2.30	43.51	0.0400	0.0615
0.3166	18.996	2.30	43.51	0.0400	0.0615
0.3333	19.998	2.30	43.51	0.0400	0.0615
0.4167	25.002	2.31	43.52	0.0300	0.0462
0.5000	30.000	2.31	43.52	0.0300	0.0462
0.5833	34.998	2.32	43.53	0.0200	0.0308
0.6667	40.002	2.32	43.53	0.0200	0.0308
0.7500	45.000	2.32	43.53	0.0200	0.0308
0.8333	49.998	2.32	43.53	0.0200	0.0308
0.9167	55.002	2.32	43.53	0.0200	0.0308
1.0000	60.000	2.32	43.53	0.0200	0.0308
1.0833	64.998	2.32	43.53	0.0200	0.0308
1.1667	70.002	2.32	43.53	0.0200	0.0308
1.2500	75.000	2.32	43.53	0.0200	0.0308
1.3330	79.980	2.32	43.53	0.0200	0.0308
1.4166	84.996	2.32	43.53	0.0200	0.0308
1.5000	90.000	2.32	43.53	0.0200	0.0308
1.5800	94.800	2.33	43.54	0.0100	0.0154
1.6667	100.002	2.33	43.54	0.0100	0.0154
1.7500	105.000	2.33	43.54	0.0100	0.0154
1.8333	109.998	2.33	43.54	0.0100	0.0154
1.9167	115.002	2.33	43.54	0.0100	0.0154
2.0000	120.000	2.33	43.54	0.0100	0.0154

SLUG TEST DATA - WELL MW-4

Performed November 21, 1994

Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0233	1.398	2.62	42.84	0.5200	1.0000
0.0266	1.596	2.67	42.89	0.4700	0.9038
0.0300	1.800	2.65	42.87	0.4900	0.9423
0.0333	2.000	2.69	42.91	0.4500	0.8654
0.0500	3.000	2.87	43.09	0.2700	0.5192
0.0666	3.996	2.97	43.19	0.1700	0.3269
0.0833	4.998	3.01	43.23	0.1300	0.2500
0.1000	6.000	3.03	43.25	0.1100	0.2115
0.1166	6.996	3.04	43.26	0.1000	0.1923
0.1333	7.998	3.05	43.27	0.0900	0.1731
0.1500	9.000	3.06	43.28	0.0800	0.1538
0.1666	9.996	3.06	43.28	0.0800	0.1538
0.1833	10.998	3.07	43.29	0.0700	0.1346
0.2000	12.000	3.07	43.29	0.0700	0.1346
0.2166	12.996	3.08	43.30	0.0600	0.1154
0.2333	13.998	3.08	43.30	0.0600	0.1154
0.2500	15.000	3.08	43.30	0.0600	0.1154
0.2666	15.996	3.08	43.30	0.0600	0.1154
0.2833	16.998	3.08	43.30	0.0600	0.1154
0.3000	18.000	3.09	43.31	0.0500	0.0962
0.3166	18.996	3.09	43.31	0.0500	0.0962
0.3333	19.998	3.09	43.31	0.0500	0.0962
0.4167	25.002	3.10	43.32	0.0400	0.0769
0.5000	30.000	3.10	43.32	0.0400	0.0769
0.5833	34.998	3.10	43.32	0.0400	0.0769
0.6667	40.002	3.11	43.33	0.0300	0.0577
0.7500	45.000	3.11	43.33	0.0300	0.0577
0.8333	49.998	3.11	43.33	0.0300	0.0577
0.9167	55.002	3.11	43.33	0.0300	0.0577
1.0000	60.000	3.11	43.33	0.0300	0.0577
1.0833	64.998	3.12	43.34	0.0200	0.0385
1.1667	70.002	3.12	43.34	0.0200	0.0385
1.2500	75.000	3.12	43.34	0.0200	0.0385
1.3330	79.980	3.12	43.34	0.0200	0.0385
1.4166	84.996	3.12	43.34	0.0200	0.0385
1.5000	90.000	3.12	43.34	0.0200	0.0385
1.5800	94.800	3.12	43.34	0.0200	0.0385
1.6667	100.002	3.12	43.34	0.0200	0.0385
1.7500	105.000	3.12	43.34	0.0200	0.0385
1.8333	109.998	3.12	43.34	0.0200	0.0385
1.9167	115.002	3.12	43.34	0.0200	0.0385
2.0000	120.000	3.12	43.34	0.0200	0.0385

SLUG TEST DATA - WELL MW-5S

Performed November 21, 1994

Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0000	0.000	2.02	42.84	0.7200	1.0000
0.0033	0.198	2.10	42.92	0.6400	0.8889
0.0133	0.798	2.38	43.20	0.3600	0.5000
0.0200	1.200	2.39	43.21	0.3500	0.4861
0.0233	1.398	2.47	43.29	0.2700	0.3750
0.0266	1.596	2.54	43.36	0.2000	0.2778
0.0300	1.800	2.58	43.40	0.1600	0.2222
0.0333	2.000	2.62	43.44	0.1200	0.1667
0.0666	3.996	2.62	43.44	0.1200	0.1667
0.0833	4.998	2.70	43.52	0.0400	0.0556
0.1000	6.000	2.71	43.53	0.0300	0.0417
0.1166	6.996	2.72	43.54	0.0200	0.0278
0.1333	7.998	2.72	43.54	0.0200	0.0278
0.1500	9.000	2.72	43.54	0.0200	0.0278
0.1666	9.996	2.72	43.54	0.0200	0.0278
0.1833	10.998	2.72	43.54	0.0200	0.0278
0.2000	12.000	2.72	43.54	0.0200	0.0278
0.2166	12.996	2.72	43.54	0.0200	0.0278
0.2333	13.998	2.72	43.54	0.0200	0.0278
0.2500	15.000	2.72	43.54	0.0200	0.0278
0.2666	15.996	2.72	43.54	0.0200	0.0278
0.2833	16.998	2.72	43.54	0.0200	0.0278
0.3000	18.000	2.72	43.54	0.0200	0.0278
0.3166	18.996	2.72	43.54	0.0200	0.0278
0.3333	19.998	2.73	43.55	0.0100	0.0139
0.4167	25.002	2.73	43.55	0.0100	0.0139
0.5000	30.000	2.73	43.55	0.0100	0.0139
0.5833	34.998	2.73	43.55	0.0100	0.0139
0.6667	40.002	2.73	43.55	0.0100	0.0139
0.7500	45.000	2.73	43.55	0.0100	0.0139
0.8333	49.998	2.73	43.55	0.0100	0.0139
0.9167	55.002	2.73	43.55	0.0100	0.0139
1.0000	60.000	2.73	43.55	0.0100	0.0139
1.0833	64.998	2.73	43.55	0.0100	0.0139
1.1667	70.002	2.73	43.55	0.0100	0.0139
1.2500	75.000	2.73	43.55	0.0100	0.0139
1.3330	79.980	2.73	43.55	0.0100	0.0139
1.4166	84.996	2.73	43.55	0.0100	0.0139
1.5000	90.000	2.73	43.55	0.0100	0.0139
1.5800	94.800	2.73	43.55	0.0100	0.0139
1.6667	100.002	2.73	43.55	0.0100	0.0139
1.7500	105.000	2.73	43.55	0.0100	0.0139
1.8333	109.998	2.73	43.55	0.0100	0.0139
1.9167	115.002	2.73	43.55	0.0100	0.0139
2.0000	120.000	2.73	43.55	0.0100	0.0139

SLUG TEST DATA - WELL MW-5D

Performed November 21, 1994

Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0833	4.998	6.41	42.49	0.7300	1.0000
0.1000	6.000	6.41	42.49	0.7300	1.0000
0.1166	6.996	6.43	42.51	0.7100	0.9726
0.1333	7.998	6.44	42.52	0.7000	0.9589
0.1500	9.000	6.44	42.52	0.7000	0.9589
0.1666	9.996	6.45	42.53	0.6900	0.9452
0.1833	10.998	6.46	42.54	0.6800	0.9315
0.2000	12.000	6.46	42.54	0.6800	0.9315
0.2166	12.996	6.46	42.54	0.6800	0.9315
0.2333	13.998	6.47	42.55	0.6700	0.9178
0.2500	15.000	6.48	42.56	0.6600	0.9041
0.2666	15.996	6.48	42.56	0.6600	0.9041
0.2833	16.998	6.48	42.56	0.6600	0.9041
0.3000	18.000	6.49	42.57	0.6500	0.8904
0.3166	18.996	6.49	42.57	0.6500	0.8904
0.3333	19.998	6.50	42.58	0.6400	0.8767
0.4167	25.002	6.52	42.60	0.6200	0.8493
0.5000	30.000	6.54	42.62	0.6000	0.8219
0.5833	34.998	6.56	42.64	0.5800	0.7945
0.6667	40.002	6.57	42.65	0.5700	0.7808
0.7500	45.000	6.58	42.66	0.5600	0.7671
0.8333	49.998	6.60	42.68	0.5400	0.7397
0.9167	55.002	6.61	42.69	0.5300	0.7260
1.0000	60.000	6.63	42.71	0.5100	0.6986
1.0833	64.998	6.64	42.72	0.5000	0.6849
1.1667	70.002	6.65	42.73	0.4900	0.6712
1.2500	75.000	6.66	42.74	0.4800	0.6575
1.3330	79.980	6.67	42.75	0.4700	0.6438
1.4166	84.996	6.69	42.77	0.4500	0.6164
1.5000	90.000	6.70	42.78	0.4400	0.6027
1.5800	94.800	6.71	42.79	0.4300	0.5890
1.6667	100.002	6.72	42.80	0.4200	0.5753
1.7500	105.000	6.73	42.81	0.4100	0.5616
1.8333	109.998	6.74	42.82	0.4000	0.5479
1.9167	115.002	6.75	42.83	0.3900	0.5342
2.0000	120.000	6.76	42.84	0.3800	0.5205
2.5000	150.000	6.81	42.89	0.3300	0.4521
3.0000	180.000	6.85	42.93	0.2900	0.3973
3.5000	210.000	6.89	42.97	0.2500	0.3425
4.0000	240.000	6.92	43.00	0.2200	0.3014
4.5000	270.000	6.95	43.03	0.1900	0.2603
5.0000	300.000	6.97	43.05	0.1700	0.2329
5.5000	330.000	6.99	43.07	0.1500	0.2055
6.0000	360.000	7.00	43.08	0.1400	0.1918
6.5000	390.000	7.02	43.10	0.1200	0.1644
7.0000	420.000	7.03	43.11	0.1100	0.1507
7.5000	450.000	7.04	43.12	0.1000	0.1370
8.0000	480.000	7.05	43.13	0.0900	0.1233
8.5000	510.000	7.06	43.14	0.0800	0.1096
9.0000	540.000	7.07	43.15	0.0700	0.0959
9.5000	570.000	7.08	43.16	0.0600	0.0822

SLUG TEST DATA - WELL MR-1SS

Performed November 21, 1994

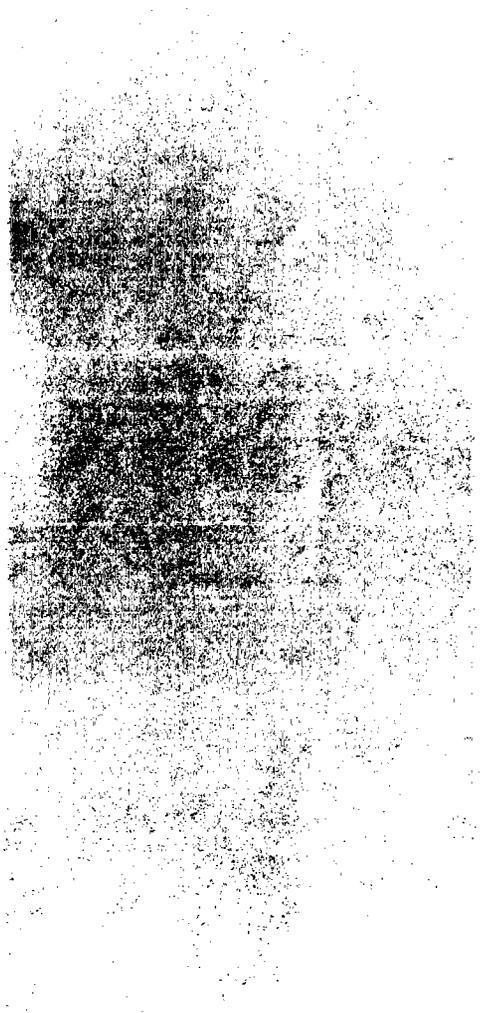
Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0666	3.996	2.63	41.52	0.4100	1.0000
0.0833	4.998	2.76	41.65	0.2800	0.6829
0.1000	6.000	2.84	41.73	0.2000	0.4878
0.1500	9.000	2.86	41.75	0.1800	0.4390
0.1666	9.996	2.89	41.78	0.1500	0.3659
0.1833	10.998	2.91	41.80	0.1300	0.3171
0.2000	12.000	2.91	41.80	0.1300	0.3171
0.2166	12.996	2.92	41.81	0.1200	0.2927
0.2333	13.998	2.92	41.81	0.1200	0.2927
0.2500	15.000	2.93	41.82	0.1100	0.2683
0.2666	15.996	2.93	41.82	0.1100	0.2683
0.2833	16.998	2.93	41.82	0.1100	0.2683
0.3000	18.000	2.94	41.83	0.1000	0.2439
0.3166	18.996	2.94	41.83	0.1000	0.2439
0.3333	19.998	2.95	41.84	0.0900	0.2195
0.4167	25.002	2.97	41.86	0.0700	0.1707
0.5000	30.000	2.98	41.87	0.0600	0.1463
0.5833	34.998	2.99	41.88	0.0500	0.1219
0.6667	40.002	3.00	41.89	0.0400	0.0976
0.7500	45.000	3.01	41.90	0.0300	0.0732
0.8333	49.998	3.01	41.90	0.0300	0.0732
0.9167	55.002	3.02	41.91	0.0200	0.0488
1.0000	60.000	3.02	41.91	0.0200	0.0488
1.0833	64.998	3.02	41.91	0.0200	0.0488
1.1667	70.002	3.02	41.91	0.0200	0.0488
1.2500	75.000	3.02	41.91	0.0200	0.0488
1.3330	79.980	3.02	41.91	0.0200	0.0488
1.4166	84.996	3.03	41.92	0.0100	0.0244
1.5000	90.000	3.03	41.92	0.0100	0.0244
1.5800	94.800	3.03	41.92	0.0100	0.0244
1.6667	100.002	3.03	41.92	0.0100	0.0244
1.7500	105.000	3.03	41.92	0.0100	0.0244
1.8333	109.998	3.03	41.92	0.0100	0.0244
1.9167	115.002	3.03	41.92	0.0100	0.0244
2.0000	120.000	3.03	41.92	0.0100	0.0244

SLUG TEST DATA - WELL MR-2SS

Performed November 21, 1994

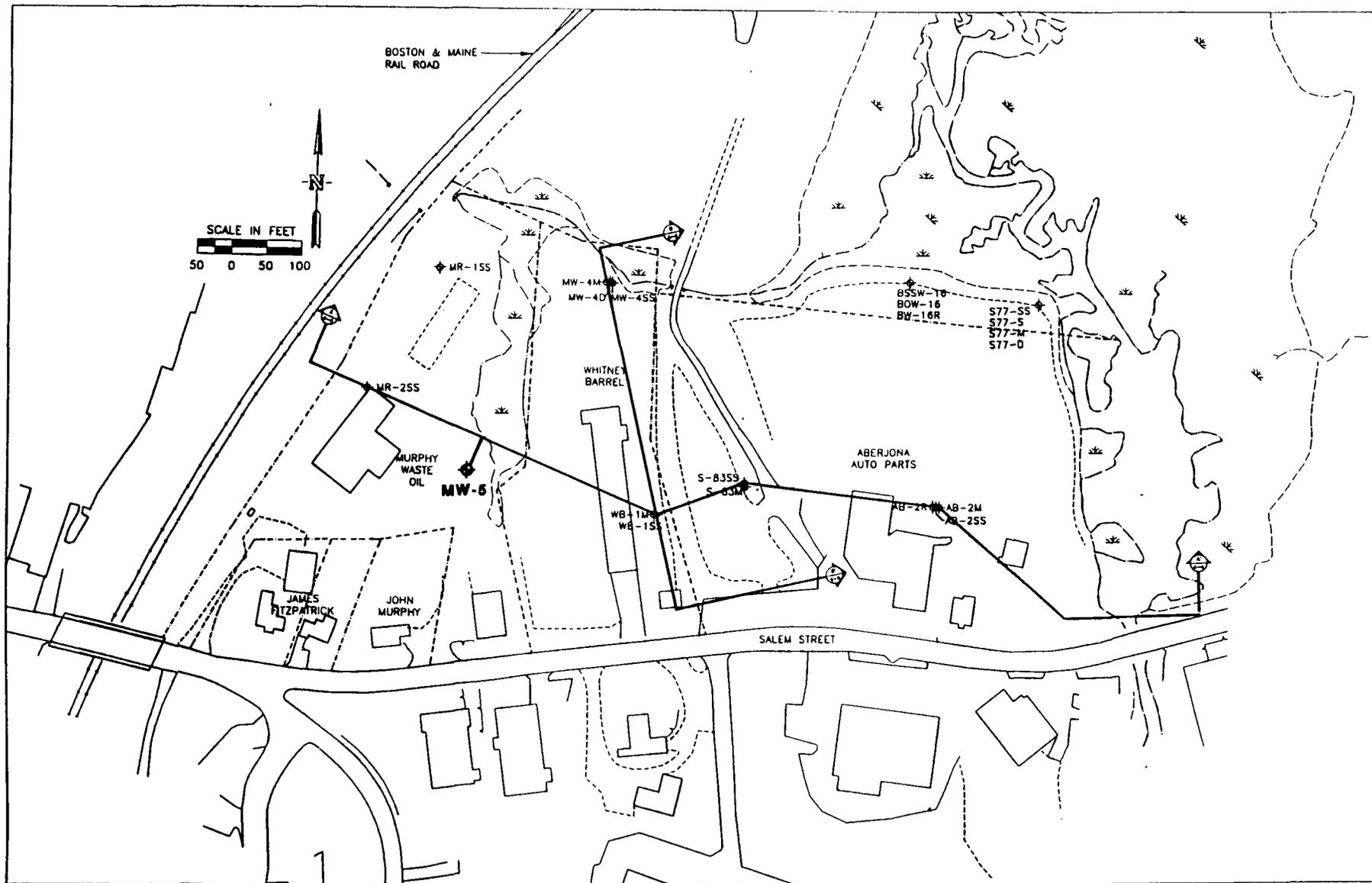
Time (min)	Time (sec)	Value (feet)	Elevation (feet)	Change (h)	Head Ratio (h/h ₀)
0.0099	0.594	2.47	43.22	0.3400	1.0000
0.0133	0.798	2.56	43.31	0.2500	0.7353
0.0266	1.596	2.60	43.35	0.2100	0.6177
0.0666	3.996	2.63	43.38	0.1800	0.5294
0.0833	4.998	2.70	43.45	0.1100	0.3235
0.1000	6.000	2.73	43.48	0.0800	0.2353
0.1166	6.996	2.74	43.49	0.0700	0.2059
0.1333	7.998	2.75	43.50	0.0600	0.1765
0.1500	9.000	2.75	43.50	0.0600	0.1765
0.1666	9.996	2.76	43.51	0.0500	0.1471
0.1833	10.998	2.76	43.51	0.0500	0.1471
0.2000	12.000	2.76	43.51	0.0500	0.1471
0.2166	12.996	2.77	43.52	0.0400	0.1176
0.2333	13.998	2.77	43.52	0.0400	0.1176
0.2500	15.000	2.77	43.52	0.0400	0.1176
0.2666	15.996	2.77	43.52	0.0400	0.1176
0.2833	16.998	2.77	43.52	0.0400	0.1176
0.3000	18.000	2.78	43.53	0.0300	0.0882
0.3166	18.996	2.78	43.53	0.0300	0.0882
0.3333	19.998	2.78	43.53	0.0300	0.0882
0.4167	25.002	2.78	43.53	0.0300	0.0882
0.5000	30.000	2.79	43.54	0.0200	0.0588
0.5833	34.998	2.79	43.54	0.0200	0.0588
0.6667	40.002	2.79	43.54	0.0200	0.0588
0.7500	45.000	2.79	43.54	0.0200	0.0588
0.8333	49.998	2.79	43.54	0.0200	0.0588
0.9167	55.002	2.79	43.54	0.0200	0.0588
1.0000	60.000	2.79	43.54	0.0200	0.0588
1.0833	64.998	2.79	43.54	0.0200	0.0588
1.1667	70.002	2.79	43.54	0.0200	0.0588
1.2500	75.000	2.79	43.54	0.0200	0.0588
1.3330	79.980	2.79	43.54	0.0200	0.0588
1.4166	84.996	2.79	43.54	0.0200	0.0588
1.5000	90.000	2.79	43.54	0.0200	0.0588
1.5800	94.800	2.79	43.54	0.0200	0.0588
1.6667	100.002	2.79	43.54	0.0200	0.0588
1.7500	105.000	2.80	43.55	0.0100	0.0294
1.8333	109.998	2.80	43.55	0.0100	0.0294
1.9167	115.002	2.80	43.55	0.0100	0.0294
2.0000	120.000	2.80	43.55	0.0100	0.0294

APP F



NOTE:

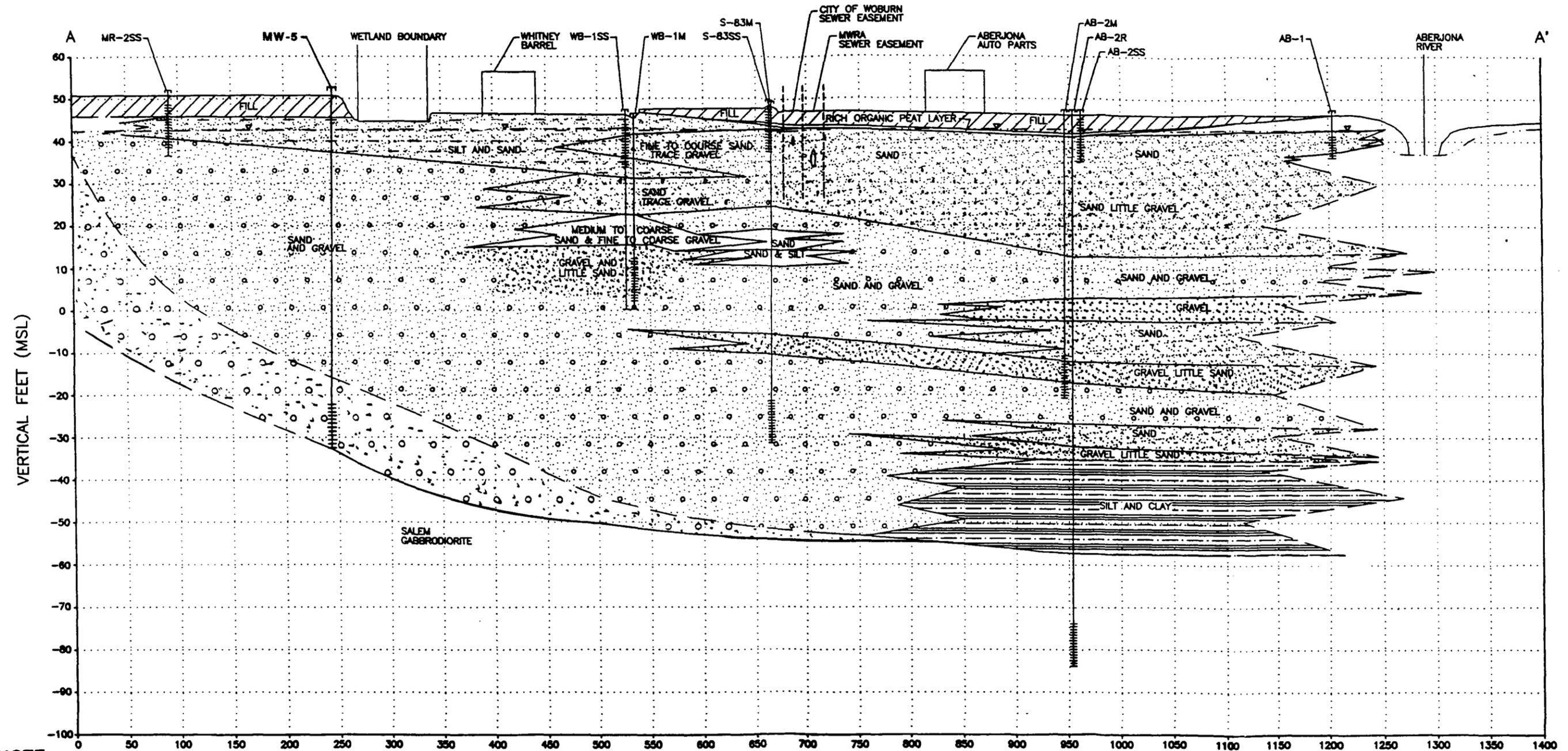
MODIFIED TO SHOW MONITORING WELL
 MW-6 WHICH WAS INSTALLED BY CLEAN
 HARBORS ENVIRONMENTAL SERVICES, INC.
 ON OCTOBER 14 THROUGH 18, 1994.



06815003

CROSS-SECTION LOCATIONS

FIGURE
 4-3



NOTE:
 MODIFIED TO SHOW SUBSURFACE
 DATA FROM MONITORING WELL MW-5
 WHICH WAS INSTALLED BY CLEAN
 HARBORS ENVIRONMENTAL SERVICES, INC.
 ON OCTOBER 14 THROUGH 18, 1994.

HORIZONTAL SCALE: 1"=100'
 VERTICAL EXAGGERATION x4

NO.	DATE	BY	DESCRIPTION

**BEATRICE
 CENTRAL AREA RIFs
 3-0881**

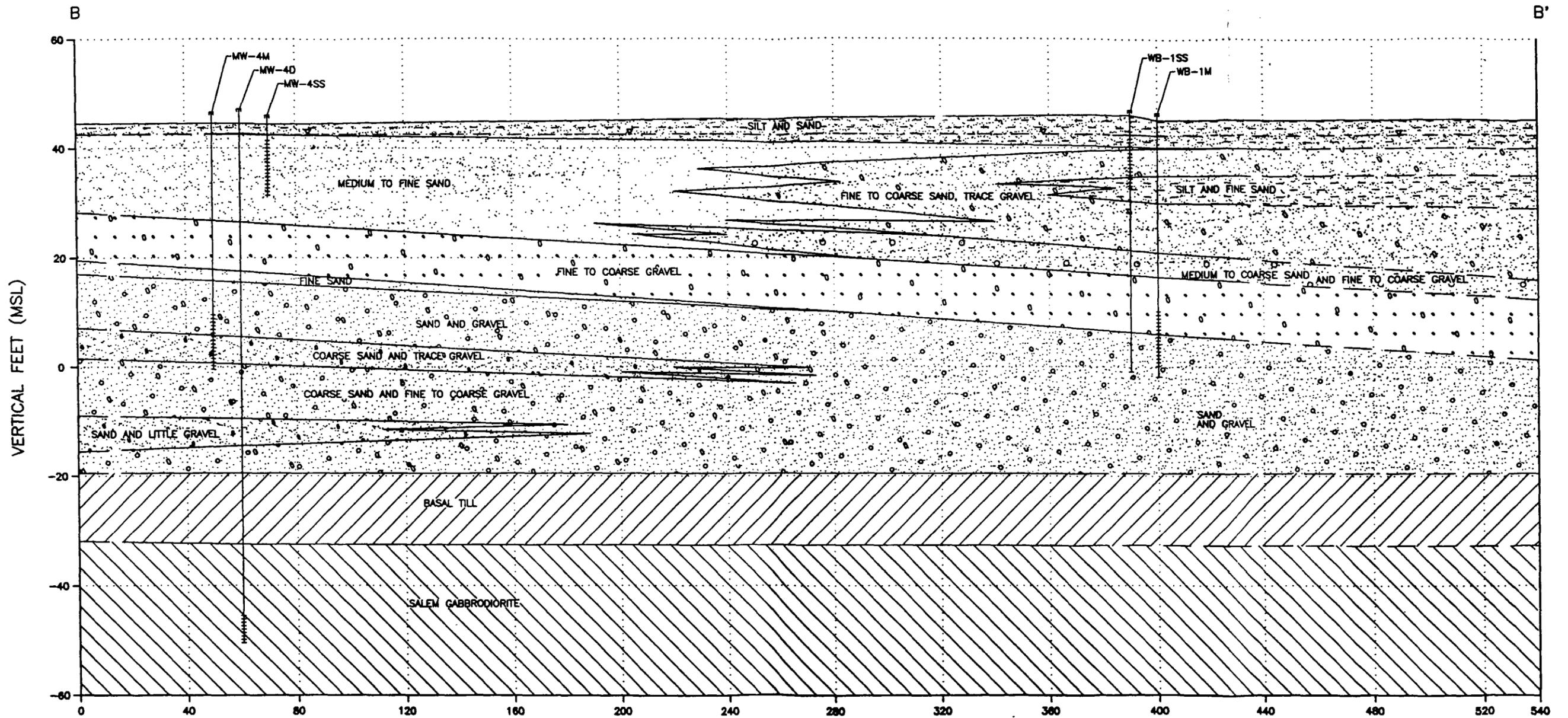
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**CROSS-SECTION A-A'
 SOUTHWEST PROPERTIES
 WELLS G & H SUPERFUND SITE
 WOBURN, MASSACHUSETTS**

CURRENT DATE: 1/21/94
 CSD FILE: 0681X001

RELIEC
 REMEDIATION
 TECHNOLOGIES INC.

4-4 10



HORIZONTAL SCALE: 1" = 40'
 VERTICAL EXAGGERATION x2

NO	DATE	BY	REVISION	GRID	DATE	APP'D	DATE
6							
5							
4							
3							
2							
1							
0							

**BEATRICE
 CENTRAL AREA RIFS
 3-0681**

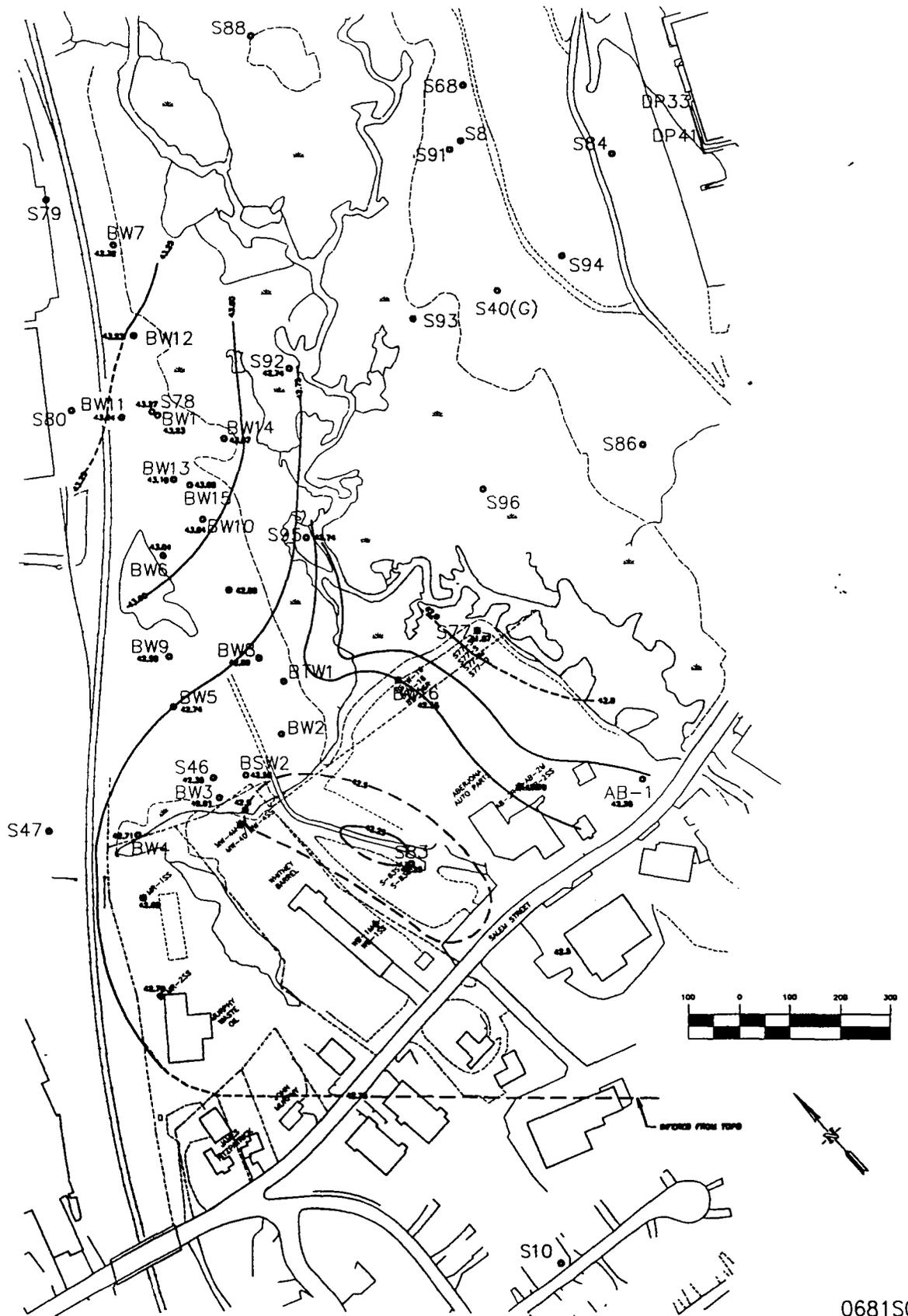
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**CROSS-SECTION B-B'
 SOUTHWEST PROPERTIES
 WELLS G & H SUPERFUND SITE
 WOBURN, MASSACHUSETTS**

CURRENT DATE: 1/21/94
 CAD FILE: 0681X001

REI/EC
 INVESTIGATION
 TECHNOLOGIES INC.

4-5 10



GROUNDWATER CONTOURS
SEPTEMBER 7, 1993

0681S003
FIGURE
4-7

