REMEDIAL ACTION REPORT

Allied Building Supplies
101 West Elizabeth Avenue
Linden, Union County, New Jersey

UST #0129486
NJDEP Case # 93-06-24-1425

February 27, 1996

Prepared for:
SELRITE Millwork Corp.
P.O. Box 387
Union, NJ 07083

BRINKERHOFF ENVIRONMENTAL SERVICES, INC.
2430 HIGHWAY 34
BUILDING A, FIRST FLOOR
MANASQUAN, NEW JERSEY 08736
Tel: (908)223-2225 Fax: (908) 223-3666

BES Job # 94193A

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1.0 TECHNICAL OVERVIEW

The Allied Building Supplies (Allied) site is located at 101 West Elizabeth Avenue in the City of Linden, Union County, New Jersey (see Figure 1). A Remedial Action Workplan (RAW) was submitted by Vectre Corporation for the Allied site in May of 1994. The RAW proposed natural remediation/attenuation as the remedial alternative for the site.

In January of 1995, Brinkerhoff Environmental Services, Inc. (BES) was retained by SELRITE Millwork Corporation to conduct a site investigation for the Allied site. The remedial investigation was conducted to provide supportive data to the May 1994 RAW, and included the installation of two (2) ground water monitoring wells (MW-5 & MW-6), and collection and analysis of ground water samples. Figure 2 is a site map depicting well locations relative to property boundaries and structures.

Following the investigation, BES prepared a Remedial Action Workplan Addendum (RAWA) dated February 23, 1995, summarizing well installation, ground water sampling and results. Elevated levels of lead were detected in Wells MW-1, MW-5, and MW-6, and elevated levels of benzene and xylenes were detected in Well MW-1, during the January 6, 1995 ground water sampling event. Hydrogeological data collected during the investigation indicated a ground water mound was present in the area of the former gasoline underground storage tank (UST) excavation area surrounding Well MW-5 (see Figure 3).

The following Remedial Action Report (RAR) addresses outstanding issues regarding the Allied investigation, including recommendations for Case Closure through natural attenuation and designation of a Classification Exception Area (CEA). Activities conducted as part of this RAR are discussed below.

Previous soil sampling and analysis indicated elevated levels of xylenes remained in the soil surrounding the former gasoline UST excavation. BES supervised excavation of soil in the area of the elevated xylene samples, collected postexcavation soil samples, and disposed of contaminated soil removed from the excavation.

Four (4) on-site ground water monitoring wells were resampled using the "Low Flow" sampling methodology to reduce turbidity and sediment within the samples. A Ground water contour map was prepared for the sampling event. To assess aquifer characteristics necessary for calculating

contaminant transportation and degradation rates, rising head slug tests were conducted on Wells MW-2 and MW-6.

Activities associated with this RAR were conducted in accordance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E. Sampling was performed in accordance with May 1992 NJDEP *Field Sampling Procedures Manual.* Cleanup Standards were based on the Soil Cleanup Criteria, revised on February 3, 1994 and Ground Water Quality Standards, N.J.A.C. 7:9-6.

2.0 SOIL REMEDIATION

Since previous soil sampling results indicated elevated levels of xylenes remained in the soil along the southern perimeter of the former gasoline UST excavation, BES proposed to excavate and dispose of additional soil in this area. Previous soil sampling results are summarized in Table 1, below, and depicted on Figure 4.

Table 1
Previous Soil Sampling Results
(Results in ppm)

Sample #	Xylenes	*NJDEP
105-T1-01 [1]	**47**	10
105-T1-D [1]	**194**	10
105-T1-05 [1]	**48**	10
105MW1-11 [2]	**131**	10

*NJDEP - NJDEP Impact to Ground Water Soil Cleanup Criteria; [1]Samples collected by Sailer Environmental in July 1993; [2]Samples collected by American Resources Consultants, Inc. and reported in September 1993.

On January 24, 1996, under the supervision of BES, Disposal Systems Inc. excavated additional soil in the area of the former gasoline UST and as depicted in Figure 4. Approximately 15 tons of soil were removed from the area, and disposed of through Soil Remediation of Philadelphia. A soil disposal manifest is included in Exhibit I of this report.

Soil types encountered during the excavation included a brown to red-brown sandy silt loam and gravel fill material (within the former excavation area) and a red silty clay loam native soil (outside the former excavation area). At a depth of 10 feet below grade, soil lithology changed from a red silty clay loam to a fine sandy loam. Soil was excavated to a depth of 12.5 feet below grade. Samples were collected at 10.5 feet below grade, where soil was moist to wet, but not saturated. Soils were completely saturated at 11 feet below grade. Ground water was encountered at 10.5 feet below grade during excavation.

Three (3) postexcavation soil samples (EXS-1, EXS-2 and EXS-3) were collected from the west and south sidewalls of the excavation, as depicted on Figure 4. Postexcavation soil sampling results are summarized in Table 2 below, and presented in Exhibit II of this report.

The excavated soil was field screened using an Hnu photoionization detector. Readings ranged from 150 to 200 meter units for the soil excavated. Headspace readings on split samples collected at the location of soil samples ranged from five (5) to 25-meter units (see Table 2).

Table 2
Post-Excavation Soil Sampling Results
January 24, 1996
(Results in ppm)

Sample #	Depth	Hnu Readings	Xylenes	*NJDEP
EXS-1	10.5'	5 - 10	<0.1	10
EXS-2	10.5'	< 5	ND	10
EXS-3	10.5'	20 - 25	<0.1	10

Hnu Readings are reported in meter units; ND - Denotes compound was not detected above the method detection limit; *NJDEP Impact to Ground Water Soil Cleanup Criteria.

Postexcavation soil sampling results indicate xylene concentrations are below NJDEP Impact to Ground Water Soil Cleanup Criteria.

3.0 GROUND WATER INVESTIGATION

3.1 Ground Water Monitoring, Sampling & Analysis

On December 21, 1995, four (4) of the six (6) on-site monitoring wells, MW-1, MW-2, MW-5 and MW-6, were sampled by BES personnel. Samples were collected within two (2) feet of the static water level after purging the wells a minimum of three (3) standing columns of water using the NJDEP approved "Low Flow" purging methodology for metals in ground water. Ground water samples were collected using dedicated bailers, then transferred to laboratory-cleansed glassware suitable for volatile organic compounds and lead. Monitoring well sampling data forms, detailing well gauging information, are included in Exhibit III of this report.

3.2 Ground Water Analytical Results

Samples MW-1, MW-2, MW-5 and MW-6, including a field and trip blank, were analyzed by a New Jersey certified laboratory, Accredited Laboratories, Inc. Samples were analyzed for volatile organic compounds with a forward library search (VO+10) calibrated for xylenes, methyl tertiary butyl-ether (MTBE), tertiary butyl-alcohol (TBA), and lead. Laboratory analytical results are summarized in Table 3 below, and presented in Exhibit IV of this report.

Table 3
Ground Water Sampling Results
Volatile Organic Compounds, MTBE, TBA and Lead
December 21, 1995
(Results in ppb)

Compound	MW-1	MW-2	MW-5	MW-6	*NJDEP Standard
Benzene	**120**	ND	ND	ND	1
Toluene	**4400**	ND	ND	ND	1000
Ethylbenzene	**3200**	ND	ND	ND	700
Xylenes	**6400**	ND	3.5	ND	~~40~~ (1000)
MTBE	ND	ND	ND	ND	~~700~~ (70)
TBA	ND	ND	ND	ND	500
Lead	**12.6**	ND	ND	ND	10

ND - Denotes compound was not detected above the method detection limit *NJDEP Class II-A Ground Water Quality Standards.

Benzene, toluene, ethylbenzene, xylenes (BTEX) and lead were detected in Sample MW-1, at concentrations above the NJDEP Class II-A Ground Water Quality Standards (GWQS). Xylenes were detected in Sample MW-5 at 3.5 parts per billion (ppb), below the NJDEP Class II-A GWQS of 40 ppb.

Historical ground water sampling results indicate a general decreasing trend in the level of petroleum-related volatile organic compounds in MW-1 since the initial sampling event conducted by Vectre, Inc. in December 1993. Table 4 is a summary of historical Ground Water Data.

Table 4
Historical Ground Water Sampling Results
Wells MW-1, MW-5 & MW-6
(Results in ppb)

	MW-1			MW-5			MW-6			*NJDEP
Compound	12/93	1/95	12/95	12/93	1/95	12/95	12/93	1/95	12/95	
Benzene	**350**	35	**120**	NI	ND	ND	NI	ND	ND	1
Toluene	**7500**	79	**4400**	NI	ND	ND	NI	ND	ND	1000
Ethylbenzene	**1600**	60	**3200**	NI	ND	ND	NI	ND	ND	700
Xylenes	**8700**	267	**6400**	NI	ND	3.5	NI	ND	ND	~~40~~ (1000)
Lead	NA	46	12.6	NI	12	ND	NI	15	ND	10

NA - Denotes sample was not analyzed for compound; NI - Denotes well was not yet installed; ND - Denotes compound was not detected above the method detection limit; *NJDEP - NJDEP Class II-A Ground Water Quality Standards.

From January of 1995 to December of 1995, lead concentrations have decreased from 46 ppb to 12.6 ppb in Well MW-1, and from 12 ppb and 15 ppb to nondetect in Wells MW-5 and MW-6, respectively. The decrease in lead concentrations is most likely due to implementation of the "Low Flow" sampling methodology for metals in ground water. The nondetectable levels reported

in MW-5 and MW-6, after using the low flow purging method, indicated that the lead previously detected was likely the result of suspended solids and not impacted ground water.

Previous sampling for volatile organic compounds and lead reported nondetectable levels in Wells MW-2, MW-3, and MW-4.

The reason for the increase in sampling results from January 1995 and December 1995 may be the result of the use of the slow purge sampling method, which would cause less volatilization of organic compounds during purging and sample collection.

3.3 Well Search

A well search was conducted by Vectre Corporation as part of the May 1994 RAW. The search included all domestic, industrial, potable and monitoring wells within a one (1) mile radius of Allied. The search identified three (3) domestic wells, seven (7) industrial wells, one (1) potable well, six (6) piezometers, one (1) recovery well and 93 monitoring wells within one (1) mile of the site. The depth of the domestic wells and potable well are greater than 100 feet and the wells do not draw water from the shallow water table aquifer. A canvass of the area revealed no wells located within 500 feet of the site. Basements were not identified immediately downgradient of the site.

3.4 Aquifer Characteristics & Classification Exception Area Application

On December 21, 1995, prior to well purging and sampling, the six (6) on-site ground water monitoring wells were gauged. Monitoring well gauging data is presented in Table 4, below.

Table 5
Monitoring Well Gauging Data
December 21, 1995
(Results in feet)

Monitoring Well	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
Headspace Reading	60	0	0	0	0	0
Casing Elevation	29.23	30.29	27.98	28.19	29.71	30.60
Well Depth	12.61	19.55	14.45	19.45	15.15	17.09
Depth to Screen	2.98	N/A	N/A	N/A	N/A	7.52
Depth to Ground Water	9.59	10.72	7.93	7.73	2.05	11.89
Product Thickness	0.00	0.00	0.00	0.00	0.00	0.00
Ground Water Elevation	19.64	19.57	20.05	20.46	27.66	18.71

N/A - Data not available.

Depth to ground water ranged from 2.05 feet in Well MW-5 to 11.89 feet in Well MW-6 during the December 21, 1995 sampling event. Ground water flow is toward the north to north-northeast, as depicted on Figure 5 - Ground Water Contour Map. This flow direction represents a

increased precipitation during the past 60 days. The ground water flow direction in January 1995 was toward the northeast. A small anomaly in flow direction is present surrounding Well MW-5, located within the former gasoline UST excavation, and may be due to mounded water within the former tank field area.

3.4.1 Hydraulic Conductivity

To evaluate hydraulic conductivity, BES field personnel conducted aquifer "slug" testing on Wells MW-2 and MW-6. A volume of water was removed from each well using a dedicated stainless steel bailer while monitoring changes in static water level over time using a Hermit Data Logger. A quantitative hydrogeologic assessment of the data was performed using the AQTESOLV ground water modeling program. The slug test data was analyzed using the Bouwer and Rice method for unconfined aquifers. Hydraulic conductivity and ground water and pollutant transport rates were calculated using the slug test data and AQTESOLV modeling calculations. Slug test data is included in Exhibit V of this report.

3.4.2 Ground Water Velocity

The rate of ground water movement in the area of concern was determined using the ground water velocity equation derived from a combination of Darcy's law and the velocity equation of hydraulics. Ground water velocity was then expressed as:

$$Vs = K \times i/ne$$

Where:

Vs = seepage velocity
K = hydraulic conductivity (calculated from slug test data)
i = hydraulic gradient (calculated from ground water flow data)
ne = effective porosity (assumed at 20%)
x = multiplication symbol

Ground water velocity in the area of concern was then calculated:

$$Vs = 0.0002592 \text{ ft/min} \times 0.01 \text{ ft/ft} / 0.20 \qquad 1.296 \times 10^{-4} \text{ cm/sec}$$
$$Vs = 0.000013 \text{ ft/min}$$

Assuming a porosity of 20%, and using a calculated hydraulic gradient of 0.01 feet per foot obtained from the most recent ground water contour map, ground water velocity is determined to be 6.83 feet per year.

3.4.3 Pollutant Transport Rate

Applying a pollutant transport rate calculation to the ground water velocity rate, calculated above, the following retardation factor is derived:

$$Rd = 1 + (KOC \times foc \times pb/ne)$$

Where:

Rd = retardation factor
KOC = soil sorption coefficient (63 - standard benzene coefficient)
foc = fraction of organic carbon (assumed at 0.005)
pb = bulk density (assumed at 1.5 g/ml.)
ne = effective porosity (assumed at 20%)

The retardation factor is then calculated:

$$Rd = 1 + (63 \times 0.005 \times 1.5/0.20)$$
$$Rd = 3.36$$

The pollutant (benzene) transport rate is then calculated as follows:

$$Vpt = V/Rd$$
$$Vpt = 6.83 \text{ ft/yr.}/3.36$$

Using this formula, assuming a bulk density of 1.5 grams per milliliter, a fraction of organic carbon content of 0.5%, and a porosity of 20%, the benzene transport rate is calculated to be approximately 2.03 ft/yr. This slow contaminant transport rate explains why gasoline related volatile compounds have not been detected in Well MW-2, located down gradient of the former UST's.

Based on the benzene transport rate calculated above, an average benzene half-life of 200 days, and an initial benzene concentration of 350 ppb, dissolved benzene concentrations are expected to naturally degrade to 1.0 ppb within approximately 4.6 years and 9.3 feet downgradient of Well MW-1. A CEA designation is requested, using natural attenuation as the method of remediation, for a duration of five (5) years and 20 feet downgradient of Well MW-1, as depicted on Figure 6 - Classification Exception Area Designation Map.

4.0 CONCLUSIONS AND RECOMMENDATIONS

BES conducted a remedial investigation at Allied Building Supplies, located at 101 West Elizabeth Avenue in the City of Linden, Union County, New Jersey. The investigation included additional soil removal in the former gasoline UST excavation area, disposal of contaminated soil removed from the excavation, collection and analysis of postexcavation soil samples, and collection and analysis of ground water samples from Wells MW-1, MW-2, MW-5 and MW-6.

4.1 January 24, 1996 Postexcavation Soil Sampling

Postexcavation soil sampling results reported xylenes below Impact to Ground Water Soil Cleanup Criteria in the area of the former gasoline UST excavation area. Less than one-tenth (0.1) of one part per million (ppm) of xylenes were detected in two (2) of the three (3) soil samples (EXS-1 & EXS-3). Xylenes were not detected above the method detection limit in sample EXS-2. Therefore, No Further Action (NFA) is requested with regard to soils in the subject area.

4.2 December 21, 1995 Ground Water Sampling

Benzene, toluene, ethylbenzene, xylenes, and lead were detected in Well MW-1 at concentrations above the NJDEP Class II-A GWQS. Xylenes were detected in Well MW-5 at 3.5 ppb, below the NJDEP Class II-A GWQS of 40 ppb. Lead was not detected above the method detection limit in samples MW-2 and MW-6.

Historical ground water sampling results indicate a decreasing trend in BTEX compounds detected in Well MW-1. Lead concentrations have decreased from 46 ppb to 12.6 ppb in Well MW-1, and from 12 ppb and 15 ppb to nondetect in Wells MW-5 and MW-6, respectively, when the slow purge methodology is applied to sampling protocol. The decrease in lead using the slow purge methodology suggests that the elevated lead levels were the result of suspended solids and not impacted ground water. Lead levels have decreased in MW-1 to just over the GWQS for lead of 10 ppb (sample reported lead at 12.6 ppb).

4.3 Recommendations

BES recommends natural attenuation be considered as a mechanism for remediation and case closure at this site. Laboratory analytical data and site specific geologic and hydrogeologic conditions favor natural attenuation. Only one (1) well, MW-1, showed elevated levels of gasoline-related volatile organics. Abundant clay content in subsurface sediments, and the mounded water present within the former tank excavation, suggest a slow ground water flow rate at this site, which has been verified through evaluation of aquifer slug test data. The combination of a limited extent of impacted ground water, a slow migration rate, the presence of a low permeability soil type, the removal of the source, and the lack of receptors in the area suggest natural attenuation will be an effective option for this site.

Based on the benzene transport rate calculated above, an average benzene half-life of 200 days, and an initial benzene concentration of 350 ppb, dissolved benzene concentrations are expected to naturally degrade to 1.0 ppb within approximately 4.6 years and 9.3 feet downgradient of Well MW-1. A CEA designation is requested, using natural attenuation as the method of remediation, for a duration of five (5) years and 20 feet downgradient of Well MW-1, as depicted on Figure 6 - Classification Exception Area Designation Map.

Regarding the slightly elevated levels of lead detected in MW-1, BES is proposing that the CEA include the lead detected in this well. The level of lead present in MW-1 was just slightly over the GWQS for lead of 10 ppb (sample reported lead at 12.6 ppb). It is BES' opinion that the lead level in MW-1 should decrease further over time and that lead will not migrate beyond the proposed CEA boundary at a level over the GWQS.

A five (5) year CEA should allow for the variations in subsurface conditions, which affect the natural remediation process, and provide adequate time for natural remediation to occur. Completed CEA and Well Restriction Forms are attached in Exhibit VI.

A well search conducted by Vectre Corporation as part of the May 1994 RAW identified three (3) domestic wells, seven (7) industrial wells, one (1) potable well, six (6) piezometers, one (1) recovery well and 93 monitoring wells within a one (1) mile radius of the site. A canvass of the area did not reveal wells within 500 feet of the site. Basements were not identified within the immediate area of the site.

BES is proposing no additional sampling and analysis for the subject site. Based on the slow contaminant transport rate, lack of receptors in the area and lack of migration to date, BES is proposing implementation of the CEA for five (5) years. After five (5) years, the CEA can be removed with one (1) confirmation sample collected in the former excavation area.

This report was prepared and is respectfully submitted by:
Brinkerhoff Environmental Services, Inc.

2/27/96

Doug Harm, P.G. Date
Principal Consultant/Hydrogeologist
NJDEP Subsurface Evaluator No. 10556

2/27/96

William A. Melnicki Date
Environmental Scientist
NJDEP Subsurface Evaluator No. 14705

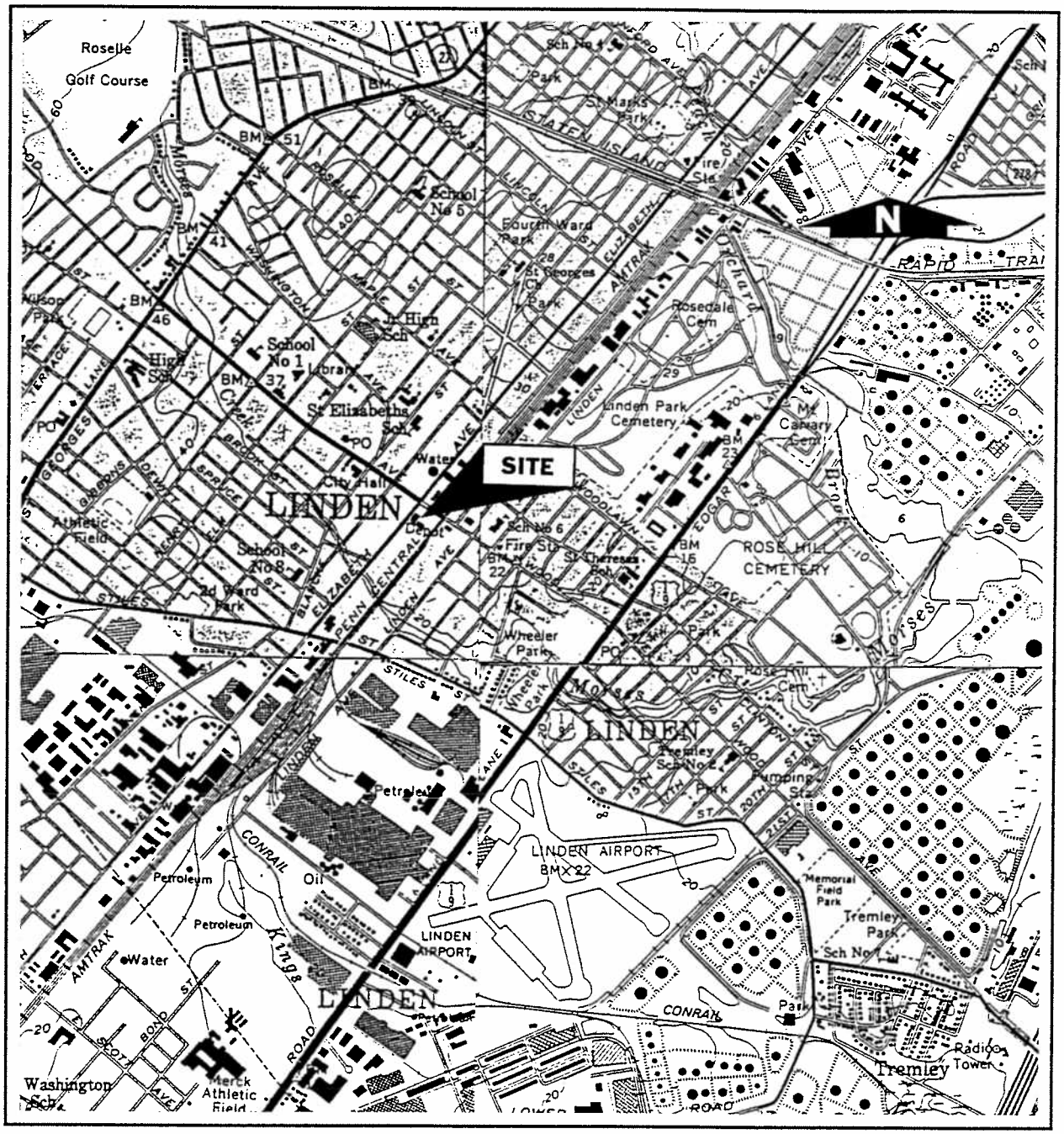

Figure 1 - **Site Location Map (U.S.G.S. Topo)**
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101 West Elizabeth Avenue
City of Linden, Union County, N.J.
Case ID # 93-06-24-1425, UST # 0129486

Scale: 1" = 2000'

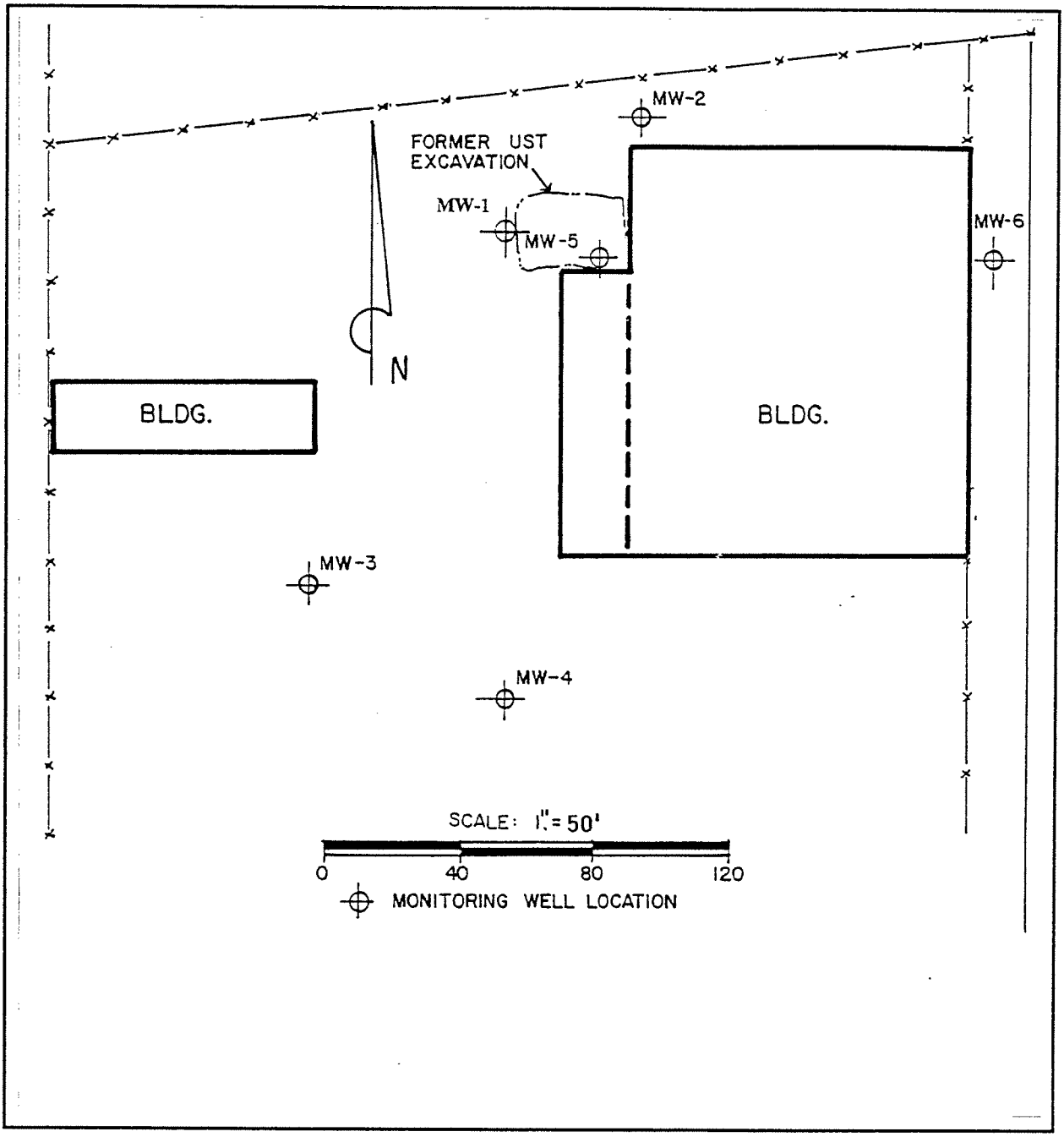

Figure 2 - **Site Map**
Allied Building Supplies
101 West Elizabeth Avenue
City of Linden, Union County, N.J.
Case ID # 93-06-24-1425, UST # 0129486

Scale: 1" = 50'

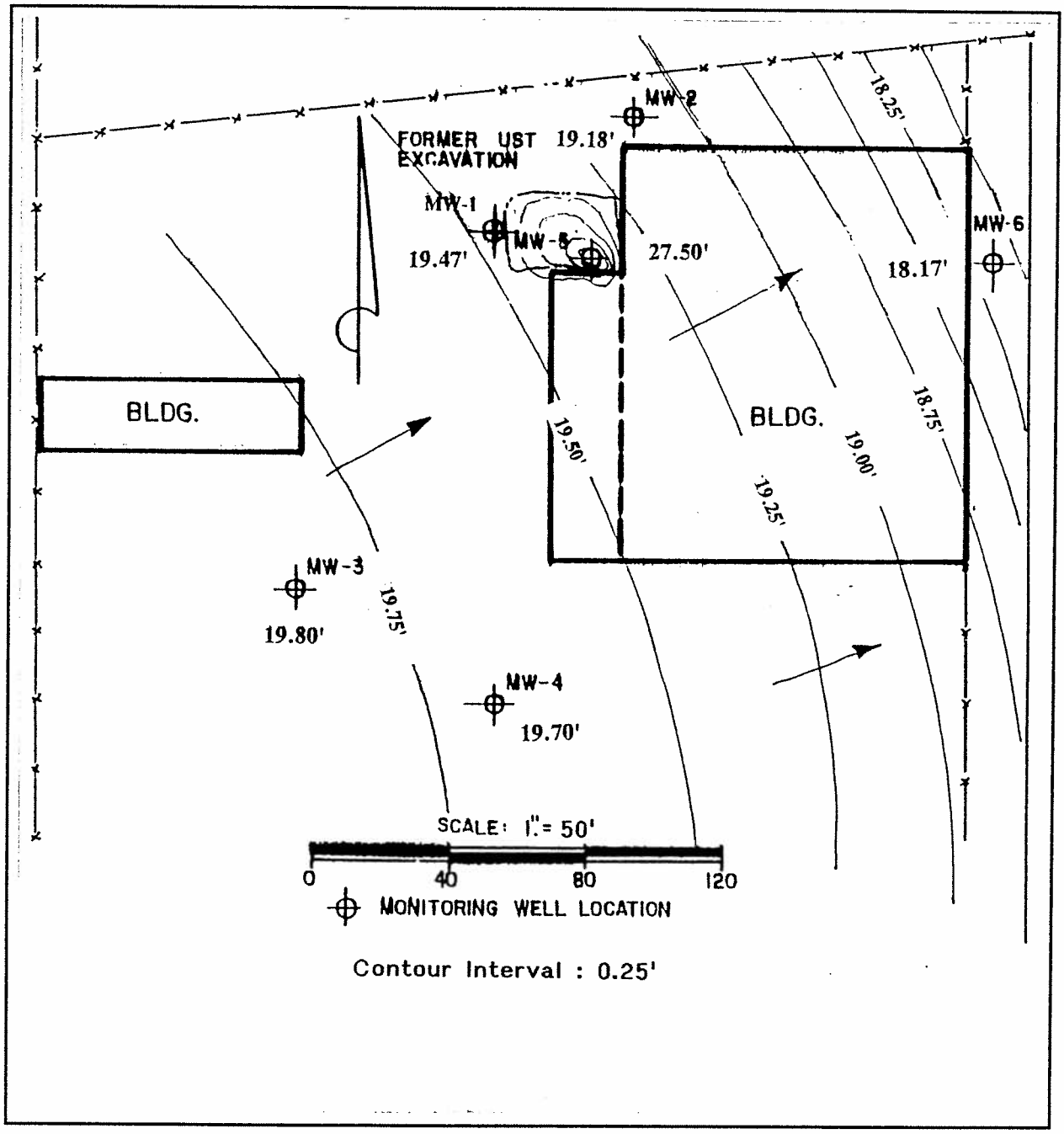

Figure 3 - **Ground Water Contour Map**
Allied Building Supplies
101 West Elizabeth Avenue
City of Linden, Union County, N.J.
Case ID # 93-06-24-1425, UST # 0129486
Data Collected January 16, 1995 **Scale: 1" = 50'**

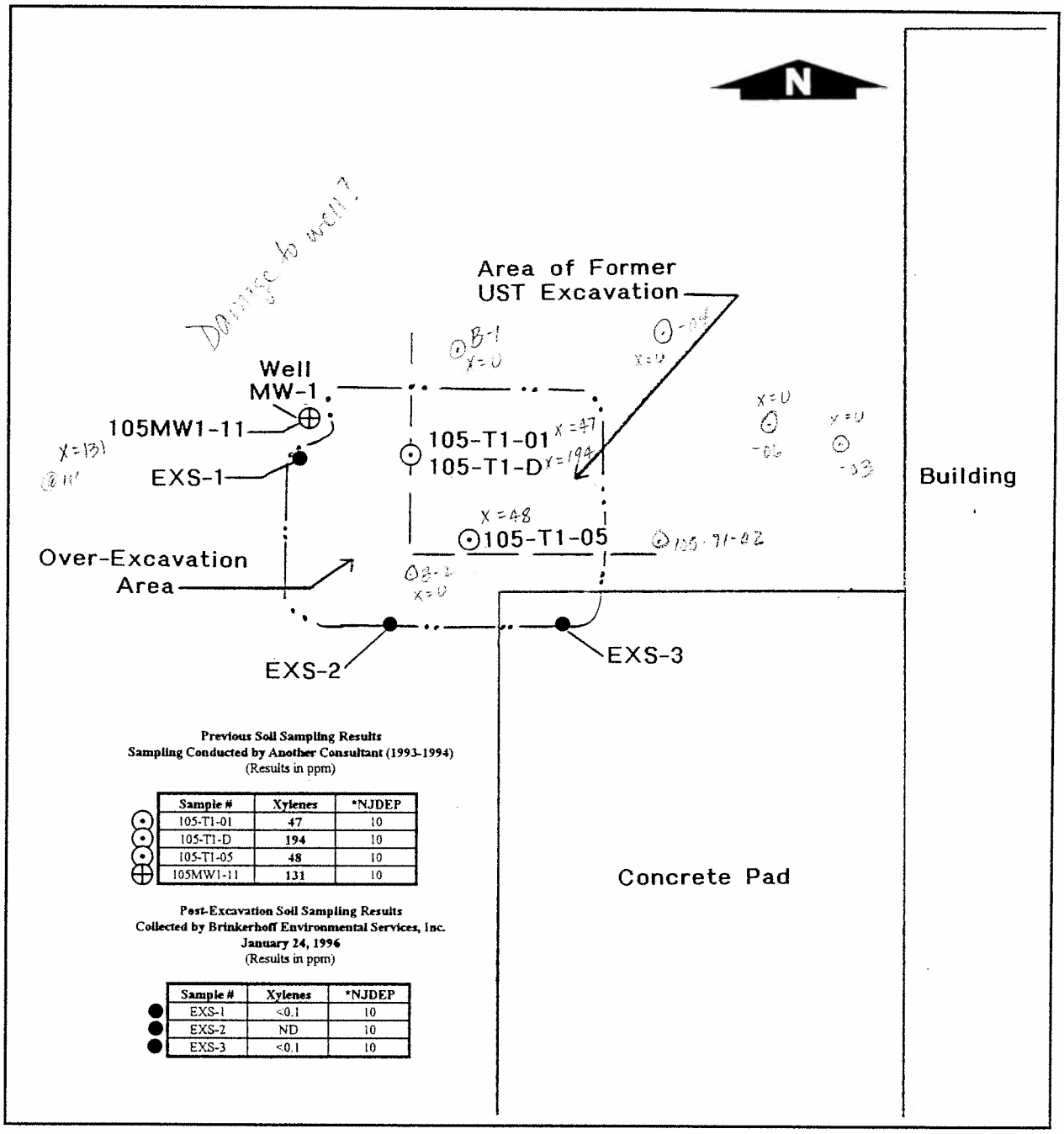

Figure 4 - Soil Sampling Map
Allied Building Supplies
101 West Elizabeth Avenue
City of Linden, Union County, N.J.
Case ID # 93-06-24-1425, UST # 0129486

Scale: 1" = 10'

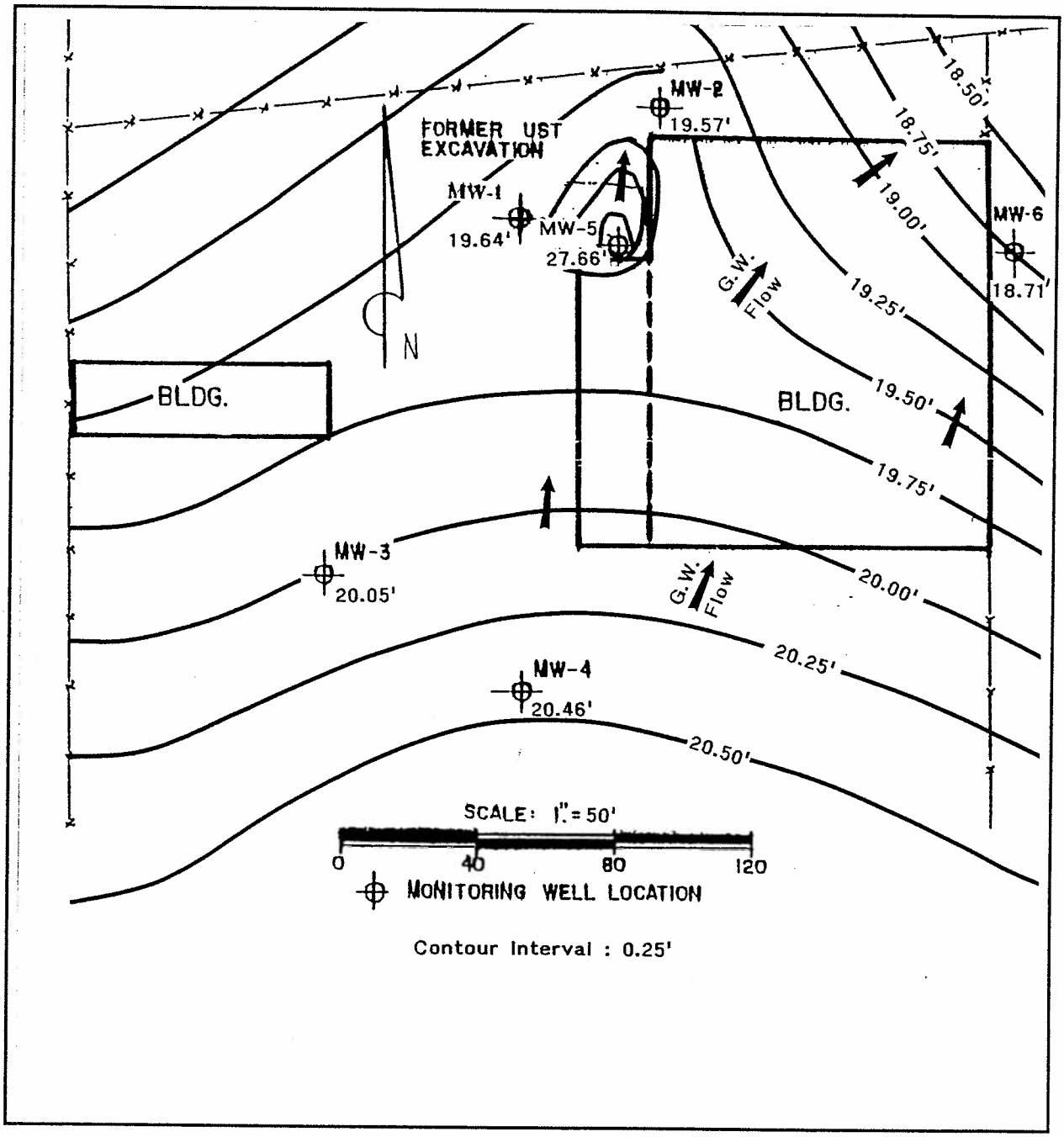

Figure 5 - **Ground Water Contour Map**
Allied Building Supplies
101 West Elizabeth Avenue
City of Linden, Union County, N.J.
Case ID # 93-06-24-1425, UST # 0129486
Data Collected December 21, 1995 **Scale: 1" = 50'**

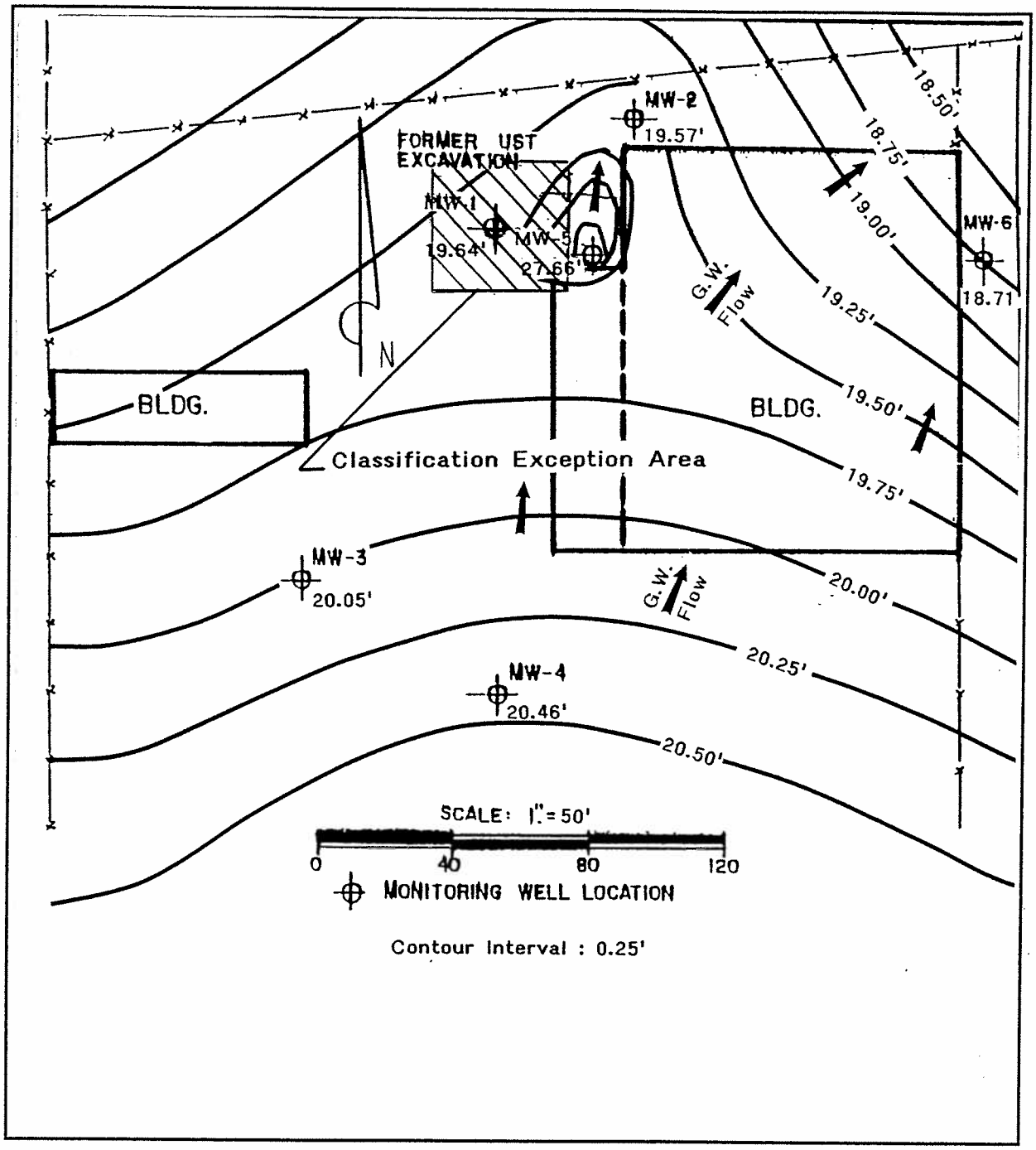

Figure 6 - **Classification Exception Area**
Allied Building Supplies
101 West Elizabeth Avenue
City of Linden, Union County, N.J.
Case ID # 93-06-24-1425, UST # 0129486
Scale 1" = 50'