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Description of the Remedy

The selected remedy addresses the source of contamination by remediation of contaminated soils as well as addressing remediation of ground water in both of the shallow saturated zone and the bedrock aquifer.

The major components of the selected remedy include:

- Onsite soil vacuum extraction (soil venting) of the volatile organic contamination, contained in a volume of approximately 47,500 yd^3 of contaminated soil;

- Treatment of vapor phase VOCs extracted from the source area in an onsite, above ground air treatment unit using activated carbon to adsorb the contaminants.

- Dewatering of the shallow saturated zone through a shallow well pumping system. Treatment of the ground water by pretreatment for metals/inorganics removal and either (1) air stripping or (2) hydrogen peroxide (H_2O_2) and ultraviolet (UV) irradiation for VOC treatment. Discharge of treated water to onsite wetlands.

- The installation of a series of extraction wells to intercept and contain the bedrock aquifer ground-water movement. Treatment of bedrock aquifer ground water by pretreatment for metals/inorganics removal and either (1) air stripping or (2) hydrogen peroxide (H_2O_2) and ultraviolet (UV) irradiation for VOC treatment. Discharge of treated water to onsite wetlands.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment

PART I

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

New Cumberland Army Depot's Former Landfill
Marsh Run Park
Fairview Township, Pennsylvania

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Marsh Run Park site in Fairview Township, Pennsylvania, chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Contingency Plan. This decision is based on and becomes part of the administrative record file for this site.

The Commonwealth of Pennsylvania concurs on the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present a very low level of risk to public health, welfare, or the environment.

(or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Lewis D. Walker Deputy Assistant Secretary of the Army (Environmental Safety and Occupational Health) OASA (I, L, and E)	Date
Francis P. Fair Regional Environmental Protection Manager Harrisburg Regional Office	Date

1. SITE NAME, LOCATION, AND DESCRIPTION

The New Cumberland Army Depot's (NCAD) former landfill, Marsh Run Park, is located in Fairview Township, York County, Pennsylvania. It is situated adjacent to and east of NCAD. The site is bounded to the south and southeast by Marsh Run Creek and Marsh Run Road and to the north and northeast by Conrail (formerly Penn Central) railroad tracks. The Susquehanna River is immediately north of the railroad tracks. The site location is shown in Figures 1-1 and 1-2.

The site is approximately 14 acres in size and is situated in a relatively flat area, which was occupied by swampy wetlands prior to landfilling. Approximately 4-5 acres of the site were formerly used as a landfill by the New Cumberland Army Depot (see Figure 1-3). The surrounding area is semirural. Single-family dwellings are located to the south and southeast of the site along Marsh Run Creek.

Currently, the site exists as a filled wetland. Fill placed at the site averages 3-4 ft above the prefill surface. The present surface of the landfill is relatively flat with slight grading to facilitate drainage. An NCAD access road (Ninth Street) borders the site to the west of Marsh Run Park. Marsh Run Creek, which flows in a general west-to-east direction, bounds the southwest of the site (inside Depot fence), passes beneath the Depot access road, and borders the landfill immediately to the south and east (Figure 1-2).

1.1 PHYSICAL CHARACTERISTICS OF STUDY AREA

The topography of Marsh Run Park is generally flat with topographic relief varying less than 10 ft across the site. The ground surface is covered with at least 6 in. of topsoil (silty loam) material brought in from an offsite location by Fairview Township. The topsoil material has promoted a good thick growth of fescue grass. Below the topsoil is a 1-2 ft thick cover of brown silty soils that were apparently excavated from the local area north of the site. Underlying the topsoil and cover

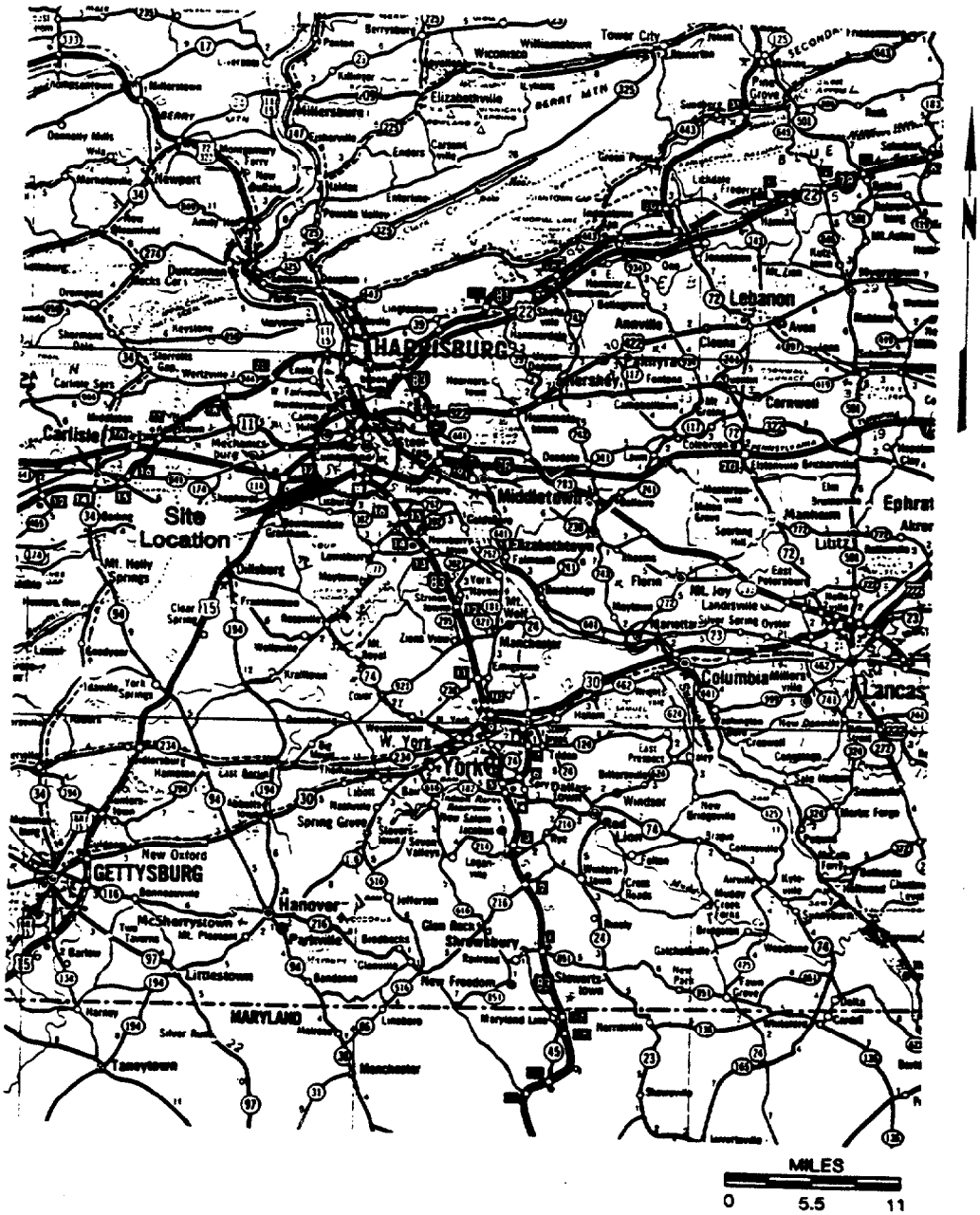
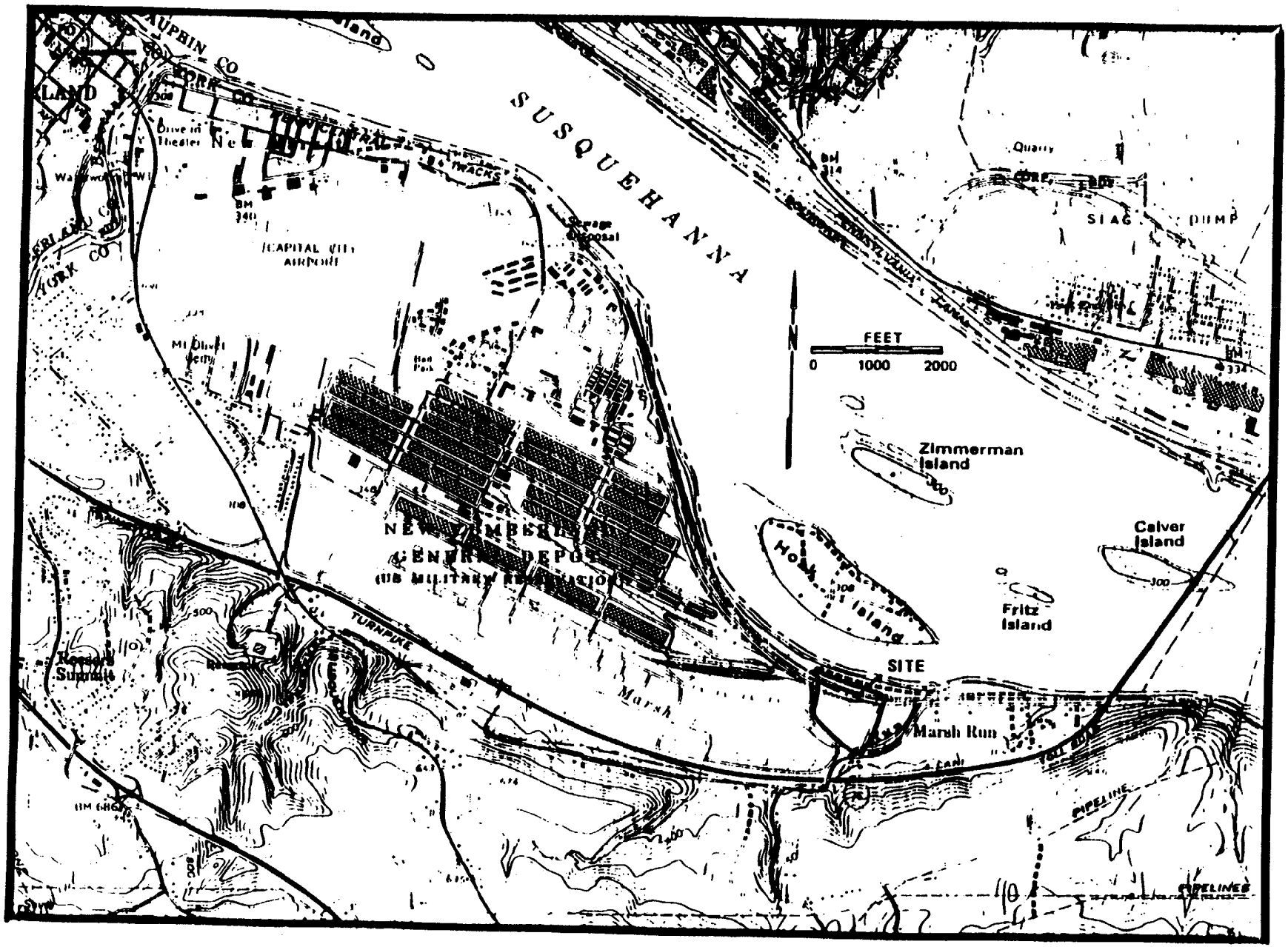


Figure 1-1. Vicinity map - Marsh Run Park site.


SUSQUEHANNA
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YORK CO
CAPITAL CITY AIRPORT
Drive in Theater
Quarry
SLAG DUMP
FEET
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Calver Island
Fritz Island
Hog Island
SITE
Marsh Run
TURNPIKE
Marsh
PIPELINE
PIPELINES

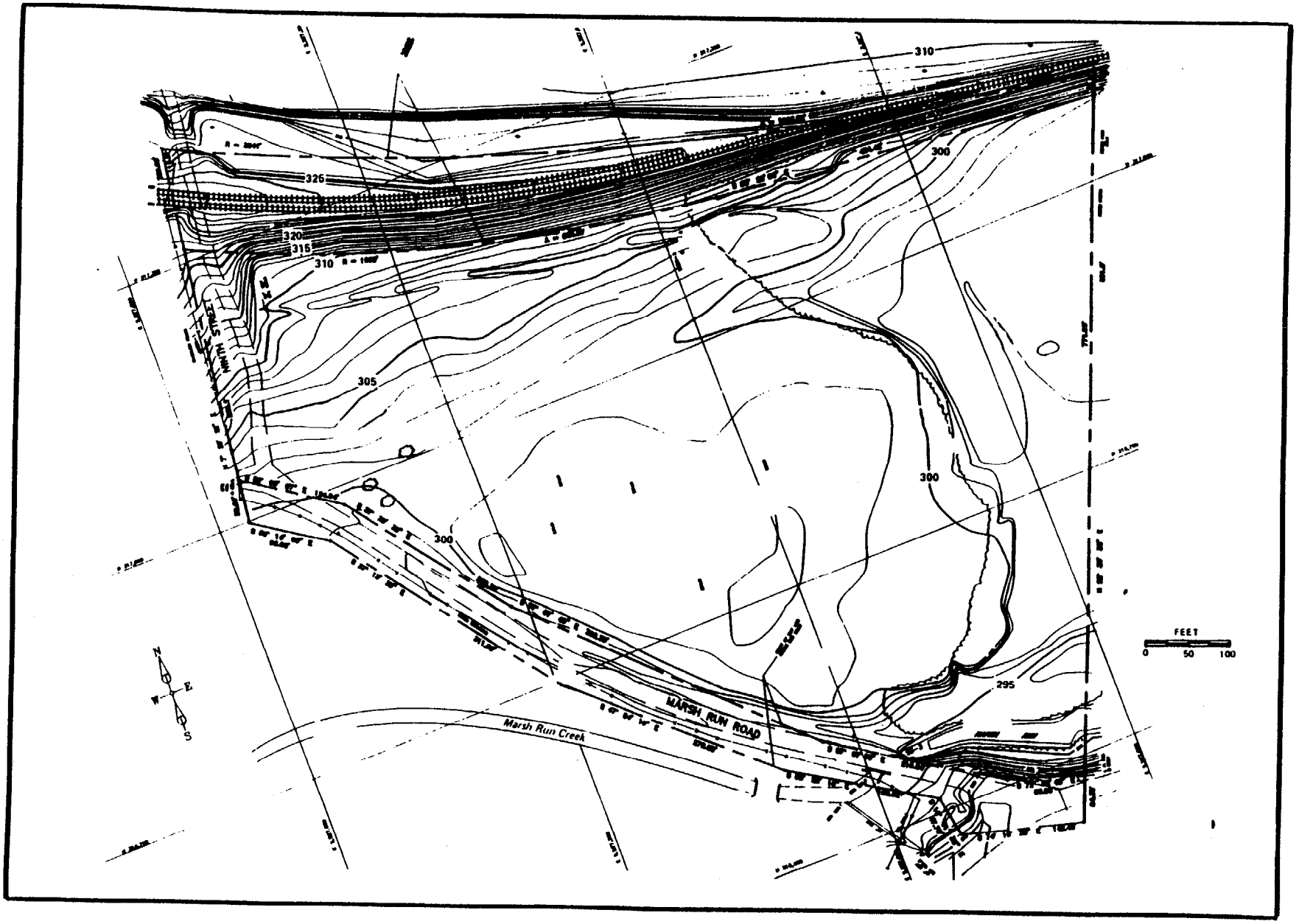

Figure 1-3. Existing site conditions - Marsh Run Park.

fill in the central, south-central portion of the site is 2-6 ft of "waste fill" material. The "waste fill" material appears to be contained within the Marsh Run Park property boundaries. Based on boring and visual observations, the "waste fill" material appears to be primarily domestic-type debris, construction debris, and industrial debris derived from NCAD (USACE Confirmation Study Report 1988). Based on indirect geophysical methods, approximately 23,000-24,000 yd^3 of waste material was estimated to be buried at the site. Subsequent refinement of the estimation of the extent of the waste fill area during the FS identified a total waste area volume of approximately 30,000 yd^3.

Outside of the "waste fill" proper, natural silt, clay, and sand up to 8 ft thick overly the Triassic shaley sandstone of the Gettysburg Formation. The Gettysburg Formation is typically a maroon silty or shaley fine sandstone. It forms the hills south of the site that rise abruptly several hundred feet in elevation.

The two distinct ground-water zones at the site are the shallow saturated zone (located in the fill and soils) and the underlying bedrock aquifer (Gettysburg Formation). Figure 1-4 is a schematic representation of subsurface conditions at the Marsh Run Park site in the vicinity of the "waste fill." In the vicinity of Marsh Run Park the saturated fill and soils are segregated from the bedrock aquifer by an apparently continuous clay layer (i.e., marsh and swamp sediments) 2 to 5 ft in thickness. Some local residents obtain their water from wells upgradient from the site installed in the Gettysburg Formation.

The movement of ground water within and between the two distinct ground-water zones comprises the overall ground-water flow system at the site. It should be noted that although the two ground-water zones are distinct, there is significant hydraulic communication between zones.

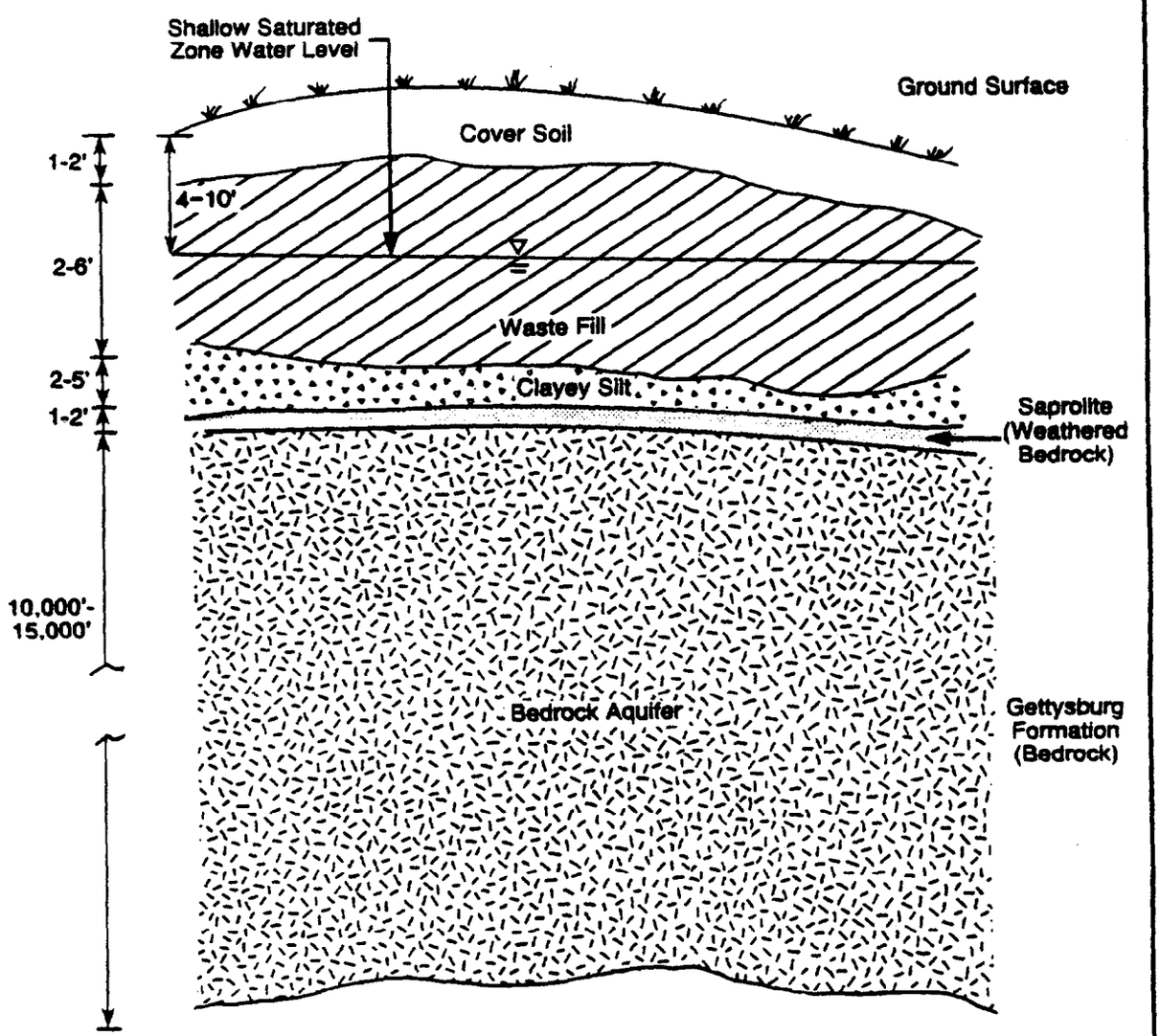

Figure 1-4. Schematic representation of subsurface conditions in the vicinity of the "waste fill" - Marsh Run Park.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Marsh Run Park site was formerly owned by NCAD, who used it as a landfill for disposal of installation-derived waste materials starting in the early 1900s. Landfilling of Depot-derived materials ceased in the late 1950s.

Ownership of the Marsh Run Park property was transferred in 1976 by the Army to the State Bureau of Outdoor Recreation, who sold the site to Fairview Township. Fairview Township brought in offsite topsoil cover, graded the property and used it as a recreational field. A 1979 NCAD installation assessment and a 1983 NCAD installation reassessment by the Army (CSL 1979, ESE 1983) identified Marsh Run Park as a potential candidate for an environmental investigation.

2.1 CONFIRMATION STUDY

A Confirmation Study (CS) was conducted by the U.S. Army Corps of Engineers, Omaha District, under the Department of Defense (DOD), Defense Environmental Restoration Program (DERP). The CS included a site reconnaissance and geophysical survey; installation and sampling of three ground water monitoring wells in the shallow saturated zone; soil sampling during well drilling; collection/analysis of surface water and sediment samples; test pit excavation and sampling; and ranking of the site using the DERP Hazard Ranking System (HRS) form. The results of the CS indicated the presence of ground-water and soil contamination at the site. The site use as a soccer field was discontinued in 1987 when the CS was initiated.

2.2 SURFACE SOIL SAMPLING PROGRAM

As a follow-up to the CS, 23 individual soil samples were collected from the landfill surface (down to 6 in.) by the U.S. Army Corps of Engineers and the EPA on 25 May and 22, 23 June 1988, respectively. These samples

were collected for the purpose of evaluating potential human health risk that may be associated with the surface soils on the field. The risk evaluation addressed such exposure pathways as dust inhalation, dermal contact, and ingestion of soils. Results of the June 1988 U.S. Army Corps of Engineers document entitled "Public Health Evaluation of Marsh Run Park" indicated that the surface soil at Marsh Run Park did not present increased risks or health hazards to the children who had been playing at the field.

2.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY

In August 1988, the US Army Corps of Engineers-Omaha District (USACE-OMAHA), initiated activities to conduct a Remedial Investigation/ Feasibility Study (RI/FS) under the DERP program at the Marsh Run Park site. USACE-OMAHA retained EA Engineering, Science, and Technology (Sparks, Maryland) to conduct the RI/FS under an indefinite delivery type contract delivery order.

2.3.1 Objectives

The objectives of the RI of the Marsh Run Park site were to:

1. Evaluate the presence and extent of hazardous waste and associated contamination both vertically and horizontally at the landfill.

2. Assess the potential for contaminant migration in the surrounding environs.

3. Identify public health and environmental risks of contaminants relative to regulatory standards.

4. Define future investigations and/or actions required at the site.

2.3.2 Field Activities/Data Collection

In October 1988, EA initiated RI field activities at the Marsh Run Park site. The RI employed a variety of investigative techniques in the performance of the field investigation. These techniques included geophysical surveying, soil borings/analysis monitoring well installation, monitoring well sampling, well point installation, and sampling, *in situ* hydraulic conductivity analysis by slug test method, household supply well sampling of residences immediately adjacent to Marsh Run Park, and surface water and sediment sampling of Marsh Run Creek.

The field investigation was conducted in two phases. The first phase was initiated by the geophysical investigation and followed by subsequent installation of five new monitoring wells to supplement three existing site wells installed during the 1987 Confirmation Study. In addition, stream surface water/sediment samples, and monitoring well soil and ground-water samples were collected and analyzed. The first phase was conducted between October 1988 and February 1989. Pursuant to the examination of the preliminary chemical analysis of ground water at the site and a review of previous investigations, a second phase of monitoring well installation and environmental sampling was conducted between July and August 1989.

2.3.3 Archeological/Historical Investigation

In October 1989, an archeological/historical investigation (Phase IA Cultural Resources Investigation) was conducted by MAAR Associates (Newark, Delaware) at the Marsh Run Park site. The purpose of the investigation was to evaluate the potential for prehistoric and/or historic cultural resources contained within the project area that would be affected by remedial action at the site.

This investigation, which consisted of extensive archaeological and historical background research, cartographic work, interviews with personnel familiar with the site, and a preliminary field reconnaissance,

resulted in the identification of a 7-acre parcel contained within the larger 13.86-acre parcel which appears to have been extensively utilized as a landfill. Three auger tests, excavated to a maximum depth of 3 ft, could not penetrate to undisturbed natural strata. It was the considered opinion of MAAR Associates, Inc. that although the project area has the potential for containing undisturbed soils beneath and surrounding the landfill, the documented presence of hazardous wastes leaching into the soils and into the aquifer makes any requirements for further archaeological investigations neither prudent nor feasible. It was therefore recommended that the proposed cleanup project be given a determination of "No Effect" with respect to archeological/historical considerations.

2.3.4 Volatile Organics Source Survey (VOSS)

During the process of screening remedial alternatives for the feasibility study, it became apparent that additional characterization of the site in the vicinity of the "waste fill" would be needed to adequately assess source area remediation. Geophysical survey results from the RI had identified an area of approximately 4.3 acres of "waste fill" (see Figure 2-1). The Final RI report concluded that this "waste fill" area was the source area for ground-water contamination in the shallow saturated zone and the bedrock aquifer. In order to more accurately assess the effectiveness of certain source area remedial actions, additional characterization of the identified source area was recommended. The objective of this characterization was to identify "hot spots" within the source area that most directly contribute to observed ground-water contamination.

The approach chosen for characterization of the source area was a volatile organics source survey (VOSS). The VOSS consisted of collecting ground-water samples from small diameter well points in the shallow saturated zone. The sampling depth was between 3 and 11 ft below ground surface. Actual sample depth was dependent upon depth to shallow saturated zone ground water, and sample depth was optimized to be representative of shallow saturated zone conditions beneath the waste fill.

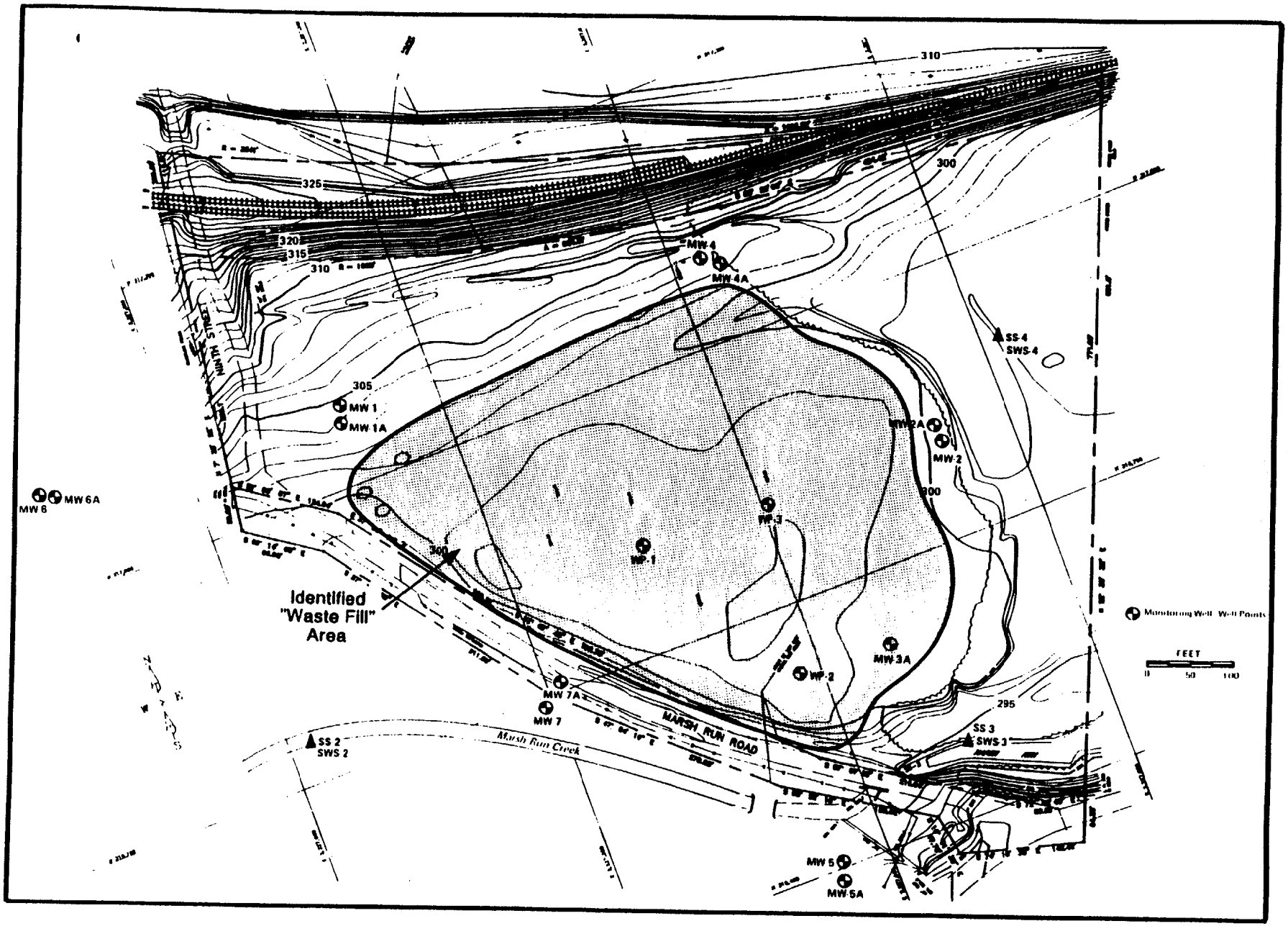

Figure 2-1. Approximate limits of "waste fill" area as identified by geophysical survey (1988).

Water samples were collected and analyzed using field apparatus and procedures similar to those used for conducting soil vapor surveys.

The primary objective of the VOSS survey was to develop a characterization of water quality conditions within the shallow saturated zone. It was concluded that a direct assessment of shallow saturated zone ground water would be more useful for source area characterization than a soil vapor survey, because the VOSS approach provides a direct assessment of actual contaminant leaching from the source area to the shallow saturated zone, while a soil vapor survey can only show vadose zone contaminants. Using the VOSS approach, it is possible to identify the types and concentrations of contaminants that have actually leached from the source area and to develop an assessment of water quality conditions in the immediate vicinity of the contaminant source area.

A grid pattern was established across the 4.3 acre "waste fill" area and extending north and northwest to encompass the area up to and including monitoring wells MW-1 and MW-4. This additional area was included since water samples from MW-1 and MW-4 had shown the highest TCE and other solvent concentration levels observed during the RI, and since they are located hydrologically downgradient of the "waste fill" area. Figure 2-2 shows the locations where shallow saturated zone ground-water samples were collected during the VOSS.

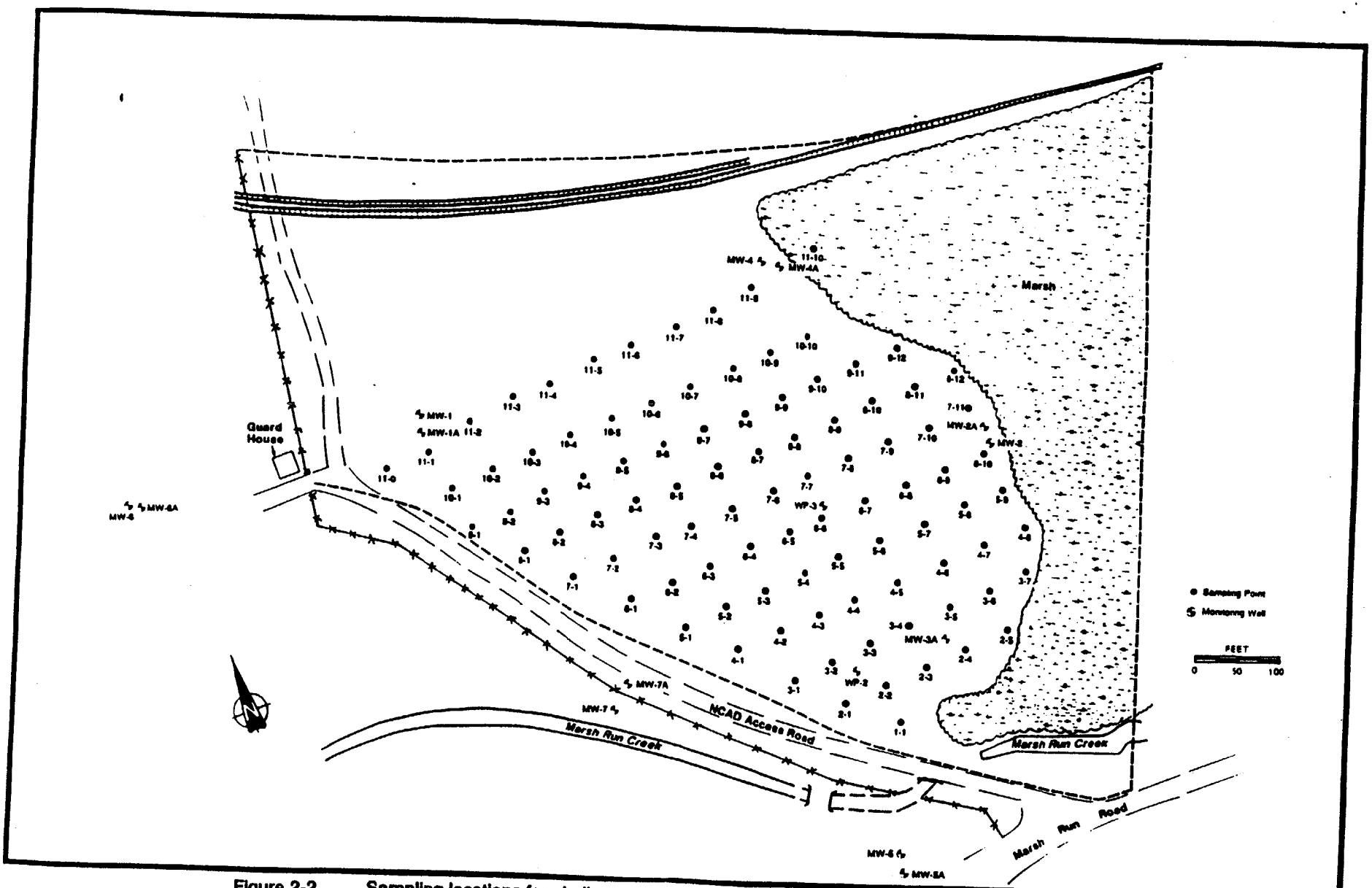

Figure 2-2. Sampling locations for shallow groundwater, Marsh Run Park, Fairview Township, Pennsylvania, April 1990.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The public participation process for this project was conducted in accordance with the provisions of the NCP. On 29 January 1990, a notice of availability was given to the area print and broadcast media, which included the Harrisburg Patriot News and the York Dispatch, that the RI report would be available to the public effective 5 February 1990 at the Fairview Township Hall, New Cumberland Public Library, Annie Sterline Library in Lewisberry, Pennsylvania, and the NCAD library.

In addition to the notice, a summation of the project was presented along with the first announcement for a public meeting to present the findings of the RI on 1 March 1990.

On 21 February 1990, a second notice was given to the area print and broadcast media to announce the public meeting on 1 March 1990. A public comment period was held from 5 February 1990 to 1 March 1990. The public meeting was held on 1 March 1990 at Fishing Creek Elementary School (located approximately 5 miles south of the site).

On 21 September 1990, a notice was sent to the area print and broadcast media announcing the availability of the Final FS report effective 1 October 1990 at Fairview Township Hall, the New Cumberland Public Library, the Annie Sterline Library in Lewisberry, Pennsylvania, and the NCAD library. In the notice, an announcement of a public meeting on 25 October 1990 to present the FS was given. On 4 October 1990, a second notice was given to area print and broadcast media which announced a rescheduling of the public meeting date to 30 October 1990. On 21 October 1990, a third notice was given to area print and broadcast media to announce the public meeting on 30 October 1990. A public comment period was held from 1 October 1990 to 30 October 1990. The public meeting was held on 30 October 1990 at Fishing Creek Elementary School.

4. SCOPE OF REMEDIAL ACTION

This ROD addresses all remedial activities which are planned for this site. The purpose of the response is to prevent further contaminant migration from the source area to the bedrock aquifer, to prevent contaminant migration from the bedrock aquifer to the Susquehanna River and to prevent future potential of direct ingestion of contaminated ground water.

The specific actions planned for remediation of the site are source area treatment of contaminated soils, and containment and mitigation of contaminated ground water (source area). Although the present condition of the source area does not represent a health-based risk to human or environmental receptors, the contaminated ground water represents a potential threat to human health because of the possibility of ingestion of water which contains contaminants above health-based levels. However, there are no existing water supply wells screened within, or downgradient of, the identified bedrock aquifer contamination. It has been determined that there is not a current pathway for human ingestion of contaminated ground water. A potential future risk would exist if water supply wells were installed onsite; therefore, remedial action is proposed.

5. SITE CHARACTERISTICS

5.1 NATURE AND EXTENT OF CONTAMINATION

Results of chemical analysis have indicated that constituents (chemical compounds, trace metals, etc.) of potential concern have been detected at various RI sampling stations (i.e., soil, water, sediment). Figures 5-1 and 5-2 show the RI sampling stations. The distributions of constituents detected in soil, sediment, and water samples are discussed below.

5.1.1 Soil Sampling Results

Although not directly sampled during the RI, the "waste fill" onsite can be characterized based on test pits conducted during the CS, and from peripheral analytical data of monitoring well boring soil samples and cover soil samples, as exhibiting elevated concentrations of semi-volatile compounds, specifically PAHs. These compounds are ubiquitous and are common constituents of asphalt, coal tar, and creosote. They are relatively immobile in ground water. Analytical data for soils collected from MW-2 (eastern edge of fill) showed relatively high concentrations of several PAH compounds, particularly phenanthrene and fluoranthene, at levels exceeding 1,000 mg/kg. However, these levels were encountered at depths below the surface topsoil (i.e., greater than 1 ft below surface). PAH levels were approximately three orders of magnitude less (1,000 times lower) in the surficial topsoil samples (Tables 5-1 and 5-2). Although the highest concentrations of PAHs were obviously detected onsite, much lower levels (i.e., approximately two to three orders of magnitude lower) were also found dispersed offsite in "clean fill" material encountered when drilling MW-5 and MW-7, which indicates that these semivolatile compounds are not unique to the site.

Elevated concentrations of the trace metals barium, lead, copper, and silver, which were detected in soil samples collected onsite and below the surface cover, are apparently related to the "waste fill." Soil samples collected from MW-2 characteristically exhibited the highest

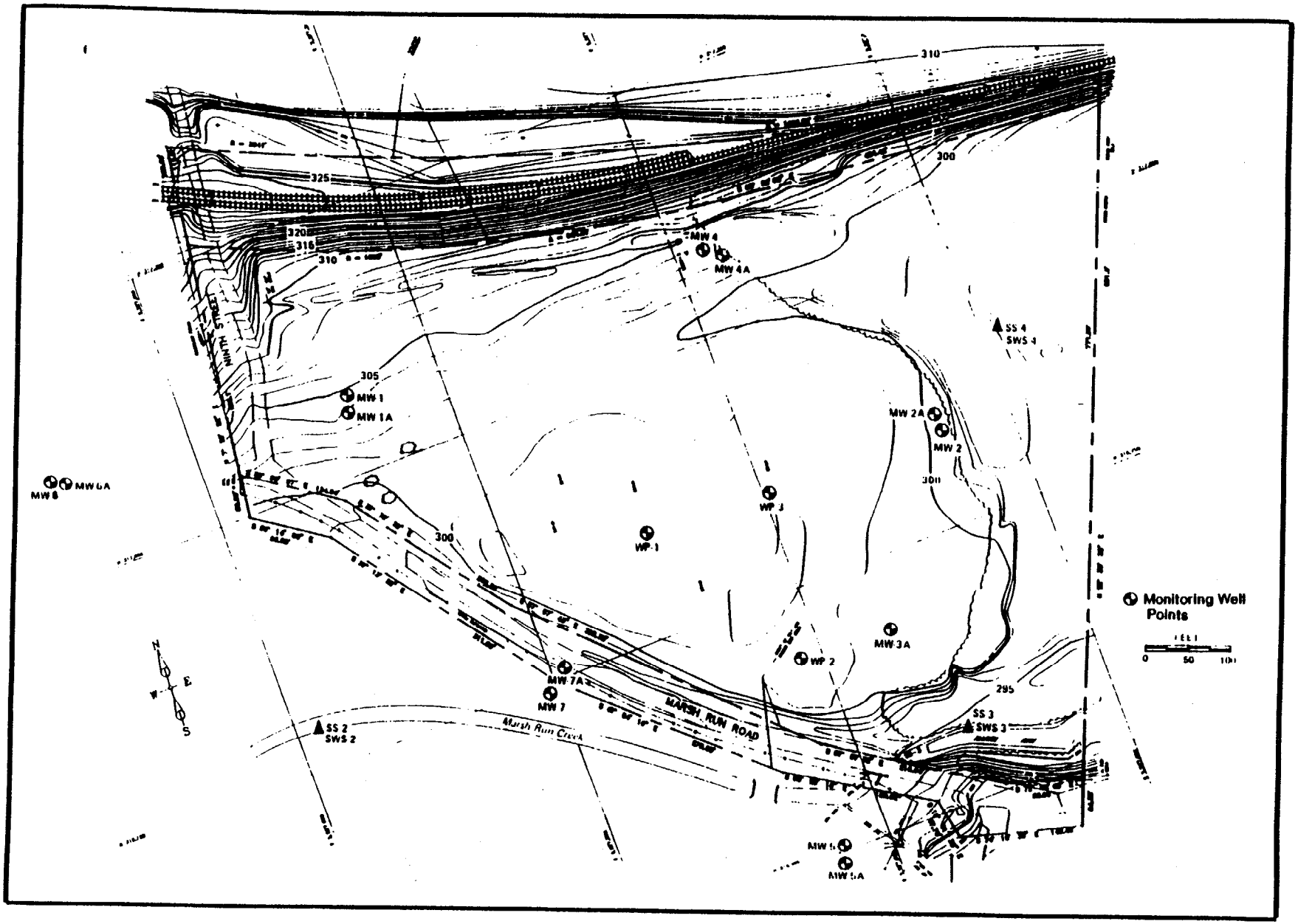

Figure 5-1. Site sampling plan.

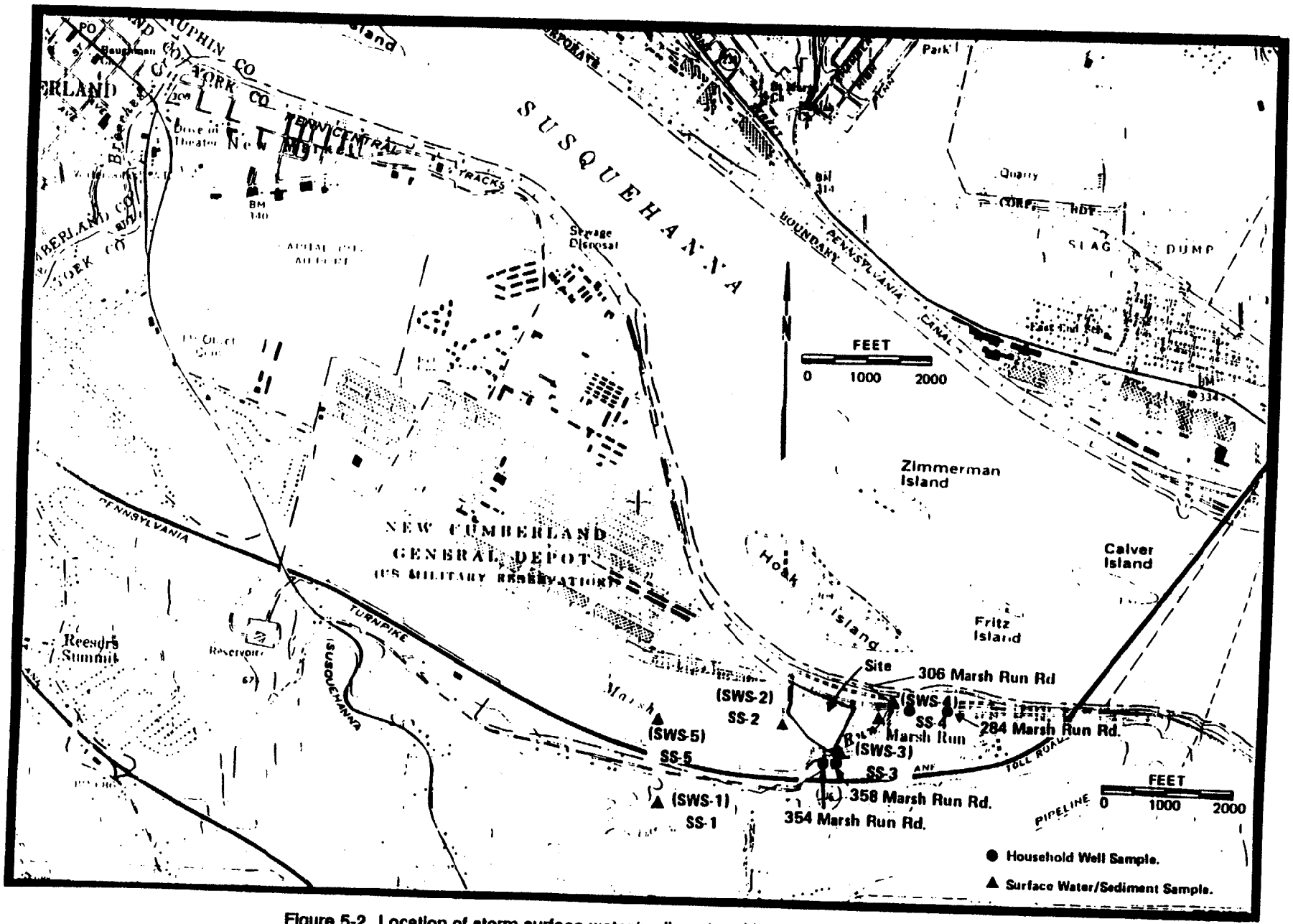

Figure 5-2. Location of storm surface water/sediment and household well samples.

TABLE 5-1 RESULTS OF CHEMICAL ANALYSIS OF SURFACE SOILS COLLECTED BY USACE AT MARSH RUN PARK, ON 25 MAY 1988
[all values in mg/kg (ppm)]

Analyte	CRDL[a]	SS1	SS2	SS2D	SS3	SS4	SS5	SS6	SS7	SS8	SS8D
Fluoranthene	0.33					0.16	0.85	0.78		8.10	4.84
Pyrene	0.33					0.14	1.16	0.64		6.86	4.10
Phenanthrene	0.33					0.16	0.51	0.45		7.15	3.63
Naphthalene	0.33						0.06			0.41	0.08
2-Methylnaphthalene	0.33						0.08			0.26	0.06
Anthracene	0.33					0.03	0.03			1.49	0.70
Chrysene	0.33						0.52	0.39		3.97	1.93
Benzo(a)anthracene	0.33						0.39	0.35		4.20	1.97
Indeno(1,2,3-c-d)pyrene	0.33							0.16		1.93	0.75
Benzo(g,h,i)perylene	0.33							0.18		2.05	0.80
Acenaphthene	0.33									0.96	0.38
Fluorene	0.33									0.98	0.42
Benzo(b)fluoranthene	0.33									2.04	0.90
Benzo(a)pyrene	0.33									3.33	1.41
Benzo(k)fluoranthene	0.33									1.77	0.89
Dibenzo(a,h)anthracene	0.33									0.78	
Dibenzofuran	0.33									0.58	0.22
Diethylphthalate	0.33	0.10	0.17	0.011	0.08	0.19	0.08			0.08	0.07
Di-n-butylphthalate	0.33	0.56	0.84	0.63	0.38	1.12	0.47	0.91	0.99	0.62	0.57
Bis(2-ethylhexyl)phthalate	0.33			0.61		0.69	1.27	1.60	1.89		0.94
Antimony	12.										
Arsenic	2.	4.23	6.93	6.79	6.36	2.77	6.81	3.93	4.19	6.22	5.63
Beryllium	1.										
Cadmium	1.										
Chromium	2.	9.03	8.88	9.28	3.33	14.60	4.23	13.40	14.80	8.36	16.60
Copper	5.	10.90	18.70	19.70	16.60	12.80	13.40	5.29	9.38	39.90	37.50
Lead	1.	10.80	12.50	14.10	130.00	25.10	73.70	21.90	15.30	44.00	32.70
Mercury	0.04	0.34	0.08	0.15	0.13	0.14	0.36	0.19	0.13	0.40	
Nickel	8.	10.30	14.00	15.10	4.82	12.40	4.74	10.60	10.80	8.87	11.70
Selenium	1.				0.18	0.12	0.17	0.08	0.16	0.10	0.11
Silver	2.										
Thallium	2.										
Zinc	4.	36.70	48.20	50.20	77.90	56.60	80.10	45.70	39.90	57.70	73.50
Cyanide	0.25[b]										

(a) Contract Required Detection Limit
(b) Actual Detection Limit
Source: U.S. ACE 1988

TABLE 5-2 SUMMARY OF ANALYTICAL RESULTS FROM SURFICIAL SOIL SAMPLES COLLECTED BY EPA TAT AT MARSH RUN PARK ON 22, 23 JUNE 1988
[all values in mg/kg (ppm)]

Compound	Detection Limit	mg/kg (ppm)														
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S51	S52	S61	S62
1,2-Dichloroethene	0.5													9.4		
Trichloroethene	0.5												0.66	2.6		
Tetrachloroethene	0.5													2.6		
Toluene	0.5													0.20		
Xylenes, total	0.5													0.13		
2-Methylnaphthalene	0.33			0.22												
Naphthalene	0.33			0.40												
Acenaphthene	0.33			0.92												
Phenanthrene	0.33			1.9												
Fluoranthene	0.33			7.3			0.36	1.1								
Pyrene	0.33			6.6			0.32	0.79								
Chrysene	0.33			4.6												
Benzo(b)fluoranthene	0.33			8.3												
Benzo(k)fluoranthene	0.33			7.3												
[1,2-B] Pyridine 5H-Indeno	0.33			0.72												
Beryllium	2.5															
Cadmium	0.5	5.5	4.6	5.6	3.6	3.8	3.09	5.05	1.02	3.6	5.7	3.6	5.1	7.7	5.05	3.6
Chromium	1.0	3.5	4.1	33	3.06	1.5	5.7	7.6	2.6	5.7	7.4	8.7	9.7	49	5.05	5.7
Copper	1.0	17	15	797	11	26.6	5.15	29	1.5	8.8	16	12	98	185	11	8.8
Nickel	2.0	12	8.8	13	8.2	4.0	2.0	12	4.08	7.2	9.6	12	12	14	6.6	7.2
Lead	1.0	36	48	1,080	32	175	38	44	28	35	66	55	68	1,020	68	35
Zinc	0.5	49	48	1,510	35	116	29	55	19	32	46	75	209	399	28	32
Arsenic	0.5	1.5	0.67	2.4	0.83	1.3	0.70	1.3	0.58	1.0	1.5	0.57	1.2	2.6	0.56	0.95
Silver	0.5			5.6				1.5								
Antimony	10.0															
Selenium	0.5	2.3	0.81	3.8	0.60	1.4	0.95	1.2	0.63	2.4	1.9	0.81	1.5	1.9	1.7	1.5
Thallium	5.0	12		13		16						17		11	9.6	
Mercury	0.05		0.05	0.07						0.32	0.05	0.07		0.09	0.09	0.06
Cyanide	0.35			1.75								0.45		1.0		

Source: U.S. EPA 1988

concentrations of trace metals. Coincidentally, MW-2 is located closest to the "waste fill." Table 5-3 lists the constituents of potential concern that were detected in cover soil samples collected during the USACE and EPA sampling events.

5.1.2 Ground-Water Sampling Results

Based on ground-water data from shallow overburden wells and the respective water level and saturated thickness of fill during each of the two RI water sampling events, the fill placed on Marsh Run Park was identified as the potential source of volatile organic compounds (VOCs). The detection of the volatile organic compounds including trichloroethylene, vinyl chloride and 1,2-dichloroethene (total) in shallow overburden wells during the second sampling event when water levels were higher and a greater portion of the "waste fill" was saturated indicates the fill as a potential temporal VOC source. Based on inferred ground-water flow patterns at the site, the presence of VOCs in the shallow ground water suggested the fill to be the source of VOCs at this site. It is unlikely that an offsite source would result in VOC contamination in the shallow overburden onsite based on inferred ground-water flow paths. Furthermore, with the exception of acetone, which is a common laboratory artifact (and which was detected in MW-5A), no VOC contamination was detected in the ground water anywhere offsite in either the overburden, bedrock, or residential wells.

Volatile organic contamination appears to be present in a localized area in the bedrock aquifer (Gettysburg Formation) beneath the site. The persistence of detected trichloroethene (TCE) and other chlorinated aliphatics at very similar concentrations during both sampling events suggests that a VOC contaminant source exists that has impacted the bedrock aquifer beneath the site. TCE was detected in site bedrock monitoring wells at concentration levels that exceeded the Maximum Contaminant Level (MCL) established by the EPA by 30 to 80 times. The VOC contamination is not present in upgradient monitoring wells to the west, to the southwest, or in residential wells to the east. Based on inferred

TABLE 5-3 CONSTITUENTS OF POTENTIAL CONCERN IN SURFICIAL COVER SOILS AT THE MARSH RUN PARK SITE, NEW CUMBERLAND, PA[a]

Chemical	Average (mg/kg)	Reasonable Worst Case (mg/kg)	Frequency of Detection
ncPAHs (b)	3.63	21.7	7/17
cPAHs (c)	2.94	20.2	4/17
Diethylphthalate	0.15	0.19	6/17
Di-n-butylphthalate	0.8	1.12	7/17
bis(2-Ethylhexyl) phthalate	0.8	1.60	5/17
Cadmium	2.55	5.7	10/17
Copper	61.5	797	17/17
Lead	111	1,080	17/17
Mercury	0.19	0.36	11/17
Selenium	1.01	3.8	15/17
Silver	0.64	5.6	2/17
Thallium	4.5	16	3/17
Zinc	138	1,510	17/17
Cyanide (total)	0.25	1.75	1/17

(a) Values are based on results of sampling conducted by the COE and EPA TAT in June 1988.

(b) Noncarcinogenic PAHs include acenaphthene, anthracene, benzo(g,h,i) perylene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, and 2-methylnaphthalene.

(c) Carcinogenic PAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h) anthracene, and indeno(1,2,3-c-d)pyrene.

ground-water flow patterns of the bedrock aquifer, the predominant contaminant migration direction of the VOC contamination localized beneath the site would be to the north toward the Susquehanna River.

The source of volatile organic compound contamination in both the bedrock and overburden ground water appears to be related to the fill material placed at Marsh Run Park. The varying ratios of TCE versus its probable biodegradation by-products 1,2-dichloroethene (total) and possibly vinyl chloride, in the saturated overburden and bedrock aquifer, respectively, appear to be related to the unique effects of each of the saturated matrix materials (fill clay and peat or bedrock) on the biotransformation capability of the microorganisms. Interactions between environmental conditions such as dissolved oxygen, redox potential, temperature, pH, and salinity, and the presence of particulate matter as well as the critical concentration range of the compound of interest, and the presence of adapted or adaptable organisms often control the occurrence, rate, and product of biodegradation.

Trace metal contamination in the ground water appears to be primarily site derived. The presence of elevated trace metals in upgradient wells installed during the RI suggests that an offsite source of trace metals contributes to the elevated trace metals in the shallow saturated zone ground water. Comparison of "total" metals and "dissolved" metals concentrations in both the bedrock aquifer and the shallow saturated zone indicates that the dissolved fraction is not a significant percentage of the total metals concentration for water samples taken from the site (Table 5-4). This indicates that much of the observed trace metal concentrations must be undissolved, suspended, or adhered to sediment particles in the water.

Metal speciation is a function of the pH and redox potential of the soil and ground water environment. Sampling data indicate that pH of the shallow saturated zone ground water is approximately neutral (6-7.5), that there is no evidence of conditions at the site that might cause conditions to become more acidic. Under these conditions, metals

TABLE 5-4 SUMMARY OF GROUND WATER QUALITY DATA FOR METALS (FEB, AUG 1988 SAMPLING EVENTS)

	Shallow Saturated Zone Wells[a]						Bedrock Aquifer Wells[a]					
	Total (Max)	Total (Avg)	Detection Frequency	Dissolved (Max)	Dissolved (Avg)	Percent Dissolved	Total (Max)	Total (Avg)	Detection Frequency	Dissolved (Max)	Dissolved (Avg)	Percent Dissolved
Arsenic	127	20.80	5/9	U	U	U	28.3	5.1	4/6	7.3	0.73	
Cadmium	33.6	7.8	4/9	U	U	U	U	U	0/6	U	U	U
Barium	2,360	598	9/9	668	179	30.0	561	327	6/6	476	291	89.0
Copper	199	44.8	5/9	16.4	2.3	5.1	29.3	4.6	2/6	17.3	5.4	117.4[b]
Mercury	1.0	0.29	5/9	U	U	U	0.7	0.24	4/6	U	U	U
Zinc	1,170	354	9/9	122	40	11.3	225	70.5	6/6	40.5	22.3	31.6
Chromium	372	63.3	6/9	U	U	U	48.2	7.4	2/6	U	U	U
Silver	U	U	0/9	U	U	U	U	U	0/6	U	U	U

U = Below detection limit.
(a) All concentrations in $\mu g/L$.
(b) Percent dissolved is calculated based on average concentrations for available data.

are likely to remain primarily in the undissolved or suspended state. Metals in this phase are not readily mobile in a subsurface ground-water environment. In addition, comparison of metal concentrations in the shallow saturated zone and the bedrock aquifer indicates that contamination levels in samples from the shallow saturated zone are considerably higher than levels observed in bedrock aquifer water samples (Table 5-4). This result is opposite from VOC concentration results which show that bedrock aquifer VOC contamination is considerably higher than shallow saturated zone VOC concentration. Consequently, these data indicate that VOCs are primarily migrating from the source area while metals remain primarily within the shallow saturated zone. Therefore, based upon dissolved metal concentrations, ground water pH, and comparison of shallow saturated zone and bedrock aquifer metal concentrations, trace metal mobility in the ground water is not considered a significant contaminant pathway.

A summary of constituents of potential concern detected in ground-water samples is presented in Table 5-5. Monitoring wells MW-1A, MW-2A, MW-3A, MW-4A, MW-5A, MW-6A, and MW-7A represent shallow saturated zone water conditions. Monitoring wells MW-1 through MW-7 represent bedrock aquifer conditions.

5.1.3 Volatile Organics Source Survey (VOSS) Results

Water samples were analyzed during the VOSS for the presence of specific volatile organic contaminants using an onsite mobile gas chromatograph (GC) laboratory. Contamination data were plotted and contoured on a site map. Figures 5-3 through 5-5 show observed concentration levels for TCE, total 1,2-dichloroethylene (cis plus trans), and total organics in water samples from the shallow saturated zone.

Review of VOSS data indicates that it was only possible to collect shallow saturated zone water samples at approximately half of the proposed sample locations. Multiple attempts were made to collect water samples from each location. Samples were obtained at 48 locations.

TABLE 5-5 AVERAGE GROUND-WATER CONCENTRATIONS (μg/L) IN MONITORING WELLS AT MARSH RUN PARK FOR COMPOUNDS INCLUDED IN THE HUMAN HEALTH RISK ASSESSMENT

	MW-1	MW-1A	MW-2	MW-2A	MW-3A	MW-4	MW-4A
Volatiles							
Ethylbenzene	3.0	2.5 (d)	2.5 (d)	11.8 (b)	2.5 (d)	2.5 (d)	2.5 (d)
1,1-Dichloroethene	7.3 (b)	2.5 (d)	2.5 (d)	2.5 (d)	2.5 (d)	2.5 (d)	2.5 (d)
1,1,2,2-Tetrachloroethane	39.5 (b)	4.8	2.5 (d)	2.5 (d)	2.5 (d)	2.8	1.8
Trichloroethene	165.0	13.3	2.5 (d)	2.5 (d)	2.5 (d)	387.5 (b)	4.3
Acetone	5.0 (d)	5.0 (d)	5.0 (d)	5.0 (d)	5.0 (d)	10.5 (b)	5.0 (d)
Methylene Chloride	2.5 (d)	2.5 (d)	2.5 (d)	6.8 (b)	2.5 (d)	2.5 (d)	2.5 (d)
1,2-Dichloroethene (total)	23.8	42.3	2.5 (d)	12.6	2.5 (d)	67.3 (b)	3.8
1,1,2-Trichloroethane	3.8	2.5 (d)	2.5 (d)	2.5 (d)	2.5 (d)	6.3 (b)	2.5 (d)
Semivolatiles							
bis(2-ethylhexyl)phthalate	5.0	15.5 (b)	5.0	5.0	5.0	5.0	4.5
Metals (e)							
Aluminum (c)	828	65,250	2,570	7,723	21,070	5,764	189,000 (b)
Arsenic (c)	5.0	44.4	5.0	10.0	8.0	9.6	77.6 (b)
Barium (c)	488	510	252	182	228	406	1,599 (b)
Beryllium (c)	1.7	3.0	2.5	2.5	2.3	1.7	7.2 (b)
Cadmium (c)	2.5	3.7	2.5	2.5	6.3	2.5	28.0 (b)
Calcium (c)	78,950	74,750	64,150	133,750	222,500 (b)	95,500	56,900
Chromium (c)	5.0	42.4	5.0	10.9	31.5	8.2	106.7 (b)
Cobalt (c)	25.0	31.2	25.0	33.7	25.0	19.9	81.8 (b)
Copper (c)	12.5	38.4	12.5	12.5	30.5	20.9	96.9 (b)
Iron (c)	637	97,100	1,950	20,775	30,790	7,723	374,500 (b)
Lead (c)	2.5	19.7	1.6	6.8	24.5	8.7	56.7 (b)
Magnesium (c)	13,550	22,900	16,450	51,375	45,100	23,775	57,800 (b)
Manganese (c)	63	4,125	44	4,943	872	642	10,800 (b)
Mercury (c)	0.29	0.32	0.10	0.29	0.31	0.32 (b)	0.32
Nickel (c)	20.0	95.5	20.0	29.8	38.8	20.0	102.3 (b)
Potassium (c)	2,130	10,000	1,525	3,873	10,485	3,070	15,400 (b)
Selenium (c)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Sodium (c)	8,505	9,365	8,240	19,300	14,100	11,150	8,295
Vanadium (c)	25.0	103.6	25.0	23.5	48.8	25.0	357.5 (b)
Zinc (c)	92	299	18	68	220	97	834 (b)
Boron	47.2	54.5	15.0	88.2	499.5 (b)	36.0	24.0
Silicon (c)	13,450	43,450	16,000	29,100	50,500	23,350	119,500 (b)
Other Inorganics							
Fluoride	100	100	100	350 (b)	200	100	100

(a) Onsite wells are 1, 1A, 2, 2A, 3A, 4, 4A, 7, and 7A
(b) Maximum average of onsite wells
(c) Omitted from further consideration since maximum average concentration is within range of natural occurrence.
(d) Observed concentrations were less than detection limits. For risk assessment calculations, a value of ½ the analytical method detection limit is used.
(e) Metals concentrations are "total" metals.

TABLE 5-5 EXTENDED

	MW-5	MW-5A	MW-6	MW-6A	MW-7	MW-7A	Average[a] of Onsite Wells
Volatiles							
Ethylbenzene	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	3.6
1,1-Dichloroethene	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	3.0
1,1,2,2-Tetrachloroethane	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	6.8
Trichloroethene	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	64.7
Acetone	5.0[d]	23.0	5.0[d]	5.0[d]	5.0[d]	5.0[d]	5.6
Methylene Chloride	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	3.0
1,2-Dichloroethene (total)	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	17.7
1,1,2-Trichloroethane	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	2.5[d]	3.1
Semivolatiles							
bis(2-ethylhexyl)phthalate	5.0	5.0	5.0	5.0	5.0	5.0	6.1
Metals							
Aluminum	15,750	137,250	232	5,950	2,250	5,220	33,297
Arsenic	16.7	38.4	8.9	5.0	5.0	5.0	18.8
Barium	393	1,133	231	187	293	779	526
Beryllium	2.2	9.2	2.5	2.5	2.5	2.5	2.9
Cadmium	2.5	17.2	2.5	2.5	2.5	2.5	5.9
Calcium	111,650	84,250	49,300	144,000	119,000	173,000	113,167
Chromium	32.7	188.5	5.0	5.0	5.0	14.9	25.5
Cobalt	25.2	101.0	25.0	25.0	25.0	25.0	32.4
Copper	14.8	105.8	12.5	12.5	12.5	19.1	28.4
Iron	24,245	171,650	174	8,820	1,350	10,900	60,636
Lead	11.2	86.5	2.5	11.1	2.5	5.2	14.2
Magnesium	30,100	34,900	16,800	57,900	30,300	50,900	34,683
Manganese	962	10,130	17	1,760	148	2,120	2,640
Mercury	0.62	0.70	0.45	0.10	0.10	0.10	0.24
Nickel	40.9	145.0	20.0	20.0	20.0	23.5	41.1
Potassium	7,395	6,620	1,815	2,210	3,350	3,020	5,873
Selenium	1.9	2.5	2.2	1.5	2.5	2.5	2.5
Sodium	63,850	68,650	10,250	234,000	16,900	48,200[b]	16,006
Vanadium	39.7	274.0	25.0	14.5	25.0	25.0	73.1
Zinc	132	658	13	41	18	51	188
Boron	15.0	15.0	159.0	55.0	15.0	60.5	93.3
Silicon	37,550	95,250	11,250	15,700	16,800	28,500	37,850
Other							
Fluoride	100	100	100	100	100	200	150

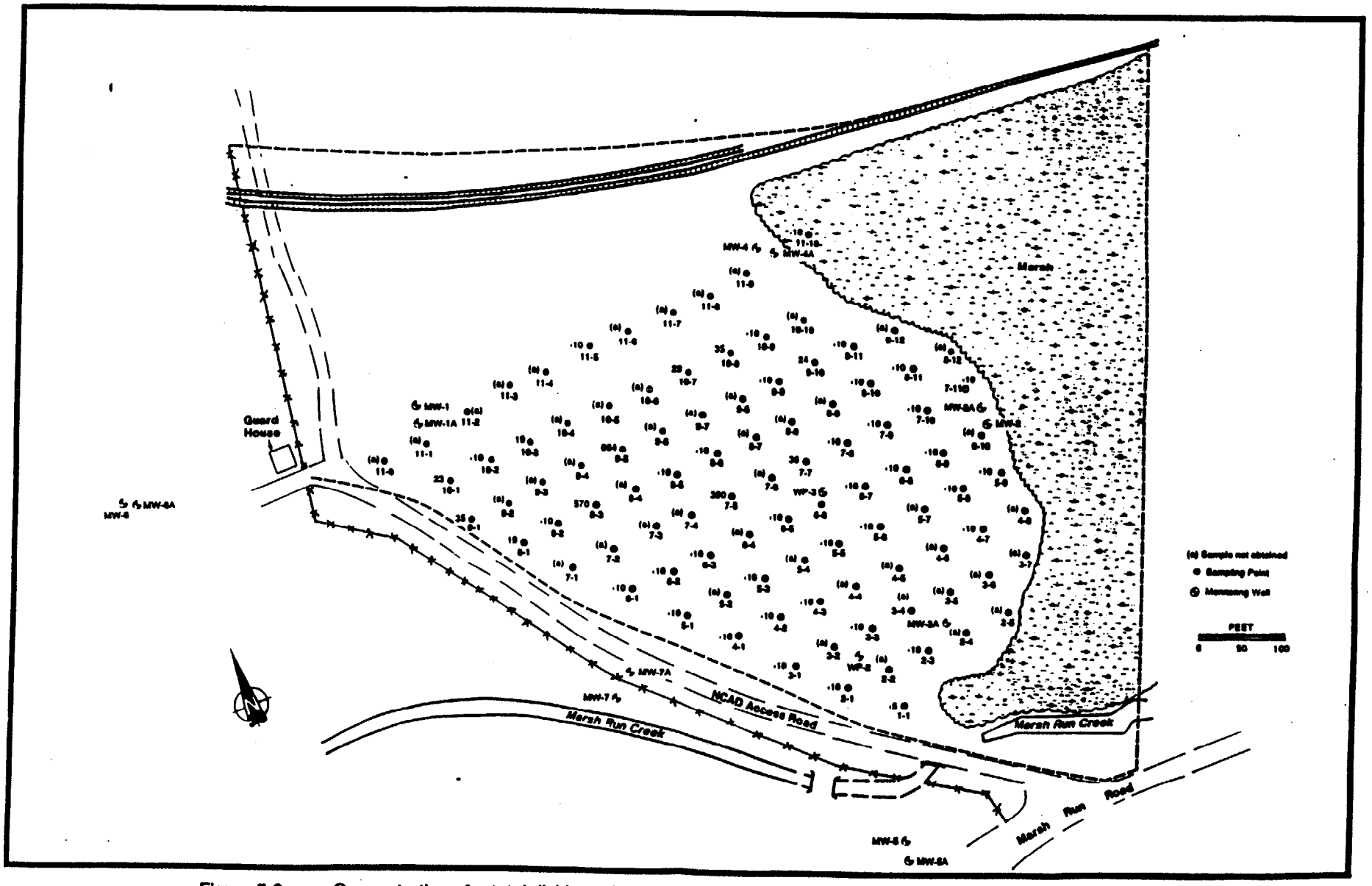

Figure 5-3. Concentrations for total dichloroethenes (ug/L) in the shallow groundwater, Marsh Run Park, Fairview Township, Pennsylvania, April 1990.

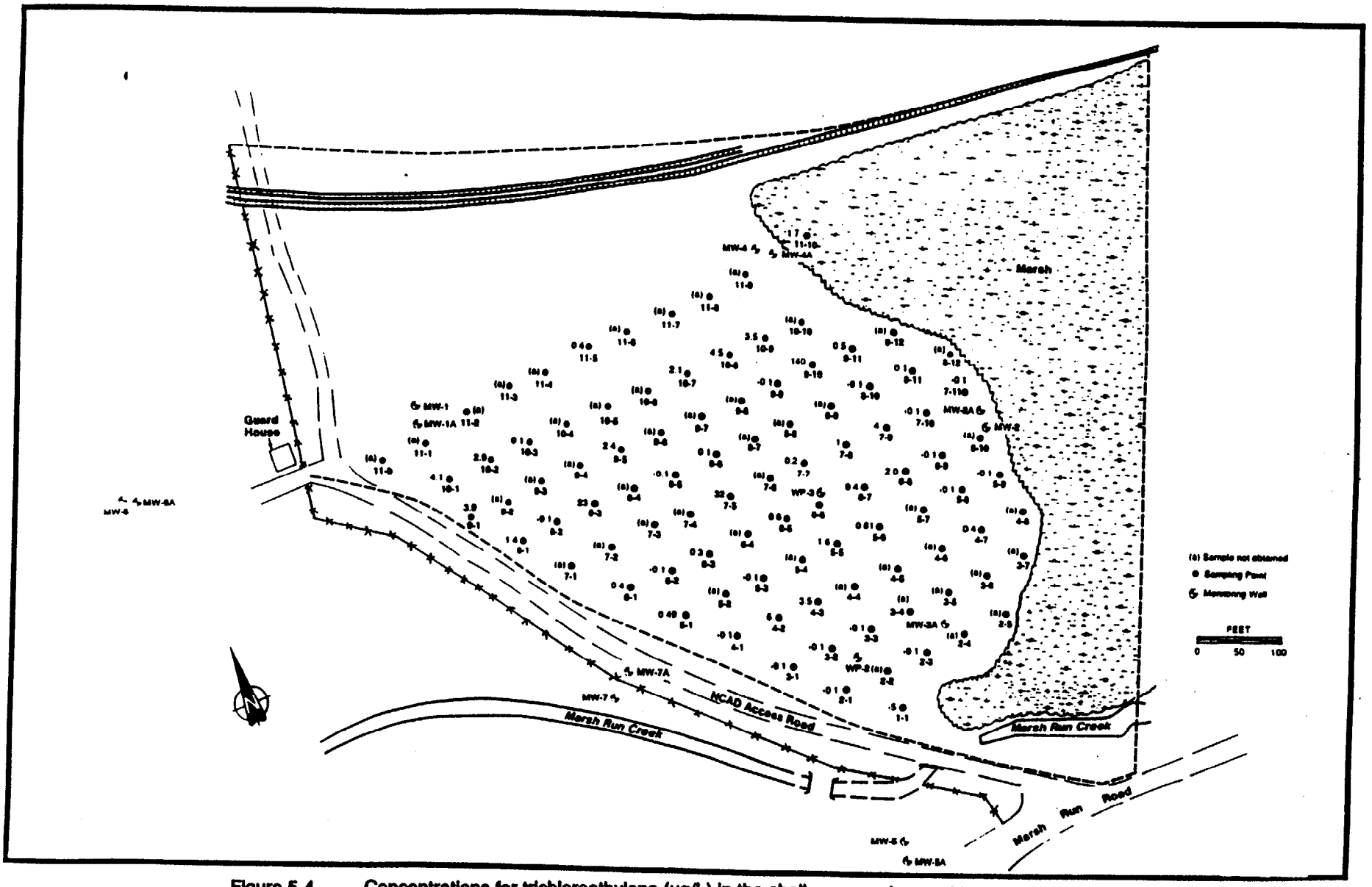

Figure 5-4. Concentrations for trichloroethylene (ug/L) in the shallow groundwater, Marsh Run Park, Fairview Township, Pennsylvania, April 1990.

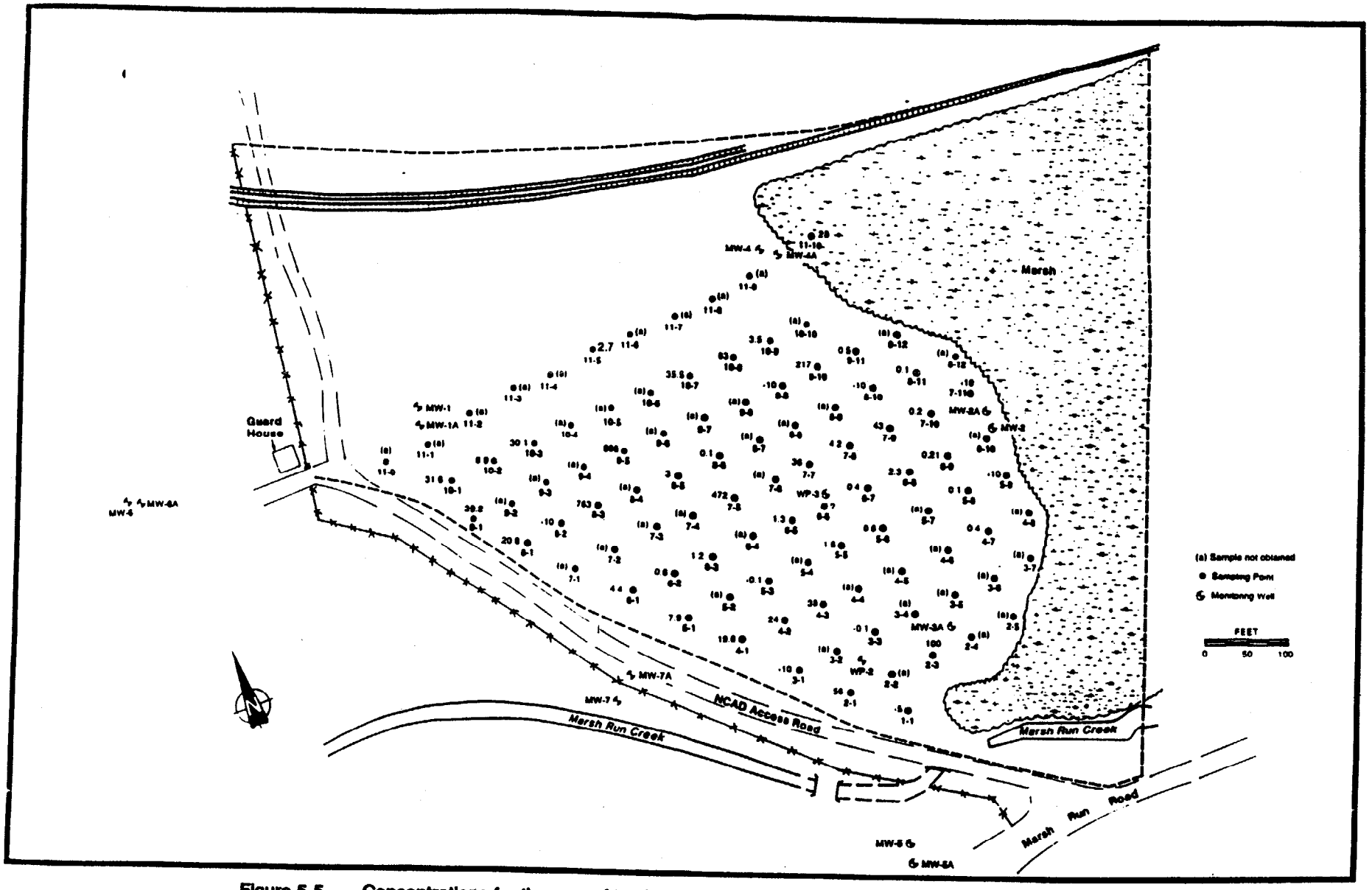

Figure 5-5. Concentrations for the sum of total volatile organic contaminants (ug/L) in the shallow groundwater, Marsh Run Park, Fairview Township, Pennsylvania, April 1990.

Probe refusal was encountered at only one location (7-2). All other unsuccessful sample points were due to inability to extract ground water at the sample location. There are several reasons why samples could not have been collected from all of the proposed sample locations. They include the heterogeneous nature of the "waste fill," depth to ground water in the northern portion of the site (9-11 ft) and technical limitations of sampling equipment.

Samples were obtained from 48 points within the fill area (Figure 5-6). These data provide thorough coverage of the source area. Furthermore, when examined in conjunction with the results of the EM survey and shallow and deep ground water monitoring results, the VOSS data provide an accurate assessment of localized contaminated areas ("hot spots") within the source area (Figure 5-7).

Assessment of the data indicated that volatile organic solvent contamination was observed throughout and north of the former landfilled area. Contaminant concentrations were found to be greatest in the northern portion of the site. Contamination was not limited to the area identified as former landfill from the electromagnetic terrain conductivity survey (EM survey). Ground-water contamination in the shallow saturated zone was also observed immediately north of the landfilled area toward monitoring wells MW-1 and MW-4. This VOC-contaminated area exhibited some of the highest ground-water contamination concentrations at the site. Figure 5-8 shows the approximate limits of the former landfill as estimated using EM survey (October 1988), and the additional VOC-contaminated area north of the landfill as estimated from the VOSS. It should be noted that the area of highest VOC contamination encompasses the northwestern portion of the former landfill and the south-central portion of the VOC-contaminated area. For clarification purposes, the term source area applies to the area encompassing both the "waste fill" and the VOC-contaminated area.

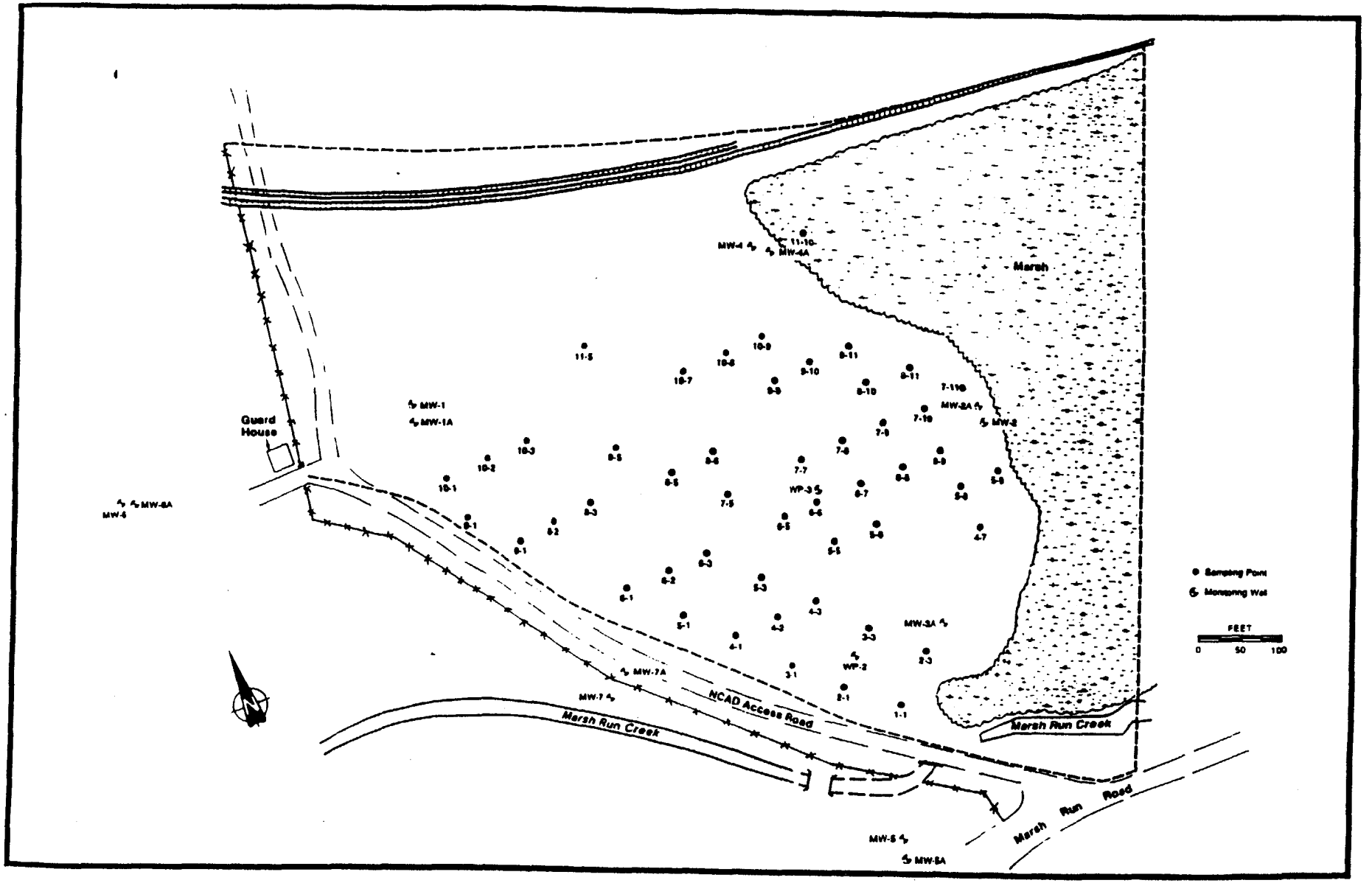

Figure 5-6. Actual VOSS survey data points, April 1990.

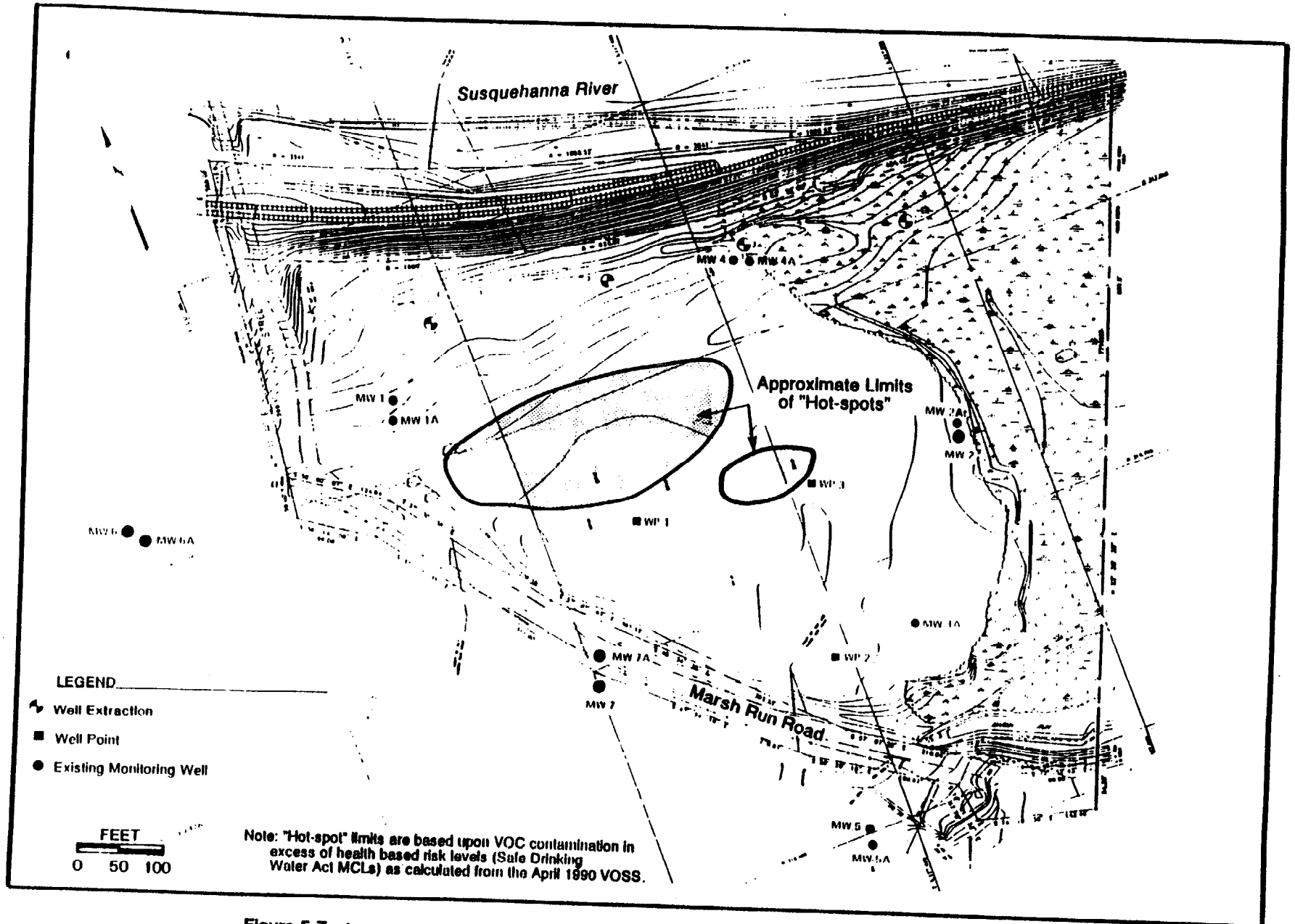

Figure 5-7. Approximate extent of "hot-spots" as identified from VOSS results (April 1990).

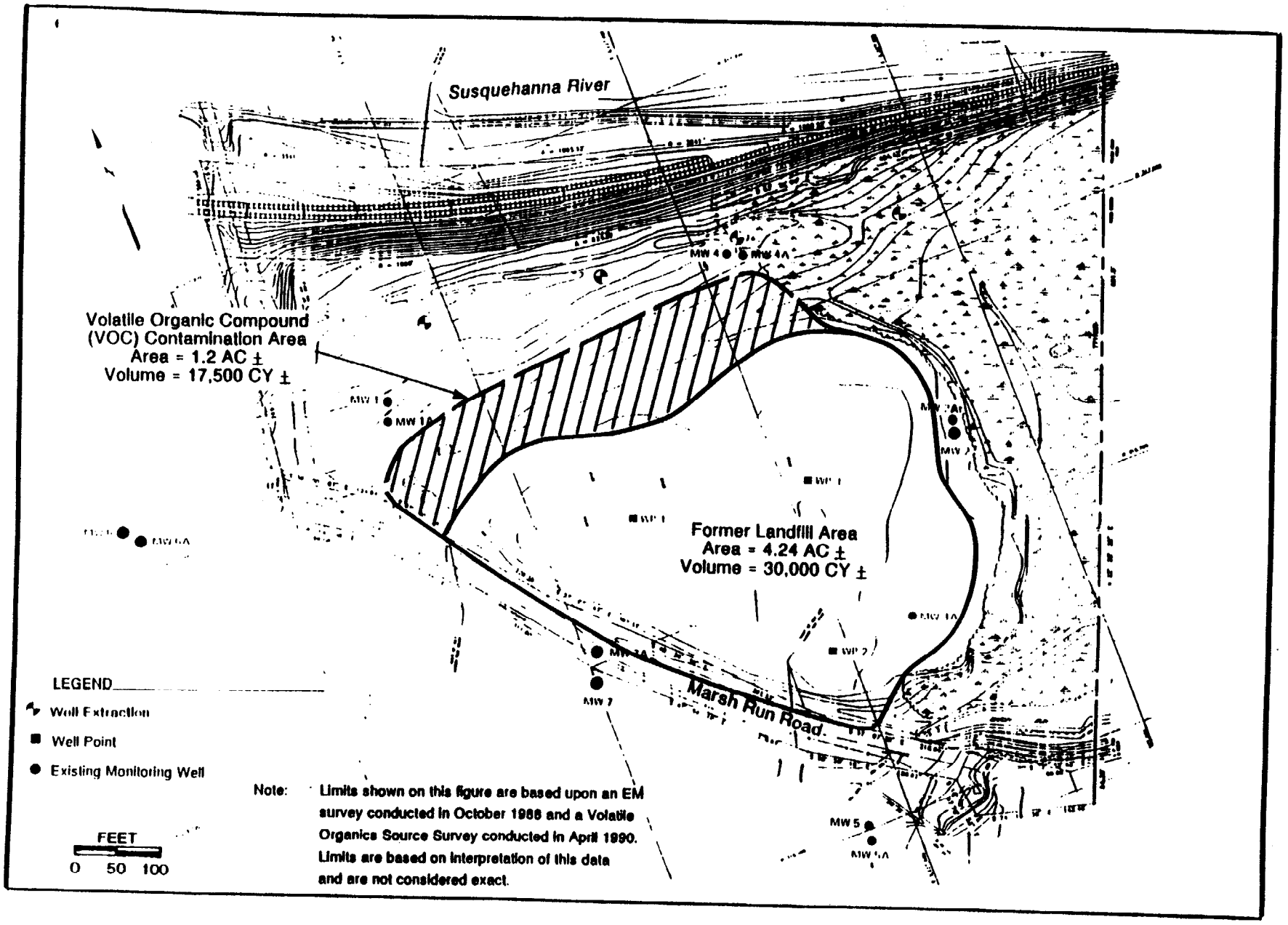

Figure 5-8. Approximate limits of ground water contamination source areas at Marsh Run Park Landfill, Fairview Township, PA

5.1.4 Surface Water and Sediment Sampling Results

Low-level concentrations of volatile organic compounds have been identified in surface water samples taken from Marsh Run Creek at the project site. There are documented sources of low-level volatiles and semivolatiles upstream of Marsh Run Park. Offsite surface water contamination is currently under investigation by USATHAMA under another DERP project. The primary sources of the VOCs in the stream are presently considered unrelated to Marsh Run Park.

Stream sediments detected upstream of Marsh Run Creek at SS-5 (Figure 5-2) were found to contain low-level PAHs and pesticides or pesticide metabolites indicative of an upstream source of these compounds with respect to Marsh Run Park. Metals detected in the surface water (measured as total metals) in some cases exceeded ambient surface water quality criteria for protection of aquatic life. However, stream sediment transport and fugitive dust emissions were not identified as exposure pathways. Table 5-6 lists all potential chemicals of concern detected in surface water and sediment samples.

5.1.5 Ground-Water Modeling

Based on the data generated from the field investigation and a ground-water flow model utilizing the U.S. Geological Survey (USGS) three-dimensional MOD-FLOW numerical ground-water flow model, the understanding of ground-water flow mechanisms at the site is summarized as follows:

- Nearly all of the water (rain water) that infiltrates Marsh Run Park (i.e., 98 percent) will ultimately migrate vertically into the bedrock aquifer. A small portion (i.e., near the edge of the fill adjacent to Marsh Run Creek) will migrate laterally and discharge to Marsh Run Creek.

TABLE 5-6 CONSTITUENTS OF POTENTIAL CONCERN IN SURFACE WATER/SEDIMENTS AT THE MARSH RUN PARK SITE, NEW CUMBERLAND, PA[a]

Chemical	Average	Reasonable Worst Case	Frequency of Detection
Surface Water (mg/liter):			
Trichloroethene	0.005	0.007	3/4
1,2-Dichloroethene (total)	NR[b]	0.001	1/4
Tetrachloroethane	NR[b]	0.002	1/4
ncPAHs (c)	0.0067	0.007	1/4
4,4'-DDE	0.000075	0.0001	1/4
4,4'-DDD	0.00013	0.00038	1/4
Aluminum	2.52	8.50	3/4
Barium	0.077	0.177	4/4
Chromium	0.0038	0.012	1/4
Copper	0.0082	0.013	1/4
Iron	4.82	16.4	4/4
Lead	0.011	0.038	1/4
Manganese	0.368	0.860	4/4
Vanadium	0.0078	0.016	1/4
Zinc	0.085	0.168	2/4
Sediments (mg/kg):			
ncPAHs (c)	1.51	5.53	1/4
cPAHs (d)	1.10	3.92	1/4
Diethylphthalate	NR[b]	0.15	1/4
Di-n-butylphthalate	0.182	0.24	1/4
bis(2-Ethylhexyl) phthalate	0.166	0.17	1/4
4,4'-DDE	0.151	0.580	1/4
4,4'-DDD	0.034	0.11	1/4
4,4'-DDT	0.068	0.245	1/4
Antimony	NR[b]	5	1/4
Arsenic	21.5	36.4	4/4
Cadmium	0.82	1.6	3/4
Lead	27.3	74.5	2/4
Manganese	350	726	4/4
Zinc	60.6	112	2/4
Cyanide (total)	0.28	0.34	3/4

(a) Values in table are based on sampling conducted during the RI.
(b) NR = not reported. Due to detection limit values, average values were calculated to be higher than the maximum detected value; therefore averages were not reported.
(c) Noncarcinogenic PAHs include acenaphthene, anthracene, benzo(g,h,i) perylene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, and 2-methylnaphthalene.
(d) Carcinogenic PAHs include benzo(a)anthracene, benzo(a)pryene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h) anthracene, and indeno(1,2,3-c-d)pryene.

- The dominant flow pattern of ground water in the bedrock aquifer beneath the site is to the north toward the Susquehanna River. A minor component of bedrock aquifer ground water discharges toward Marsh Run Creek.

- Site characterization data from the RI indicate that the bottom of Marsh Run Creek is below the bottom level of "waste fill" at the site (see Figure 5-9). Consequently, Marsh Run Creek acts as a hydraulic barrier to prevent shallow saturated zone water flow through the landfill from the south. Furthermore, ground-water modeling data indicate that 98 percent of all flow through the shallow saturated zone travels vertically rather than horizontally. Therefore, there is little possibility of ground-water flow "eroding" contaminants laterally from the waste fill.

- Bedrock aquifer flow is from the south (flowing toward the Susquehanna River) and will carry dissolved bedrock aquifer contamination in the direction of prevailing ground-water flow (see Figure 5-9). Since the proposed remedial action at this site includes a ground-water extraction and treatment system with extraction wells located downgradient of identified site contamination, the proposed extraction system should effectively address bedrock aquifer contamination. Flow in the bedrock aquifer will also not contribute to "eroding" of contaminants from the waste fill because bedrock aquifer flow occurs below the silty clay strata that lie between the shallow saturated zone and the bedrock aquifer.

- The presence of the natural hydraulic barrier (Marsh Run Creek) and the topographically higher elevations to the southeast and east of the site further prevent potential migration of ground water from beneath the site to existing residences along Marsh Run Road. In order to induce ground-water flow from beneath the site toward the residences located southeast

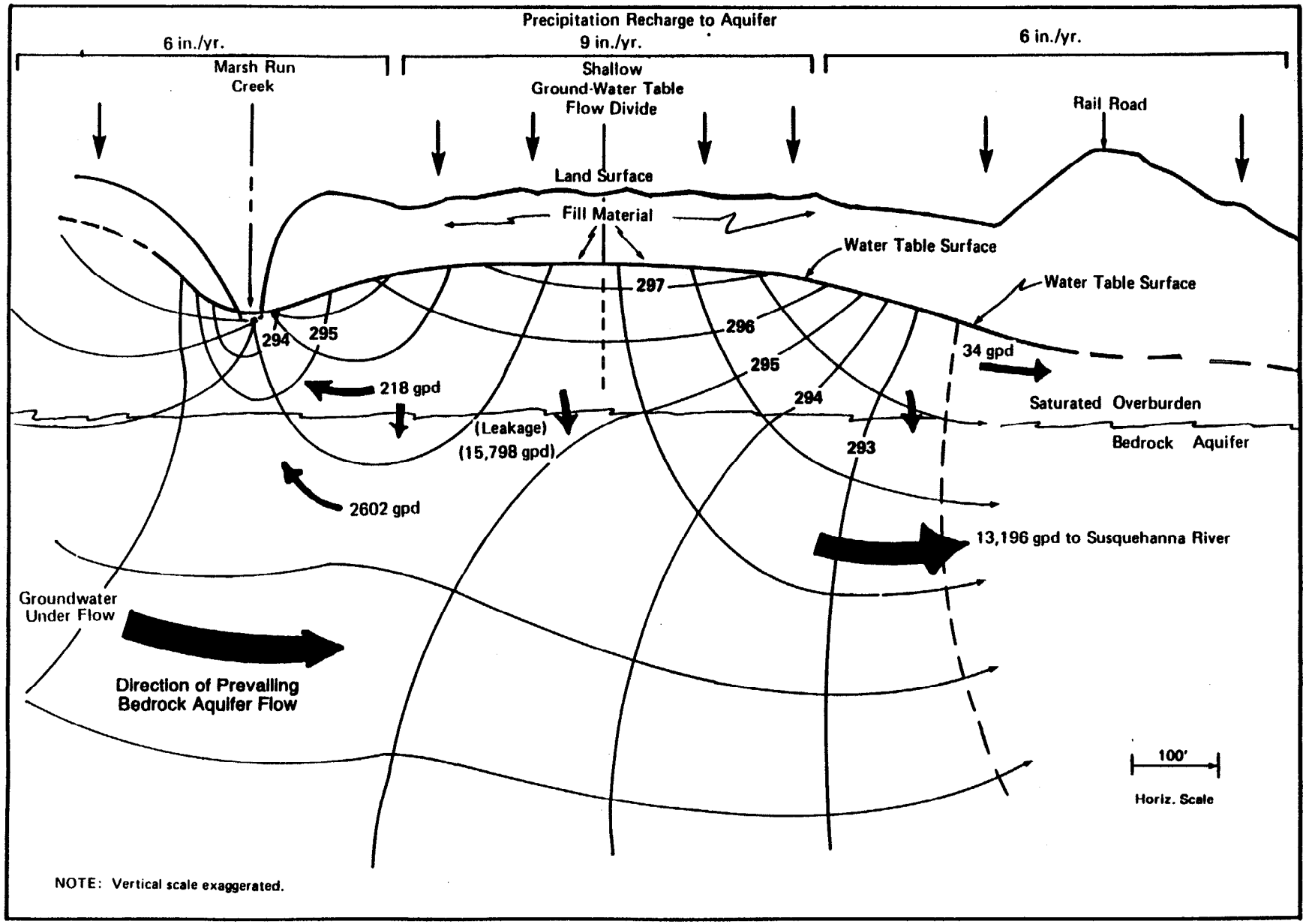

Figure 5-9. Idealized vertical cross section of ground water balance model.

and east of the site, the ground-water elevation levels at the residences and extending toward Marsh Run Creek would have to be lowered in excess of the leakage capacity of Marsh Run Creek to the bedrock aquifer. Based on present or plausible future use, such a scenario is highly unlikely. Figure 5-9 illustrates the conceptualized ground-water flow model at Marsh Run Park.

5.1.6 Residential Wells

Water samples were collected and analyzed from private water supply wells at four residences in the vicinity of the site. The residences' private supply wells sampled during the RI showed no indication that site-derived contamination has impacted the wells. Analytical results indicate the residences' supply well water quality is within State and Federal drinking water quality standards.

5.2 CONTAMINANT FATE AND TRANSPORT

Fate and transport analysis of the constituents of concern was assessed by direct observation of sampling results and computer modeling of the ground-water contaminant transport mechanisms using the USGS SUTRA numerical contaminant transport model. Results of the fate and transport modeling are as follows:

- The potential source of volatile organic contamination detected in site monitoring wells is the fill placed at Marsh Run Park. Leaching of the buried waste materials (i.e., "waste fill") by percolating rain waters has carried these volatile compounds vertically to the bedrock aquifer.

- The primary transport mechanism of VOCs is most likely by the migration of these constituents under regional and intermediate ground-water flow conditions within the fractured

bedrock aquifer to ground-water discharge points at the Susquehanna River and possibly to Marsh Run Creek.

- Abiotic and microbial transformation of presumed parent volatile compounds trichloroethene, and possibly tetrachloroethene and 1,1,2,2-tetrachloroethane has resulted in the formation of daughter volatile compounds, specifically 1,2-dichloroethene (total) and possibly vinyl chloride. These daughter compounds are more persistent (resistant to further degradation) than the parent compounds in the environment.

- Ground-water modeling of the Marsh Run Park hydrogeologic conditions indicates that the primary migration path of the VOC contamination appears to be within the fractured bedrock northward toward the Susquehanna River. A southward bedrock aquifer component of flow is quasi-radial toward the intermediate ground-water discharge point, Marsh Run Creek.

- Marsh Run Creek's location with respect to the site, serves as a hydraulic barrier which intercepts all intermediate ground-water discharge from the site. Marsh Run Creek does not allow ground-water in the bedrock aquifer or saturated overburden to migrate beyond its boundaries to residences to the south, southeast, and east. These residences are topographically higher in elevation than Marsh Run Park. The residences are uphill and upgradient of the site and exhibit no apparent site-derived contamination. Under current or realistic future ground-water pumping scenarios, site-derived contamination will not impact the nearby residences.

- Elevated trace metals detected in site monitoring wells appear to be primarily site-derived contamination, although slightly elevated metal concentrations in shallow saturated zone samples from upgradient wells indicate some contribution

from an offsite source. Based on inferred ground-water paths to the depth investigated (i.e., 50 ft) interaction between an offsite source(s) and an onsite source is unlikely, due to Marsh Run Creek's role as a hydraulic barrier.

- Trace metal mobility in ground water is low based on the comparison of dissolved (filtered) and total (nonfiltered) trace metal concentrations in the ground water, ground-water pH, and the comparison of contaminant concentrations in the shallow saturated zone and the bedrock aquifer. Ground-water data show elevated metals to be primarily restricted to suspended and particulate phases or adhered to other particles solids (undissolved phase). A detailed discussion of trace metal mobility is included in Section 5.1.2 of this report.

- The surface water of Marsh Run Creek has exhibited low levels of volatile organic concentrations adjacent to Marsh Run Park. However, surface water samples collected upstream have also shown similar compounds and concentrations. Although an upstream source of VOC contamination of Marsh Run Creek is evident, ground-water modeling indicates that ground-water base flow to Marsh Run Creek from the overburden and bedrock aquifer may also contribute to low-level surface water VOC contamination. This condition was not evident in MW-7, which is situated between Marsh Run Park and Marsh Run Creek.

- Both VOC solute mass flux via ground water to the Susquehanna and the resultant solute mass flux of Marsh Run Creek surface water discharge to the Susquehanna are greatly diluted by the Susquehanna River.

- Migration of contaminants via soil erosion or dust emissions is not a significant transport mechanism.

6. SUMMARY OF SITE RISKS

6.1 BASELINE RISK ASSESSMENT

The overall objective of the risk assessment was to evaluate the potential for effects on humans and on the environment from releases from the site. The assessment considered potential releases from the former landfill site to ground water, to surface water and sediment, to soil, and to air.

The human health risk assessment considered the following topics: (1) contaminants detected during the remedial investigation at the site; (2) potential environmental pathways by which populations might be exposed to compounds released from the site; (3) estimated exposure point concentrations of the compounds of concern; (4) estimated intake levels of the compounds of concern; (5) toxicity values of the compounds of concern; (6) past, current, and future land-use conditions; and (7) uncertainties in the exposure and toxicity assessments. The level of risk that the site posed to human health under past, current, and future use scenarios was then evaluated and discussed. The past assessment was based on past exposure scenarios (i.e., use of Marsh Run Park as a soccer field). All exposure assessments were based on the current physical conditions of the site.

6.1.1 Summary of Chemicals of Potential Concern

Tables 5-3, 5-4, and 5-5 list chemicals of potential concern for soil, surface water/sediments, and ground water, respectively. These are the compounds which were carried through the analysis to quantify the risk posed to humans by releases from the site.

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6.1.2 Exposure Pathways

In light of the current physical conditions and past, present, and potential future uses of the site, the following human exposure pathways were quantitatively evaluated:

- Past exposure of local children to surface soils onsite via direct contact, incidental ingestion, and inhalation during activities involving use of the site as a playing field. Chemical data from surface soils collected by the EPA and USACE following the Confirmation Study (Woodward-Clyde 1988) were used to estimate exposure concentrations.

- Current exposure of local children to surface water/sediment contamination via direct contact (i.e., dermal contact) and incidental ingestion during wading and other recreational activities;

- Current exposure of local residents to contaminants in surface water via ingestion of fish from Marsh Run Creek;

- Future exposure of hypothetical onsite residents to ground-water contaminants via ingestion of ground water from onsite wells.

Evaluation of risks associated with the past use of Marsh Run Park as a soccer field (i.e., dermal exposure, incidental ingestion of cover soils and inhalation of dust) leads to the conclusions that this use resulted in little or no risk to the children using the field. The quantification of noncarcinogenic risks shows that hazard indexes for both average (2×10^{-2}) and worst case (2×10^{-1}) scenarios are both less than 1, indicating no expectation of noncarcinogenic effects. The lifetime excess cancer risk for both average (5×10^{-9}) and worst

cases (3×10^{-7}) is orders of magnitude less than the risk level of one in a million, indicating that this risk could not be distinguished from background risk.

Evaluation of the current use scenario of children playing in Marsh Run Creek indicates that there is little cause for concern from contact with surface water or sediment. The current use scenario takes into account the current physical conditions of the site and the present limitations to its use as a recreational facility. Risk from exposure to both non-carcinogenic and carcinogenic compounds is within acceptable ranges even under the conservative assumptions of the reasonable worst case exposure scenarios. (Non-carcinogenic reasonable worst case risk = 4×10^{-2}. Carcinogenic reasonable worst case risk = 8×10^{-7}).

Evaluation of risk from ingestion of fish from Marsh Run Creek indicates that there are no potential noncarcinogenic effects and that reasonable worst case potential carcinogenic risk (3×10^{-7}) is at the lower end of the range of acceptable risks for remediation alternatives at Superfund sites (NCP, 300.430(e)(2)(i)(A), March 1990). In addition, field investigation during the RI suggests that there are no fish of edible size in Marsh Run Creek to make this a possible exposure pathway.

Evaluation of the risk from ingestion of onsite ground water (i.e., future use scenario) indicates that there would be potential risk associated with this exposure pathway. The hazard quotient associated with arsenic (average = 0.54; maximum = 2.2) indicates that ingestion of this element in drinking water would be at unacceptable levels regarding noncarcinogenic effects. In addition the carcinogenic risks (i.e., from volatile organic compounds) from drinking this ground water would not be acceptable (average risk = 1.1×10^{-3}; reasonable worst case risk = 4.5×10^{-3}). As stated previously, this is a highly unlikely exposure scenario since residential development is not likely to occur on the site. The site has very low growth potential. Development is unlikely to occur on a former landfill site. The site itself would be a wetlands/marsh area if it were not for the waste deposited on the site and the cap

covering the fill. The area is in a floodplain and is bounded by r
road tracks. All of these factors combine to make any development
site unlikely. In addition, development is not likely to occur in
north of the site and adjacent to the Susquehanna since this area i
wetlands and is prone to flooding.

Evaluation of the offsite residential wells in the neighboring area
showed that these wells did not contain contaminants and hence pose
no risk from the ingestion of water from the residential wells. Gr
water monitoring and modeling described previously indicate that cu
residents are not downgradient of the site and that contaminants fr
the site will not impact residential wells. This indicates that th
is no risk to current residents in the vicinity of Marsh Run Park.

6.1.3 Conclusions

Based on the above analysis, although there is apparent local site-related ground-water contamination, there are no risks identified wi the site's existing conditions or past uses of the site as a recreat field. Potential future risks may exist, however, if domestic water supply wells were installed downgradient of the site. It is highly unlikely that domestic wells will be installed in this proximity, since the area downgradient of the site is wetlands, which are prone to flooding.

Offsite sources of contamination to the west of Marsh Run Park (i.e., upstream of the site) appear potentially to have contributed contamination to Marsh Run Creek.

6.2 BASELINE ECOLOGICAL ASSESSMENT

The vicinity of the Marsh Run site is largely grassland with boundary areas of upland forest and swamp. Terrestrial wildlife is expected to be limited to small mammals, birds, amphibians, reptiles, and assorted invertebrates. Larger wildlife are expected to be restricted from the

site by a fence. The Marsh Run Creek borders the site for a small area before its confluence with the Susquehanna River. High sediment loads are expected to have adverse effects on the benthic invertebrate community of the stream. The sediment load appears to originate upstream from the Marsh Run site, as the thick vegetative cover on the landfill cap precludes the generation of excess sediments. The observed fish community is typical of streams classified as warmwater fisheries by the Pennsylvania Department of Environmental Resources (PaDER). The species observed and their sizes are not expected to be pursued as sport or food species by humans.

The site control present on the site (cover soil, fence separating NCAD, etc.) makes the potential for a terrestrial exposure route unlikely. The presence of contaminated ground water and the relationship between ground-water elevation, gradient, and stream base flow indicate a potential aquatic exposure route. The invertebrate and fish community present have the potential to be exposed to contaminants present in ground water.

7. DESCRIPTION OF ALTERNATIVES

7.1 INTRODUCTION AND DESCRIPTION OF EVALUATION PROCESS

The overall objective of the CERCLA RI/FS process is the identification of the most appropriate alternative for remediation of a site. In accordance with SARA, emphasis is placed on remedial technologies that reduce the toxicity, mobility, and volume of wastes and contaminated materials. In addition, SARA requires EPA to select a remedy that utilizes permanent solutions, alternative treatment technologies, or resource recovery techniques to the maximum extent practicable. This RI/FS is conducted in accordance with CERCLA/SARA and Commonwealth of Pennsylvania guidance for remediation of hazardous waste sites. At this time, the Marsh Run Park site is not listed on EPA's NPL. As such, it has not been specifically identified for priority evaluation by EPA under CERCLA for remediation. However, since the site investigation is being conducted under the Army's Defense Environmental Restoration Program, the CERCLA requirements per the NCP on format and contents of the RI/FS and ROD have been used. State guidance is included in Section 504 of Pennsylvania's Hazardous Sites Cleanup Act, which governs remedial action at hazardous waste sites in Pennsylvania. This section states that "...until final cleanup standards have been promulgated, State cleanup standards shall be those cleanup standards applicable under section 121 of the Federal Superfund Act."

Pursuant to CERCLA/SARA guidance (NCP), the major steps of the multi-phased approach to the FS process are

1. Establishment of Remedial Action Objectives
2. Development of General Response Actions
3. Identification of Potential Treatment and Disposal Technologies
4. Technology Screening
5. Development of Remedial Action Alternatives
6. Detailed Analysis of Remedial Action Alternatives
7. Summary and Comparison of Remedial Action Alternatives

This section presents the first steps of the FS process for the Marsh Run Park site. A review of applicable or relevant and appropriate Federal and State environmental and public health requirements (ARARs) for remedial actions is presented in Section 7.2. Remedial action objectives are outlined in Section 7.3, and general response actions are presented in Section 7.4. The initial identification and screening of remedial technologies was completed to identify technically feasible technologies for development into remedial alternatives. The detailed analysis and summary of remedial action alternatives is included in Section 7.5 of this document.

7.2 APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL AND PUBLIC HEALTH REQUIREMENTS

Pursuant to SARA and the NCP, the development and evaluation of remedial actions under CERCLA must include a comparison of all alternative site remedies to all applicable or relevant and appropriate requirements (ARARs). In recognition of the unique characteristics and circumstances associated with remediation of individual sites, neither SARA nor the NCP provide specific standards for the determination of whether a particular remedy provides sufficient cleanup at a given site. It is essential that any remedial action selected must meet all ARARs unless specific waivers have been granted.

The following subsections discuss in detail the ARARs that must be considered for evaluation of remedial activities at the Marsh Run Park site.

7.2.1 State Hazardous Waste Cleanup Laws

Remedial action at the former Marsh Run Park landfill will be performed in accordance with the Pennsylvania Hazardous Sites Cleanup Act (Pennsylvania Statues--Title 35--Health and Safety). The Pennsylvania Hazardous Sites Cleanup Act governs remediation of non-NPL hazardous waste sites in Pennsylvania. The legislation is administered by the PaDER Bureau

of Waste Management. At this time, Pennsylvania has adopted the cleanup standards specified in Section 121 of CERCLA and the subsequent revisions to CERCLA contained in SARA.

7.2.2 Resource Conservation and Recovery Act Requirements

The Federal Resource Conservation and Recovery Act (RCRA) serves as the basis for development of technology-based requirements governing the identification and listing, storage, transportation, and disposal of hazardous wastes at active or proposed hazardous waste facilities (generators, transporters, storage or disposal facilities). RCRA requirements include ground-water protection, landfill permitting, design and performance standards, and standards for waste piles and surface impoundments. For this project, ARARs under RCRA relate to offsite disposal of waste materials from the site and to siting and closure permitting for onsite treatment actions. Specifically, 40 Code of Federal Regulations (CFR) 261 (Identification and Listing of Hazardous Waste), 40 CFR 263 (Standards Applicable to Transporters of Hazardous Waste), and 40 CFR 268 (Land Disposal Restrictions) will apply to removal and transportation of waste materials from the site. All offsite hazardous waste disposal shall be at an RCRA-permitted treatment and disposal facility.

RCRA Land Ban Regulations

The requirements of 40 CFR 268 [the Land Disposal Regulations (LDR)] are of particular relevance to implementation of remedial alternatives at hazardous waste sites. The 8 November 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA serve as the basis for the LDRs. On 7 November 1986, the first of the LDRs went into place with the publication of treatment standards for spent solvent and dioxin-containing wastes. Shortly thereafter, EPA issued regulations pertaining to land disposal of "California List" wastes. Regulations for the "first third" wastes

were issued on 17 August 1988. Regulations for the "second thi were issued on 8 June 1989, and regulations for the "third thir were proposed on 22 November 1989.

The Land Disposal Regulations (often referred to as the "Land B prohibit land disposal of regulated wastes that have been classi RCRA listed hazardous wastes (in accordance with 40 CFR 261) or characteristic wastes. RCRA characteristic wastes are materials are considered reactive, ignitable, corrosive, or toxic in accord with specific testing methodology as identified in 40 CFR 261. T Toxicity Characteristic Leaching Procedure (TCLP) extraction proc is used by EPA to define if a waste is a "toxic" characteristic w Based on what is known about waste materials at the Marsh Run Park it is possible that much of the "waste fill" materials will be cl as RCRA characteristic waste based on TCLP concentrations of solv heavy metals. TCLP testing has not been conducted on any soil sampl from the site so it is not possible to determine at this time what centage of "waste fill" material would be considered as RCRA charac tic waste. However, results of the VOSS survey show contaminant co trations in the shallow saturated zone that are representative of c inant leaching in that area. Actual TCLP analyses will be run of samples during the pre-design phase for any material considered for offsite disposal. TCLP extract limits for land disposal of wastes with contaminants as identified at the Marsh Run Park site are liste in Table 7-1. Land Ban considerations will affect all offsite dispo options and may impact certain onsite remedial technologies.

EPA has issued guidance regarding the impact of land disposal regulat on Superfund response actions (EPA 1987). Four essential questions m be addressed in determining if the LDRs are ARARs:

1. Is the waste being placed?
2. Is the waste an RCRA hazardous waste?
3. Is the waste restricted?
4. Is the waste soil and debris?

TABLE 7-1 TCLP EXTRACT CONCENTRATIONS FOR RCRA CHARACTERISTIC WASTES

Constituent	Regulatory Level (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon Tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0[a]
m-Cresol	200.0[a]
p-Cresol	200.0[a]
Cresol	200.0[a]
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichlorobenzene	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13[b]
Endrin	0.02
Heptachlor (and its hydroxide)	0.008
Hexachlorobenzene	0.13[b]
Hexachloro-1,3-butadiene	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0[b]
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2

Reference: 40 CFR Part 261 et al. EPA 29 March 1990/

(a) If o-, m-, and p-cresol concentrations cannot be differentiated, the total cresol (D026) concentration level is used. The regulatory level for total cresol is 200 mg/L.

(b) Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

The most significant question is that of "placement." EPA's proposed revisions to the National Contingency Plan (53 FR 51435) state that land disposal restrictions would only be triggered when hazardous wastes are "placed" in a land disposal unit. Placement is defined as

1. Depositing wastes in a land disposal unit for the first time.

2. Removing wastes from one unit and depositing them in another unit with or without intermediate treatment.

3. Consolidating wastes from several units into one unit.

4. Removing wastes from a land disposal unit, treating them, and redepositing them in the same unit.

Moving wastes entirely within a unit or treating wastes in situ would not be considered "placement." Therefore, LDRs would not impact remedial activities in which containment alone or containment with in situ treatment is proposed.

At present, EPA has also proposed two options to reduce the impact of land disposal regulations on Superfund cleanups:

1. Excavation, treatment, or redeposition in the same unit or area of contamination would not constitute land disposal and, therefore, would not trigger the LDRs.

2. Wastes that are excavated, treated, and redeposited elsewhere on the site, in a different, new or existing, unit would not trigger the LDRs, recognizing that a CERCLA site is essentially one large "unit" for the purpose of making remedial decisions.

These options have been proposed for public comment in the Federal Register.

The PaDER Bureau of Waste Management is responsible for implementation of RCRA in Pennsylvania. PaDER was granted primacy for implementation of RCRA in January 1986; however, EPA still retains authority for implementation of certain portions of the legislation, most notably many of the provisions of the 1985 HSWA.

7.2.3 Federal/State Drinking Water Standards

The Federal Safe Drinking Water Act (SDWA), passed by Congress in 1974 and amended by the Safe Drinking Water Act Amendments of 1986 (PL 99-339), establishes national interim primary drinking water standards. Primary drinking water standards are set as maximum contaminant levels (MCLs). MCLs represent the maximum allowable level of selected contaminants to which "...it is economically and technologically feasible to ascertain the level of such contaminant in water in public water systems." MCLs are developed by EPA based upon maximum contaminant level goals (MCLGs). MCLGs are nonenforceable health goals at which "...no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety." The SDWA tasks EPA with development of MCLs and MCLGs for drinking water contaminants. Pursuant to the SDWA, EPA sets MCL standards for drinking water contaminants "as close to the MCLGs as is feasible," where feasible means, "feasible with the use of the best technology, treatment techniques, and other means, which the Administrator finds, after examination for efficacy under field conditions and not solely under laboratory conditions [to be] available (taking costs into consideration)."

The SDWA also calls for EPA to establish health advisories for contaminants found in drinking water. Various advisories including one day, ten day, longer term, and lifetime advisories have been developed for many drinking water contaminants. Appendix C includes a summary table identifying the MCLs, MCLGs, and drinking water health advisories for

certain environmental contaminants that have been finalized or proposed as of October 1989. This list is continually updated by EPA as health assessments of other environmental contaminants are compiled. EPA is also directed under the SDWA to establish secondary maximum contaminant levels (SMCLs). SMCLs address aesthetic considerations such as odor, turbidity, and taste. SMCLs issued to date by EPA are also included in Appendix C.

Under Section 121 of CERCLA, remedial actions must require "...a level or standard of control that at least attains Maximum Contaminant Level Goals established under the Safe Drinking Water Act...." EPA's ground water quality guidance encourages that a remedial action should attain MCLGs for ground water or surface water when the MCLG is above zero. Where the MCLG has been set at zero, "...the MCL promulgated for that contaminant under the SDWA shall be attained..." (EPA 1990). Under certain circumstances, however, a waiver of the requirement to meet all ARARs, such as MCLs, can be attained and a less stringent alternate concentration level (ACL) may be set and approved. Under new Section 121(d)(2)(B)(ii) of SARA, ACLs cannot be established

> "...if the process assumes a point of human exposure beyond the facility boundary. The only exception is in cases of a known or projected point of entry of groundwater to which such a standard would apply, into surface water which is a reasonable distance from the facility boundary. If at such points of entry, or at any point downstream where accumulations of constituents may occur, there will be no statistically significant increase of such constituents in the surface water from such groundwater, and there are enforceable measures that preclude human exposure at any point between the facility boundary and points of entry into surface water, an alternate concentration level process may assume such points of entry into surface water as the point of human exposure."

EPA's "Interim Guidance on Compliance With Applicable or Relevant and Appropriate Requirements, July 1987" indicates that "for water that is or may be used for drinking, the Maximum Contaminant Levels (MCLs) set under the Safe Drinking Water Act are generally the applicable or relevant and

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appropriate standards." Section 300.430(e)(2)(B) of EPA's revised NCP clarifies and restates this guidance. Therefore, MCLs will be used as the cleanup standard for ground water at this site.

In Pennsylvania, the State has primacy for the Safe Drinking Water Act, and has adopted the Federal primary and secondary drinking water standards. Table 7-2 summarizes the water quality limits that will govern remedial actions at the Marsh Run Park site. The PaDER Bureau of Community Environmental Control is responsible for administration of the SDWA in Pennsylvania.

PaDER has issued a Proposed Ground Water Quality Protection Strategy (dated December 1989) that addresses site remediation of contaminated ground water. Section IV, "Assessment and Remediation," identifies ground water cleanup goals as follows:

> "When remediation results in contaminants remaining on the site above background levels, the owner/operator will not be released from liability. It is assumed that, where it is technologically infeasible to achieve background levels, and where health and environmental protection levels have been achieved, additional remediation to approach background levels will not be required unless the Department finds additional information or unforeseen or changed circumstances, such as newly identified contaminants on the site, new toxicological information on the contaminants that shows that a risk to public health or the environment still exists, a determination that information about the site has been falsified or a determination that additional remediation has become technologically feasible. In such cases, the Department may require the application of any newly developed technology at the site as it becomes available and technologically feasible for the owner/operator to do so, provided that application of the new technology will not cause more environmental harm than the contaminants.
>
> Human health-based protection levels will be based on the more stringent of promulgated Maximum Contaminant Levels (MCLs) or Secondary Maximum Contaminant Levels (SMCLs). If no promulgated MCL or SMCL for a parameter exists, the Department will develop protection levels for threshold (non-carcinogen) and non-threshold (carcinogen) parameters as follows:
>
> 1. Threshold - application of margins of safety to the results of toxicity testing to prevent the occurrence of a threshold effect.

TABLE 7-2 MAXIMUM CONTAMINANT LEVELS (MCLs) FOR SELECTED CONTAMINANTS IN WATER SUPPLY SYSTEMS IN PENNSYLVANIA

Compound	MCL (µg/L)[a]
Volatile Organics	
Trichloroethylene	5.0
cis-1,2-Dichloroethylene	70.0[b]
trans-1,2-Dichloroethylene	100.0[b]
1,1,1-Trichloroethane	200.0
1,1-Dichloroethylene	7.0
1,2-Dichloroethane	5.0
Vinyl Chloride	2.0
Carbon Tetrachloride	5.0
Tetrachloroethene	5.0[b]
Toluene	2,000.0[b]
Xylenes	10,000.0[b]
Benzene	5.0
Ethylbenzene	700.0[b]
1,1,2-Trichloroethane	3.0[c]
PAHs [Benzo(a)Pyrene]	0.2[c]
Inorganics	
Antimony	10.0/5.0[c]
Arsenic	50.0
Barium	1,000.0[a]/5,000.0[b]
Beryllium	1/2[c]
Cadmium	10[a]/5.0[b]
Chromium	50[a]/100.0[b]
Copper	1,300.0[b]
Cyanide	200.0[c]
Fluoride	4,000.0
Lead	5.0
Mercury	2.0
Nickel	100.0[c]
Selenium	10[a]/50.0[b]

(a) Final MCL, unless otherwise noted.
(b) Proposed MCL.
(c) Tentative MCL.
(d) This listing is not a complete listing of all compounds for which MCLs have been developed. It is meant to represent only compounds that have been previously detected in ground water or surface water sampling at Marsh Run Park.

2. Non-threshold - Use of a risk management level on one excess case of cancer in a population of one million (1×10^{-6}) over a 70-year lifetime. For those carcinogens for which cancer potency (slope factor) values have not been developed, the Department will set protection levels as not detectable by the most sensitive analytical procedure or at a background, whichever is greater.

For parameters with insufficient toxicity data, the Department may use data on related chemicals in developing protection levels."

7.2.4 Federal Ambient Water Quality Criteria

The Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 and the Water Quality Act of 1987, commonly known as the Clean Water Act (CWA), was enacted to "...restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 303 of the CWA establishes levels of specified pollutants that ambient water can contain and still be suitable for certain uses (i.e., recreation, fish and wildlife, water supply, agricultural, and industrial use). Section 301 of the CWA identifies criteria for listing toxic pollutants and establishing effluent guidelines and pretreatment standards. Section 307 establishes effluent standards for pretreatment and toxic substances based upon Best Available Technology (BAT) for control.

Federal ambient water quality criteria documents currently have been published for pollutants listed as toxic under CWA. These criteria are unenforceable guidelines that may be used by states to set surface water quality standards. Under SARA, remedial actions must attain a level of standard of control equivalent to these criteria unless a waiver has been granted.

The water quality criteria are generally listed in categories representative of differing surface water use designations. Concentrations represent the maximum level of a contaminant that, if not exceeded, should protect most aquatic life against acute and chronic toxicity.

Water quality criteria that have been published by EPA as of January 1 are listed in Appendix D.

CWA authorizes establishment of the National Pollutant Discharge Elimination System (NPDES). NPDES regulates direct discharges into navigable waterways. All discharges are subject to NPDES permits which set limits on water quality of discharges based on the provisions of sections 301, 303, and 307 of the CWA.

For the Marsh Run Park project, the CWA will apply to discharge of effluent from onsite water treatment processes, if such processes are used. Regulations concerning effluent water quality are addressed in 40 CFR 122 and 123. The Commonwealth of Pennsylvania is authorized by EPA to administer the NPDES program (40 CFR 123) through Pennsylvania's Clean Streams Law. The Bureau of Water Quality Management in PaDER is responsible for administration of the NPDES program in Pennsylvania.

In addition to NPDES considerations, Sections 401 and 404 of the CWA address minimization of aquatic impacts associated with the discharge of fill material from wetlands. Federal Executive Orders 11988 and 119 state procedures for floodplain management and wetland protection.

7.2.5 State Water Quality Standards

Pennsylvania's Water Quality Standards [Pennsylvania (Pa.) Code, Title 25--Environmental Resources, Chapter 16--Water Quality Toxics Management Strategy--Statement of Policy], Adopted 10 March 1989, and Chapters 91-95 and 97 of Title 25 govern Pennsylvania's administration of the Federal Clean Water Act. Pennsylvania, in its CWA implementation responsibility, has developed water quality criteria for toxic substances. Pennsylvania's water quality criteria are presented in Appendix D. These water quality criteria are used as the basis for development of effluent limits in NPDES permits in Pennsylvania and are addressed in Title 25, Chapter 93--Water Quality Standards. The procedures for NPDES applications, permitting, and monitoring are addressed

in Pa. Code, Title 25--Environmental Resources, Chapter 92--National Pollutant Discharge Elimination System. Title 25, Chapter 95--Wastewater Treatment Requirements sets forth waste treatment requirements for all discharges and procedure for special circumstances including discharges to lakes, ponds, and impoundments. Chapter 97--Industrial Wastes applies to the discharge of industrial wastes to waters of the Commonwealth. Chapter 101--Special Water Pollution Regulations sets forth specific provisions concerning discharge of industrial wastes to Pennsylvania waters. Since Marsh Run Park is not currently listed on EPA's NPL, it will be necessary to apply for an NPDES permit for onsite waste treatment units that will discharge to waters of the Commonwealth.

7.2.6 State and National Air Quality Standards

In response to the Clean Air Act (CAA) of 1971 and subsequent amendments, EPA has established National Ambient Air Quality Standards (NAAQS). NAAQS are primary (health based) and secondary (welfare based) standards established for control of specific air emissions, as identified in Section 109 of the CAA. Table 7-3 identifies the NAAQS identified to date by EPA.

In addition to the NAAQS, pursuant to Section 112 of the Federal Clean Air Act, EPA has identified pollutants "...for which no ambient air quality standard exists, but that cause or contribute to air pollution that may reasonably be anticipated to result in an increase in mortality, or in serious irreversible or incapacitating reversible illness." EPA has developed National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for eight air contaminants as of December 1989. A listing of contaminants for which NESHAPS have been promulgated is presented in Table 7-4. These standards will be applicable to remedial activities resulting in airborne discharges from the site.

EPA has also established New Source Performance Standards (NSPS) under Section 111 of the CAA. These standards apply to specific types and target one or more compounds discharged by the source type. The NSPS

TABLE 7-3 EPA AMBIENT AIR QUALITY CRITERIA (NAAQS)

Chemical	Concentration[a] ($\mu g/m^3$)
Carbon Monoxide	40,000 (1 hour)[b] 10,000 (8 hours)[b]
Hydrocarbons (nonmethane)	160 (3 hours)[b][c][d] 20 ppd[e]
Lead	1.5 (90 days)
Nitrogen Dioxide	100 (1 year)[f]
Particulate Matter	260 (24 hours)[b] 75 (24 hours)[g]
Ozone	235[h]
Sulfur Dioxide	80 (1 year)[e]

(a) National Ambient Air Quality Standards.
(b) Annual maximum concentration is not to be exceeded more than once per year.
(c) As a guide in devising implementation plans for achieving oxidant standards.
(d) Not adopted by the Maryland Air Management Administration.
(e) Code of Maryland Regulations.
(f) Annual arithmetic mean concentration.
(g) Annual geometric mean concentration.
(h) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than one.

TABLE 7-4. SUMMARY OF NESHAPS PROMULGATED BY EPA UNDER SECTION 112 OF THE CLEAN AIR ACT.

EPA'S TOXIC POLLUTANT EVALUATION AND CONTROL PROGRAM[1]

Preliminary Health and Source Screening	Detailed Assessment	Intent to List Section 112	Decision not to Regulate	Listed Under Section 112[4]	NESHAP Proposed	NESHAP Promulgated
Propylene Oxide[7]	Chlorine and HCl[8]	Chromium	Toluene	Asbestos	Benzene	Mercury
Ammonia[7]	Phosgene[6]	Carbon tectrachloride	POM	Beryllium	Coke-oven emissions	Beryllium
Styrene[7]	Acetaldehyde[7]	Ethylene oxide	CFC-113	Vinyl chloride		Asbestos
Ethyl Chloride	Acrolein[9]	Chloroform	Methyl chloroform	Coke-oven emissions		Vinyl chloride
Methyl Methacrylate[7]	Hydrogen sulfide[7]	Ethylene dichloride	Manganese	Benzene		Benzene
Meleic Anhydride[7]	Beryllium[2]	Cadmium	Chlorobenzenes	Arsenic		Radionuclides
Phthalic Anhydride[7]	Dibenzofurans[6]	1-3-Butadiene	Vinylidene chloride	Radionuclides		Arsenic
Florides & Comps.	Asbestos2	Methylene chloride	Hexachlorocyclo-pentadiene	Mercury		
Phosphorus & Comps.	Dioxins[6]	Perchloroethylene	Chloroprene			
Hydrocyanic acid [7]	Formaldehyde	Trichloroethylene	Acrylonitrile3			
Selenium & Comps.[6]	Toluene disocyanate[6]		Nickel			
Mercuric Chloride[6]	Methyl isocyanate[6]		Phenol			
Bromine & Inorganic Compounds	Mineral fibers[6]		Copper			
Methanol[5]	Epichlorohydrin[5]		Zinc/zinc oxide			
Contaminant asbestos[6]			Epichlorohydrin			
			Naphthalene			
			Sodium Hydroxide			

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1 As of January 31, 1989 (received from U.S. Environmental Protection Agency, Research Triangle Park, NC).
2 Reassessment of original health effects information.
3 Referred to States for evaluation.
4 EPA is also regulating wood stove emissions and municipal waste combustor emissions under section 111 (New Source Peformance Standards) which will siginficantly reduce the toxic components of these emissions. Onboard controls for gasoline vapors from vehicle refueling are being developed under Title II of the CAA.
5 Reassessed based on noncancer health effects.
6 Ongoing
7 Incorporated into Source Category Ranking System. Pollutant specific determination will not be made.
8 Hold
9 Promoted initiatives underway in 2 States.

would apply to implementation of an onsite incinerator at the Marsh Run Park site.

PaDER has adopted in its entirety the Standards of Performance for New Stationary Sources, promulgated in 40 CFR Part 60 by the Administrator of EPA pursuant to Section 111(b) of the Federal Clean Air Act (U.S.C. Section 7411). PaDER has also adopted in its entirety the NAAQS (Section 109 of CAA) and the NESHAPs (Section 112 of CAA). Air pollutant discharges are regulated under Pa. Code, Title 25--Environmental Resources, Subpart C--Protection of Natural Resources, Article III--Air Resources, Chapter 121 (Pennsylvania Air Pollution Control Regulations) and Pa. Code, Title 35--Health and Safety, Chapter 23--Air Pollution (Pennsylvania Air Pollution Control Act).

Permits are required for any onsite stationary air pollution source as indicated in Section 4006.1 of the Pennsylvania Air Pollution Control Act. Permitting and approval of onsite hazardous air pollutant sources are addressed in Chapter 127 of the Pennsylvania Air Pollution Regulations. Chapter 128 of the Pennsylvania Air Pollution Regulations addresses other ARARs that require compliance during remedial alternative implementation, including standards for fugitive emissions [paragraph (para.) 123.1], particulate matter emissions (para. 128.11), odor emissions (para. 123.31), and visible emissions (para. 123.41-123.43). In addition, emissions are subject to all other requirements of the CAA.

7.2.7 Other Action-Specific Federal ARARs

The following is a listing of other Federal regulations that may be action-specific ARARs, depending on the remedial action selected.

- Occupational Safety and Health Administration (OSHA) Health and Safety Requirements (29 CFR, Parts 1910, 1926, and 1904). Addresses requirements for worker safety during remedial investigation and remedial action activities at hazardous waste sites.

- Department of Transportation (DOT) Rules for Hazardous Materials Transport (49 CFR, Parts 107, 171.1-500). Addresses requirements for marking, manifesting, handling, and transport of hazardous materials; applicable if offsite treatment or disposal of wastes is required.

- Threshold Limit Values, American Conference of Governmental Industrial Hygienists (ACGIH). Provides standards for respiratory protection; applicable to air concentrations during remedial activities.

7.2.8 Other Action-Specific State ARARs

In addition to the Federal and State ARARs addressed previously, the following State regulations may be action-specific ARARs, depending on the remedial alternative selected.

- Pennsylvania Clean Streams Law - Chapter 102 (25 Pa. Code, Chapter 102). Provides requirements for erosion and sediment control provisions for earth-moving activities; jointly administered by PaDER Bureau of Soil and Water Conservation and York County Soil Conservation District.

- Pennsylvania Dam and Safety Encroachments Act of 1978 (25 Pa. Code, Chapter 105). Provides regulations related to encroachments in wetlands areas; administered by PaDER Bureau of Water Resources Management, Division of Rivers and Wetlands.

- Pennsylvania Flood Plain Management Act of 1978 (25 Pa. Code, Chapter 106). Provides regulation of obstructions constructed, owned, or maintained by a political subdivision of the Commonwealth located within the 100-year

floodplain as delineated by FEMA Flood Hazard Boundary Maps; administered by PaDER Bureau of Dams and Waterway Management.

- Pennsylvania Water Well Drillers License Act of 1956 (25 Pa. Code, Chapter 107). Provides for licensing of well drillers, well construction records, well abandonment, and pollution prevention of underground waters; administered by PaDER Bureau of Topographic and Geologic Survey.

- Pennsylvania Historic Preservation Act of 1978 (71 Pa. Statutes, Section 1047.1 et. seq.).

- Pennsylvania Solid Waste Management Act of 1980 (25 Pa. Code, Chapter 75). Addresses requirements for identification, storage, collection, treatment, processing, and disposal of non-hazardous (Subchapter D) and hazardous (Subchapter C) wastes, and addresses State implementation of RCRA; administered by PaDER Bureau of Waste Management.

7.2.9 Circumstances In Which ARARs May Be Waived

Pursuant to Section 300.430(f)(3) of CERCLA and Section 504(e) of the Pennsylvania Hazardous Sites Cleanup Act (HSCA), several conditions presently exist under which all ARARs need not be attained. These waivers apply only to meeting ARARs with respect to remedial activities occurring onsite. A waiver must be invoked for each ARAR that will not be attained or exceeded. Other statutory requirements, such as that remedies must be cost-effective, cannot be waived.

The six criteria for waivers of ARARs provided for by CERCLA Section 121(d)(4) are as follows:

1. The remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed.

2. Compliance with such requirement at the facility will result in greater risk to human health and the environment than alternative options.

3. Compliance with such requirement is technically impracticable from an engineering perspective.

4. The remedial action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation, through use of another method or approach.

5. With respect to a State standard, requirement, criteria, or limitation, the State has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial actions.

6. In the case of a remedial action to be undertaken solely under Section 104 using the Fund, selection of a remedial action that attains such level or standard of control will not provide a balance between the need for protection of public health and welfare and the environment at the facility under consideration, and the availability of amounts from the Fund to respond to other sites which present or may present a threat to public health or welfare or the environment, taking into consideration the relative immediacy of such threats.

Criterion No. 6 is not applicable for this project since the Marsh Run Park site is not an NPL site and funding is not provided for by the Superfund. One additional criterion from Section 504 of the HSCA is applicable for this project. It states that PaDER may modify an ARAR if "the remedial action selected will not provide for cost-effective response."

7.3 REMEDIAL ACTION OBJECTIVES

Based upon the results of the RI and the baseline risk assessment (public health and environmental evaluations), general, conceptual-level remedial action objectives for the Marsh Run Park site have been developed. Remedial action alternatives are long-term permanent remedies that minimize or prevent hazardous substance releases from the site. Pursuant to SARA, remedial alternatives will include a preference for permanent treatment and/or destruction of contaminants at the site. The specific remedial action objectives for the Marsh Run Park site are

1. Reduce or eliminate the chlorinated solvent contamination present in the bedrock aquifer to ground-water cleanup levels (MCLs). The cleanup standards to be achieved for volatile organic contaminants are as follows:

   trichloroethene - 5 µg/L
   cis-1,2-dichloroethene - 70 µg/L
   trans-1,2-dichloroethene - 100 µg/L
   vinyl chloride - 2 µg/L
   tetrachloroethene - 5 µg/L

2. Reduce or eliminate metals and volatile organic solvent contamination present in the shallow saturated zone to ground-water cleanup levels (MCLs). VOC cleanup levels are listed above. The cleanup standards to be achieved for inorganic contaminants are as follows:

   Arsenic - 30 µg/L
   Barium - 5,000 µg/L
   Beryllium - 0.5 µg/L
   Cadmium - 5 µg/L
   Chromium - 100 µg/L
   Copper - 1,300 µg/L

Cyanide - 200 µg/L
Lead - 5 µg/L
Mercury - 2 µg/L

3. Reduce or eliminate the threat to future ground-water contamination by containment, treatment, or removal of the solvent contamination source area within the landfill, as identified based on the RI and the VOSS.

4. Reduce or eliminate future contaminant releases to Marsh Run Creek and the Susquehanna River through surface water or sediment pathways.

5. Reduce or eliminate future contaminant releases to Marsh Run and the Susquehanna River through ground-water pathways.

It should be noted that cleanup of surface water at the site should address contamination emanating from Marsh Run Park only. It has been established that volatile organic solvent and metals contamination has been identified in surface water samples upstream of the Marsh Run site. This observation indicates that an upstream source is partly responsible for observed contamination identified in Marsh Run Creek. Furthermore, the risk assessment indicates that the contamination levels identified in surface water and sediment samples, both at and upstream of the Marsh Run Park site, do not represent a public health risk. Therefore, remediation of surface water at the site will consist only of prevention of future contaminant releases, via surface water or ground-water pathways, from the Marsh Run Park site. Restoration of surface water to ambient water quality criteria levels will not be a component of this FS.

7.4 GENERAL RESPONSE ACTIONS

Based upon the information obtained through the RI and previous investigations and the remedial action objectives, an inventory of general response actions for the Marsh Run Park site was developed. The response

actions were developed to identify the universe of technologies that have demonstrated promise in remediation of site problem areas similar to that identified at the Marsh Run Park site. Evolving technologies, such as those being demonstrated under EPA's Superfund Innovative Technology Evaluation (SITE) program and technologies under investigation and development through the DOD Installation Restoration Program, were examined in addition to traditionally accepted remedial action technologies. A summary of general response actions is presented in Table 7-5. The identified response actions and technologies include source-control measures and ground-water control measures. The "No Action" alternative was used as a baseline to evaluate comparative advantages/disadvantages of other alternatives.

Remediation of the Marsh Run Park site addresses two potential problem areas: (1) source area remediation, and (2) ground-water contamination. Surface water and sediment contamination were not addressed, pursuant to the results of the baseline risk assessment. Contamination of surface soil was not identified as a problem area, since surface soil in the former landfilled area was uncontaminated clean fill deposited on the site by the current owner. Chemical analysis of surface soil samples initiated by both the Army and PaDER did not identify contaminant levels of concern in the surficial soils at the Marsh Run Park site. Furthermore, the RI risk assessment concluded that the surface soils did not represent a public health risk in accordance with current EPA risk assessment guidance.

7.5 DETAILED ASSESSMENT OF REMEDIAL ALTERNATIVES

The purpose of developing remedial action alternatives is to provide a range of potential techniques that comply with the general response actions and remedial action objectives for the Marsh Run Park site.

Pursuant to review of the ARARs for this project, it is apparent that any remedial action selected (with the exception of the "No Action"

TABLE 7-5 GENERAL REPSPONSE ACTIONS AND ASSOCIATED REMEDIAL TECHNOLOGIES FOR MARSH RUN PARK LANDFILL, FAIRVIEW TOWNSHIP, PENNSYLVANIA

General Response Actions	Remedial Technology Types and Process Options	Site Problems Primarily Addressed by Technologies
No Action	None	None
Institution Actions	Monitoring Access Restrictions Site Security . Fencing	Human/Wildlife Contact with site contaminants
Source Area Containment Actions	Capping Techniques . Compacted Clay . Flexible Membrane Liner . RCRA Multimedia Cap Vertical Barriers . Slurry Wall . Sheet Pile Barrier Horizontal Barriers . Bottom Sealing Surface Diversion/Collection . Grading/Revegetation . Dikes and Berms . Terraces and Benches	Surficial Infiltration: Subsurface Soils, Bedrock Aquifer, Surface Water, Sediments
Ground-Water Collection/Treatment Actions	Ground-Water Extraction . Extraction Wells . Extraction/Injection Wells Subsurface Drains . Interceptor Trenches	Bedrock Aquifer, Shallow Saturated Zone

TABLE 7-5 (Cont.)

General Response Actions	Remedial Technology Types and Process Options	Site Problems Primarily Addressed by Technologies
Ground-Water Collection/Treatment Actions (Cont.)	Physical/Chemical Treatment . Activated Carbon Adsorption . Air Stripping . UV Oxidation . Physical/Chemical Precipitation	
	Biological Treatment . Aerobic Bioreactor . Anaerobic Bioreactor	
	Offsite Treatment . Publicly Owned Treatment Works (POTW) . RCRA Disposal Facility	
	In Situ Treatment . Bioremediation . Aeration	
	Onsite Discharge . Marsh Run Creek	
	Offsite Discharge . Susquehanna River . POTW . Deep Well Injection	
Source Area Treatment Actions	Excavation . Excavation/Removal . Excavation/Treatment . Selective Excavation	

TABLE 7-5 (Cont.)

General Response Actions	Remedial Technology Types and Process Options	Site Problems Primarily Addressed by Technologies
Source Area Treatment Actions (Cont.)	Onsite Treatment Physical/Chemical Processes . Soil Washing/Extraction . Stabilization/Solidification . Chemical Oxidation/Reduction	Source Area Contribution to Bedrock Aquifer Contamination
	Biological Processes . Aerobic Bioreactor . Anaerobic Bioreactor . Landfarming	
	Thermal Processes . Low-Temp. Thermal Stripping . Wet Air Oxidation . Rotary Kiln Incineration . Infrared Incineration	
	In Situ Treatment Physical Processes . Soil Venting	Surface Soils, Subsurface Soils
	Chemical Processes . Soil Flushing	Ground Water
	Biological Processes . In Situ Bioremediation	
	Thermal Processes . In Situ Vitrification . RF Heating	
Collection Actions	Gas Control Technologies . Passive Perimeter Gas Control . Active Gas Venting	Subsurface Soils, Shallow Saturated Zone Water

alternative) would need to consider ground-water treatment. Consequently, the alternatives described herein are divided into source-area alternatives and ground-water alternatives. It is recognized that all remedial actions (except the No Action alternative) would need to select one source-area alternative and one ground-water alternative so that the final alternative would address both source-area and ground-water considerations.

The development and screening of alternatives presented in this section has been conducted in accordance with EPA's "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA" (EPA 1988).

Table 7-6 summarizes the alternatives that were developed for detailed examination in the FS. The following sections briefly outline the alternatives identified in Table 7-6.

7.6 SOURCE-AREA ALTERNATIVE NO. 1: NO ACTION WITH SITE CONTROL

7.6.1 Description

The "No Action" alternative was presented as a baseline against which other remedial measures were compared. EPA requires that the No Action option be examined in detail during the remedial alternatives evaluation phase. No further action would be taken to remediate the contaminated source area under this alternative. Institutional actions would be initiated to minimize potential exposure to subsurface and ground water site contamination. Specific institutional actions to be implemented would be increased site security, deed restrictions, and ground-water monitoring.

Site security would be upgraded by constructing a perimeter fence around the site to restrict unauthorized access. Approximately 1,500 ft of fencing would be required to tie in to existing DOD fencing along the west and south boundaries of the Marsh Run Park site. A gate would be provided to allow access to Marsh Run Road. The gate would remain locked at all times.

TABLE 7-6 REMEDIAL ALTERNATIVES EXAMINED DURING THE FS FOR THE FORMER MARSH RUN FIELD LANDFILL SITE, FAIRVIEW TOWNSHIP, PENNSYLVANIA

Source-Area Alternatives

• No Action	(Alternative 1A)
• No Action with Site Control	(Alternative 1B)
• Capping with Surface Water and Gas Controls	(Alternative 2)
• Excavation with Offsite Treatment	(Alternative 3A)
• Excavation with Onsite Thermal Treatment	(Alternative 3B)
• *In Situ* Soil Venting	(Alternative 4)
• *In Situ* Soil Flushing/Bioremediation	(Alternative 5)
• *In Situ* Vitrification	(Alternative 6)
• Selective Excavation with Offsite Treatment	(Alternative 7)

Ground-Water Alternatives

• Extraction/Carbon Adsorption/ Discharge to Marsh Run Creek	(Alternative 1)
• Extraction/Air Stripping/ Discharge to Marsh Run Creek	(Alternative 2)
• Extraction/Onsite Aerobic Bioreactor/ Reinjection to Aquifer	(Alternative 3)
• Extraction/UV Oxidation/ Discharge to Marsh Run Creek	(Alternative 4)

Deed restrictions that could be applied to the property could limit the type and location of allowable development on the site, and could prohibit the use of ground water from the site for drinking water purposes.

Ground-water monitoring would be conducted to monitor the concentration of contaminants in both the surficial and deep aquifer over time. Ground-water monitoring would be conducted on a quarterly basis for the first year and semiannually thereafter. Existing monitoring wells would be used. One new monitoring well would be installed downgradient of observed deep aquifer contamination to monitor movement of contaminants from the source area.

The NCP requires consideration of the No Action option as a stand-alone remedial action. For the FS, the No Action option was examined both as a stand-alone action and as a source-area alternative in conjunction with a ground-water alternative to address remedial action objectives for the site.

7.6.2 Compliance with ARARs

This alternative will comply with the Pennsylvania Water Well Drillers License Act of 1956 during monitoring well installation.

ARARs which are not complied with for this alternative are the MCLs developed by the EPA in response to the Safe Drinking Water Act, and which Pennsylvania has adopted for all waters of the state, including ground water. The alternative also does not comply with the Pennsylvania Hazardous Sites Cleanup Act which governs remediation of hazardous waste sites; it does not comply with RCRA 40 CFR 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities).

7.7 SOURCE-AREA ALTERNATIVE NO. 2: CAPPING WITH SURFACE WATER AND GAS VENTING CONTROLS

7.7.1 Description

This alternative involves closure of a designated area with a multi-layered cap system. The cap would be constructed over the former landfill area and the VOC-contaminated area immediately north of the landfill. A total of approximately 6 acres would be capped.

The purpose of the cap is to minimize infiltration of precipitation through the contaminated zones and thus minimize contaminant transport into the water systems and soil. The cap would be designed in accordance with Pennsylvania Department of Environmental Resources (PaDER) closure standards and would have the following features:

- The cap would be designed to minimize erosion and promote drainage by construction of a 3 percent minimum closure grade, establishment of vegetative measures, and stormwater management.

- A 2-ft-thick compacted clay liner (permeability $<1 \times 10^{-7}$ cm/sec) would be constructed above the existing fill area.

- A synthetic membrane liner serving as a hydraulic barrier would be placed over a prepared subbase to limit infiltration.

- A drainage layer consisting of sand or synthetic material (geonet) would be placed over the membrane liner to convey liquid off the cap.

- Soil would be placed over the drainage layer (separated by a synthetic filter or geotextile) to protect the liner and drainage system. This layer would have a 2-ft minimum thickness and would also have sufficient thickness to prevent frost penetration. The uppermost portion of the 2-ft layer would be a 6-in. topsoil layer to support vegetative growth.

- Provision of PVC passive gas vents would prevent trapping of methane and other landfill gases within the capped area.

- A piping system would surround the perimeter of the cap to transmit water collected in the drainage layer away from the cap.

The area to be capped would require stripping, grading, and offsite fill to establish proposed closure grades. It is estimated that 38,000 yd^3 of offsite soil would be necessary. The disturbed area would require stormwater, sediment, and erosion control devices, such as swales, berms, control ponds, and silt fencing. The extent of areal limits of the cap would be as determined by findings of the EM survey completed for the RI and the volatile organics source survey conducted during the FS.

Post-action ground-water and surface-water monitoring will be required to assess the long-term effectiveness of capping as a containment action. Quarterly monitoring of ground water from the surficial aquifer, downgradient wells, and from the surface water and sediments of Marsh Run Creek and the Susquehanna River would be conducted for the first year after implementation of remedial actions, and annually thereafter.

7.7.2 Compliance with ARARs

This alternative satisfies RCRA 40 CFR Par 264.310 (Closure and Post-Closure Care) due to its ability to minimize the infiltration of precipitation into the source area. The passive gas venting system will comply with National Ambient Air Quality Standards established in response to

the Clean Air Act of 1971 and subsequent revisions. The remedial action activities for capping will comply with OSHA health and safety requirements for worker safety as well as Threshold Limit Values for air concentrations established by the American Conference of Governmental Hygienists (ACGIH). The alternative will comply with the Pennsylvania Clean Streams Law which provides for erosion and sediment control; it will comply with the Pennsylvania Dam and Safety Encroachment Act of 1978 which protects wetlands; it will comply with the Pennsylvania Flood Plain Management Act of 1978 which regulates construction in areas located within the 100-year floodplain.

In combination with one of the ground water treatment alternatives (see Sections 7.13 through 7.16), this alternative will comply with the MCLs established by EPA and adopted by the State of Pennsylvania under the Safe Drinking Water Act for contaminants in drinking water. This alternative will also comply with ambient water quality criteria established under the Clean Water Act in regards to the ground-water contamination.

7.8 SOURCE-AREA ALTERNATIVE NO. 3: ALTERNATIVE NO. 3A--EXCAVATION/OFFSITE INCINERATION ALTERNATIVE NO. 3B--EXCAVATION/ONSITE LOW-TEMPERATURE THERMAL TREATMENT

7.8.1 Description

Alternative No. 3A

This alternative involves the stripping and stockpiling of clean cover soils; excavation of the landfill waste and VOC-contaminated soil; loading of contaminated materials onto trucks; and transportation to a RCRA-permitted hazardous waste facility for incineration and disposal. After contaminated materials have been removed, the site will be backfilled with clean fill material from an offsite source. The existing clean cover soil material will be replaced, and the site will be revegetated.

Based upon the RI report, the estimated fill area is approximately 4.24 acres, with an average depth of about 4 ft. The estimated volume of fill is about 30,000 yd^3. The nature of the waste material in the fill is largely unknown; however, it is believed that the site was used for general refuse disposal. This assumes that the waste constituents include paper products, plastic, metals, and glass, comprising 50-80 percent of the volume. The remaining 20-50 percent of the volume is assumed to be soil.

In addition to the former landfill area, characterization studies of the source area during the FS identified an area of approximately ±52,000 ft^2 immediately north of the landfilled area in which shallow saturated zone ground water (4-10 ft below ground) was found to be contaminated with TCE and other VOCs (Figure 5-8). This VOC area appears to be contributing to contamination of both the deep aquifer and the landfilled area. Excavation and disposal of soil from this area will also be considered as part of the source area remedial action. The approximate volume of affected soil is 17,500 yd^3. Therefore, the total estimated volume of contaminated material to be addressed under this alternative is approximately 47,500 yd^3.

Due to the variety of materials likely to be encountered during excavation, the site layout will be required to have specific areas for materials handling, separation, preparation, and loading. These areas will be contained within the exclusion zone.

Materials handling areas will have to be lined and bermed to prevent contamination from moving offsite. Materials handling will be required to separate the waste according to size, composition, extent of contamination, and ultimate treatment.

The installation of sediment/erosion control devices will be required. These will include silt fences, sediment/stormwater basins, and stormwater diversions to prevent runon and runoff. These measures should be

conservatively designed and built, as the potential to contaminate the surface water is great. Dust control measures must also be considered.

As part of the excavation process it will probably be necessary to dewater the waste area, primarily because the site was originally a marsh upon which the refuse was deposited. It is likely that ground water will infiltrate the excavation pit since ground water has been identified at 4-7 ft below ground surface in the vicinity of the former landfill. In addition, rain water will collect in the open excavation. For these reasons, ground-water containment measures may be needed during excavation, and ground water may need to be contained onsite and processed through the onsite treatment system (see ground-water alternatives in Sections 7.13 through 7.16).

During the excavation it will also be necessary to monitor and control organic vapor and fugitive dust emissions. Respirators may be required for onsite personnel. It is expected that Level C personal protective equipment (PPE) will be required for excavation activities, although certain conditions may warrant use of Level B PPE.

After excavation, the waste material will have to be separated according to contamination level, compatibility, and size, prior to preparing it for transportation to an offsite disposal facility. Wastes will be sampled and analyzed for RCRA hazardous waste characteristics, including TCLP toxicity. Wastes exhibiting TCLP toxicity in excess of regulatory levels will be disposed of by incineration. Other wastes may be disposed of in a RCRA permitted landfill. The primary factors to consider for incineration are the size, type of incineration process, and the applicability of the process to the waste obtained from the site. Major types of incinerators are rotary kiln, cement kiln, liquid injection, and gas fueled. Waste applicability considerations include Btu content (generally required to be $\geq$5,000 Btu/lb), water content, viscosity, halogen content, metal content, ash content, size, shape, and state (solid, liquid) of waste materials.

For disposal at most RCRA-permitted incinerators, waste material must be packaged into containers (usually 55-gal fiberboard). This process has the potential to be time-consuming and hazardous to the onsite workers. There are no RCRA incineration facilities less than 200 mi from the site. The closest facility is the Rollins Environmental site in Bridgeport, New Jersey. Other facilities that could process the waste include the ENSCO facility in Little Rock, Arkansas, and Chem Waste Management's Emelle, Alabama, facility. The closest facility that would accept bulk solid waste is the former LWD facility in Calvert City, Kentucky.

Transportation of the waste to the incinerator requires special considerations relating to the vehicle, such as size and safety features. These features include bed liners, covers, and vents (for liquid containers). Both the vehicle and driver must be DOT approved. Vehicles should also be in excellent mechanical working condition. In addition, if the waste is transported in bulk, compatibility testing is required.

After incineration, it will be necessary to determine if the ash will have a hazardous or nonhazardous classification for landfill disposal. Then the nearest acceptable RCRA permitted facility can be located to receive the remains of the incineration process.

This alternative is expected to be a permanent solution to remediation of the source area. When completed, Alternative No. 3A should exceed ARARs, in addition to achieving and maintaining the overall protection of human health and the environment. This is accomplished through the removal of the source material from the site and its offsite incineration, which eliminates the supply of contaminants to the ground water and destroys the pollutant, subsequently reducing the toxicity, mobility, and volume of the contaminant.

Alternative No. 3B

This alternative is basically the same as Alternative No. 3A; however, instead of transporting the excavated waste to an offsite incinerator, it is treated onsite with a low-temperature roasting process (400-450 F) which is designed to completely destroy the organics. The process utilizes a mobile unit which is similar to conventional incinerators but operates at a much lower temperature. It is treated onsite with a low-temperature roasting process that operates at a temperature range of 400-500 F and completely strips the volatile organics from the soil through evaporation. The volatiles are then recovered or destroyed using conventional methods such as carbon adsorption or through a flame afterburner. After treatment with this process, the soil is restored to an uncontaminated condition which is then suitable for backfill as a delisted waste pursuant to EPA Land Disposal Regulations (LDR) considerations as specified in 40 CFR 268.

The full-scale system has four major components:

1. Solids Handling System
2. Hot Oil Heating System
3. Gas Handling System
4. Water System

The solids handling system screens the waste prior to feeding it into the thermal processing unit, where a temperature of 400 F is maintained by the hot oil heating system. The heating system can run on propane, natural gas, or oil and provides heat to the soil through the circulation of the hot oil. The gas handling system carries the volatiles through a condenser, then an afterburner to destroy the volatiles. The water system handles the condensate by first running it through an oil/water separator and then through carbon adsorption units.

The low-temperature stripping system can process a wide variety of soils with differing moisture and contaminant concentrations, and its effectiveness has been proven to remove over 99.9 percent of the volatile organics from the soil.

7.8.2 Compliance with ARARs

Alternative Nos. 3A and 3B, in conjunction with ground-water pumping and treatment, are expected to achieve Federal and State cleanup goals pertaining to ground water quality and drinking water standards, surface water quality, ambient water quality criteria for protection of human health and ambient water quality for protection of aquatic life. These alternatives meet or exceed cleanup goals related to the source area and destruction of the contaminants.

In particular, the ARARs with which these alternatives comply with are the Pennsylvania Hazardous Sites Cleanup Act, RCRA 40 CFR 261 (Identification and Listing of Hazardous Waste), 40 CFR 263 (Standards Applicable to Transporters of Hazardous Waste), 40 CFR 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities). The alternative will also comply with National Ambient Air Quality Standards during excavation; it will comply with OSHA Health and Safety Requirements for worker safety; it will comply with DOT Rules for Hazardous Materials Transport; it will comply with Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists for all concentrations; it will comply with the Pennsylvania Clean Streams Law for erosion and sediment requirements; it will comply with the Pennsylvania Dam and Safety Encroachments Act of 1978 regarding encroachment of wetlands; it will comply with the Pennsylvania Flood Plain Management Act of 1978 which is concerned with construction within the 100-year floodplain; and it will comply with the Pennsylvania Solid Waste Management Act of 1980 which governs treatment and disposal of hazardous wastes.

7.9 SOURCE-AREA ALTERNATIVE NO. 4: IN SITU SOIL VENTING

7.9.1 Description

Soil venting is a vacuum extraction process in which volatile organic contaminants are removed from the vadose (unsaturated) zone of soil. Soil venting is effective at contaminant extraction through both liquid and vapor phases. Generally, source area VOC contamination exists in three phases:

- As dissolved constituents in the ground water,
- As a liquid adsorbed to the soil matrix, and
- As free product in liquid and vapor forms located in the interstitial pore spaces of the soil.

Vacuum extraction wells and laterals are installed in the contaminated area and are connected by piping to an air/liquid separator device and off-gas treatment system. The wells are designed with a vacuum-tight seal at the surface of the ground, and a slotted screen in the desired extraction zone. Extraction wells are installed vertically, but slotted piping may be installed horizontally in trenches to cover a larger area, minimizing the number of extraction wells. The horizontal system is also utilized exclusively in high ground-water table conditions. For this site, a combined horizontal and vertical extraction system would be used.

A high-capacity vacuum pump and/or blower is used to produce a lateral air flow through the soil. This flow carries the contaminant that is located in the interstitial soil pore spaces into the extraction wells and to the surface treatment system. In addition, the volatile contaminants that are adsorbed to the soil are stripped and volatilized into

the air stream. Also, ground water containing the dissolved contaminant can be extracted and treated. In general, higher vacuum pressures will achieve faster cleanup of the contamination.

Due to the two-phase flow of the air and water, a liquid/vapor separator is required as part of the treatment system. At this step, the contaminated water is removed and either treated onsite or shipped to an off-site treatment facility. Water generated from the soil venting process at Marsh Run Park will be circulated through the ground-water treatment plant that will be provided at the site. The contaminated air flows through activated carbon to remove the volatiles and prevent their discharge to the atmosphere. An added feature of soil venting is that the pumping action of the extraction process enhances in situ biodegradation of VOCs remaining in the soil. The process provides a continuous oxygen flow which is essential to effective bioremediation.

There are a number of variables to consider in the design of a vapor extraction system. These are listed below.

Initial Site Conditions	Control Variables	Response Variables
. Initial soil VOCs	. Well-head vacuum	. Final soil VOCs
. Depth to ground water	. Extracted air flow	. Extracted air VOCs
. Soil permeability	. Extraction well spacing	. Adsorption equilibria
. Soil moisture	. Screened depth	. Radius of influence
. Soil porosity	. Duration of operation	
. Soil bulk density	. Power consumption	
. Soil particle density		
. Soil organic carbon		
. Henry's Constant		
. Solubility		
. Temperature		
. Consistency of existing cap		

The initial variables are the given site conditions, the control variables (which can be chosen for in the system design), and the response variables (which change as a function of the control variables). One control variable which is critical to efficient remediation is the well spacing, which depends primarily on the soil characteristics, including

permeability, porosity, moisture content, stratigraphy, and depth to ground water. Prior to the design of the extraction system, a vapor flow model would be required to refine site conditions and design parameters. From this modeling, pilot testing should be conducted prior to full-scale system installation.

The approximate limits of area to be treated by soil venting are shown in Figure 5-8. Initially, soil venting wells and laterals will be concentrated in the identified "hot spots" (Figure 5-7). Further, refinement of the area to be treated will be made during the pre-design phase. The first objective will be to dewater the shallow saturated zone using the shallow zone wells installed for the soil venting system. This extracted ground water will be pumped to the ground water treatment system. Pumping of the bedrock aquifer will be initiated shortly thereafter to keep the shallow saturated zone dewatered to as great a degree as possible.

Once the shallow zone has been sufficiently dewatered, soil venting will be initiated. Soil venting will be continued until analysis of samples from the source area indicates that target treatment levels have been achieved. The target treatment level will be as defined in Appendix A. When VOC concentrations in soil samples are found to be less than the target treatment concentrations, source area treatment may be stopped.

Installation of sediment and erosion control devices would be required. Erosion/sediment control provisions could include silt fences, sediment basins, and stormwater diversions. After the site work is completed, the area would have to be stabilized through revegetation.

A Hazardous Materials Contingency Plan will be developed during the design phase as a component of this action. The plan will identify procedures and methods for handling, separating, and removing (if necessary) hazardous materials that may be encountered during implementation of the remedial action. Key provisions of the Hazardous

Materials Contingency Plan will be developed into the technical specifications for construction activities and the Contractor will be required to abide by these provisions.

7.9.2 Compliance with ARARs

The principal ARAR which will govern this remedial action is the Pennsylvania Hazardous Sites Cleanup Act. The alternative will also comply with National Ambient Air Quality Standards during venting; it will comply with OSHA Health and Safety Requirements for worker safety; it will comply with Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists for all concentrations; it will comply with the Pennsylvania Clean Streams Law for erosion and sediment requirements; it will comply with the Pennsylvania Dam and Safety Encroachments Act of 1978 regarding encroachment of wetlands; it will comply with the Pennsylvania Flood Plain Management Act of 1978 which is concerned with construction within the 100-year floodplain; and it will comply with the Pennsylvania Solid Waste Management Act of 1980 which governs treatment and disposal of hazardous wastes.

In combination with ground water remedial action (Sections 7.13 through 7.16), this alternative will contribute toward achieving MCLs established by EPA and adopted by the Commonwealth of Pennsylvania for ground water quality. This alternative would not likely achieve MCLs without some type of ground-water extraction and treatment in addition to the source area action.

7.10 SOURCE-AREA ALTERNATIVE NO. 5: IN-SITU SOIL FLUSHING/ BIOREMEDIATION

7.10.1 Description

This alternative consists of treating the contaminated soil and ground water through biological processes. The treatment system consists of a bioreactor which degrades the TCE and other VOCs in the water after it is pumped from the ground. The treated water is then discharged into

the ground via either injection wells or an infiltration basin to enhance the subsurface microflora. Microbes, nutrients, and oxygen are added to both the bioreactor and the injection/infiltration water to aid the growth of the microorganisms which degrade the TCE and other VOCs. The injected/infiltrated water is then recovered from the surficial aquifer through pumped wells to produce a closed treatment system.

The design of the treatment system depends on the contaminants, soil permeability, regulatory constraints, and nature of the vadose zone. In addition, an understanding of the metabolic pathways of the microorganisms is required in order to effectively control and manipulate the environment for optimum bioremediation.

The biological degradation of the subsurface contamination is accomplished through injection or infiltration of the oxygenated nutrient solution into the contaminated zone to stimulate the natural microbial activity. Additional microbes (naturally occurring) may be added here. The water is cycled through a series of recharge basins or wells and recovery wells until the contamination is reduced to required levels. The recharge causes mounding of the ground water to occur in the area of contamination, which aids in providing a suitable environment for biological degradation.

Treatability studies would be required to establish the degradation potential rates, microbial growth kinetics, and hydraulic residence times for the injected/infiltrated water. These studies include

- Laboratory screening,
- Bench-scale testing, and
- Pilot-scale testing.

Laboratory screening is first performed as a relatively quick determination of the contaminant concentration and to isolate and establish a population of TCE-degrading microorganisms. Once established, a bench-scale test is set up to produce information on the performance

of the biodegradation process, including rates of contaminant reduction, levels achieved, and required amounts and chemical forms of nutrients and oxygen which optimize the process. Once the bench-scale testing is completed, pilot-scale testing in the field is necessary to evaluate the hydraulics of the treatment process under site conditions. This step is critical, as in situ conditions are always poorer and less controlled than conditions in the laboratory. As a consequence, bioremediation rates are usually much slower, and larger amounts of nutrient and oxygen additives are required.

Necessary studies to support the above are soil borings and their characterization as to classification, permeability, depth, and contaminant concentration. In addition, ground-water pumping capabilities are needed in order to design the system to accommodate pumping rates, size the treatment system components, and determine the recycle rates.

The two primary considerations of a bioremediation treatment system are the nature of the contaminant and the soil characteristics. TCE has been found to be biodegradable with the addition of nutrients, oxygen, and specific TCE-degrading bacteria under controlled site conditions. TCE is not as degradable as petroleum hydrocarbons, but is more degradable than other highly chlorinated substances like PCBs and dioxins. There are specific examples of sites where subsurface contamination of TCE has been proven to be biodegraded. It is concluded that source area TCE may be amenable to treatment through bioremediation.

The soil characteristics of concern are primarily related to the permeability and subsequent flow of ground water. For bioremediation to be successful, sufficient hydraulic conductivity in the contamination area is required. This will ensure that the solution of nutrients, microbes, and oxygenated water which is injected or infiltrated into the ground is able to migrate and provide the naturally occurring microorganisms with a favorable environment for their growth. This, in turn, will allow the growing population of indigenous bacteria, yeast, and fungi to consume and degrade the pollutant.

Figure 5-8 shows the approximate limits of the area to be treated by in situ bioremediation. Further refinement of the area to be treated would be made during the design and construction phases. Bioremediation would be continued until analysis of samples from the source area indicate that target treatment levels have been achieved. Target treatment levels would be as described previously for soil venting.

Because site work would consist of earth moving, the installation of sediment and erosion control devices would be required; these could include silt fences, sediment basins, and stormwater diversion. After the site work is completed, the area would have to be stabilized through revegetation.

A Hazardous Materials Contingency Plan will be developed during the design phase as a component of this action. The plan will identify procedures and methods for handling, separating, and removing (if necessary) hazardous materials that may be encountered during implementation of the remedial action. Key provisions of the Hazardous Materials Contingency Plan will be developed into the technical specifications for construction activities, and the Contractor will be required to abide by these provisions.

7.10.2 Compliance with ARARs

The principal ARAR which will govern this remedial action is the Pennsylvania Hazardous Sites Cleanup Act. The alternative will also comply with National Ambient Air Quality Standards during excavation; it will comply with OSHA Health and Safety Requirements for worker safety; it will comply with Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists for all concentrations; it will comply with the Pennsylvania Clean Streams Law for erosion and sediment requirements; it will comply with the Pennsylvania Dam and Safety Encroachments Act of 1978 regarding encroachment of wetlands; it will comply with the Pennsylvania Flood Plain Management Act of 1978

which is concerned with construction within the 100-year floodplain; and it will comply with the Pennsylvania Solid Waste Management Act of 1980 which governs treatment and disposal of hazardous wastes.

For discharge of any treated water, this alternative will comply with Federal Ambient Water Quality Criteria under the Clean Water Act, specifically regarding NPDES permits, and therefore it will concurrently comply with Pennsylvania Water Quality Standards.

This alternative in conjunction with ground water remedial action (Sections 7.13 through 7.16) will contribute toward achieving MCLs established by EPA and adopted by the Commonwealth of Pennsylvania for ground water quality. This alternative would not likely achieve MCLs without some type of ground-water extraction and treatment in addition to the source area action.

7.11 SOURCE-AREA ALTERNATIVE NO. 6: IN SITU VITRIFICATION

7.11.1 Description

In Situ Vitrification (ISV) is a new treatment method that may be applied directly to undisturbed waste material. The ISV process electrically melts inorganic soil material so that a thermo-chemical process can treat, free, and/or containerize contaminants in the waste volume. Natural soils or other process residual inorganics (sludges, tailings, sediments) may be treated by the melting process. Utilizing soil in the waste, the ISV process destroys and/or removes organic contaminants while chemically incorporating and immobilizing inorganics (metals) into a chemically inert and stable glass crystalline residual.

Typically, three stages are required in the ISV melting process. During stage 1, electrodes (usually four) are configured to a design depth around a design treatment volume. Soils in the waste usually do not have sufficient electrical conductive capacity to initiate the melting process; therefore, a conductive material comprised of graphite

and glass frit is placed as a starter conductive material between the electrodes. As electric potential flows through the starter materials, between the electrodes, the adjacent soil heats to its fusion temperature (±1,000 C). This heat in the soil allows the soil to become electrically conductive enough to be the primary electric conductor.

The applied electrical energy, stage 2, causes the melted material to subside downward and outward to encompass the desired waste volume. A total melt mass of up to 1,000 tons and a maximum width and depth of 30 ft are reported to be feasible for a setting at Marsh Run Park. The depth of fill is considerably less; therefore, the total waste depth could be treated in a single setting. Geophysical, optical, and thermal principles may be used to determine the actual extent of the melt.

The third stage involves backfilling over the treatment zone with clean soil since a subsidence volume above the melt is created. The volume reduction is created by a void volume present in particulate materials (20-40 percent depending on soil type) and by materials present in the soil, such as humus and organic materials, which are removed as gases and vapors during the melt.

The molten soil mass is usually at a temperature of 1,600 to 2,000 C depending on the chemistry of the waste. A large-scale ISV process melts soil at a 4-6 ton/hr rate or a melt rate of 1-2 in./hr. As the thermal gradient advances on organic materials, vaporization into elemental components occurs, followed by pyrolysis decomposition in the absence of oxygen. When the organic material undergoes pyrolysis, typical products are gases, which move slowly due to the high viscosity of the molten material, from the melt to the upper surface of the melt. Gases may dissolve in the melt itself while the remaining gases move to the surface, where the combustible fraction burns in the presence of air. The pyrolysis and combustion products are trapped in an off-gas collection hood to be treated to air emissions requirements. Due to the high temperatures of the melt process, no residual organic contamination

remains in the original in situ organic compound from the vitrified product. Based on the extent and volume of material to be treated at Marsh Run Park, this process would be expected to take approximately 1 year using multiple units.

The inorganic fraction of the waste may decompose or enter into reactions with other compounds in the melt. While nitrates and sulfates decompose into gas products to be collected in an off-gas collection hood with organic vapors, inorganic elements are incorporated into the vitrified residual.

Saturated soils may be processed by vaporizing water to 100 C; however, the energy required to remove the water fraction is approximately equal to that required to melt an equal weight of soil. It is therefore advantageous to have the soil in a dry condition for processing. The ground-water elevation at Marsh Run Park may affect the treatment volume at different periods. An option would be to attempt to lower the water table using extraction wells. It is also possible to process the waste in the water table if recharge is slow enough. It is generally feasible to process below the water table if soil permeability is less than 10^{-4} cm/sec. Moisture content in the soil, matrix permeabilities, and recharge rates would be evaluated for final design.

Figure 5-8 shows the approximate limits of the area to be treated by in situ vitrification. Further refinement of the area to be treated will be made during the design and construction phases. Successful performance of this system will be determined through analysis of samples taken from the solidified mass, and subjected to contaminant leaching tests. The target treatment levels for this remedial action will be based upon TCLP extract contaminant concentrations, and upon the objective of limiting source area contribution to the bedrock aquifer to below SDWA MCLs. The target treatment level for this technology will be as described previously for soil venting.

A Hazardous Materials Contingency Plan will be developed during the design phase as a component of this action. The plan will identify procedures and methods for handling, separating, and removing (if necessary) hazardous materials that may be encountered during implementation of the remedial action. Key provisions of the Hazardous Materials Contingency Plan will be developed into the technical specifications for construction activities and the Contractor will be required to abide by these provisions.

7.11.2 Compliance with ARARs

The principal ARAR which will govern this remedial action is the Pennsylvania Hazardous Site Cleanup Act. The alternative will comply with National Ambient Air Quality Standards during excavation; it will comply with OSHA Health and Safety Requirements for worker safety; it will comply with Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists for all concentrations; it will comply with the Pennsylvania Clean Streams Law for erosion and sediment requirements; it will comply with the Pennsylvania Dam and Safety Encroachments Act of 1978 regarding encroachment of wetlands; it will comply with the Pennsylvania Flood Plain Management Act of 1978 which is concerned with construction within the 100-year floodplain; and it will comply with the Pennsylvania Solid Waste Management Act of 1980 which governs treatment and disposal of hazardous wastes.

This alternative in conjunction with ground water remedial action (Sections 7.13 through 7.16) will contribute toward achieving MCLs established by EPA and adopted by the Commonwealth of Pennsylvania for ground water quality. This alternative would not likely achieve MCLs without some type of ground-water extraction and treatment in addition to the source area action.

7.12 SOURCE-AREA ALTERNATIVE NO. 7: SELECTIVE EXCAVATION WITH OFFSITE DISPOSAL

7.12.1 Description

This alternative is basically the same as Alternative No. 3, with the exception that it is only necessary to excavate the portions of the waste fill which have been identified by the ground-water sampling study performed in April 1990 as the major sources of contamination. These areas will be considered the "hot spots." The volume of this material is estimated to be 18,000 yd^3, of which 4,000 yd^3 are waste material and 14,000 yd^3 are contaminated soil.

Figure 5-7 shows the estimated limits of excavation for this alternative. The limits shown correspond to the "hot spots" as identified in the VOSS. Further refinement of the area to be excavated will be made during the design and construction phases. The actual limits of excavation will be based upon action specific target treatment levels. The target treatment level for selective excavation will be based on the concentration of target VOCs in source area soil samples. The target treatment levels will be as defined in Appendix A.

Confirmatory soil samples will be collected at selected intervals to assess limits of excavation. The scope of confirmatory soil sampling shall be defined in the design phase.

Due to the variety of materials likely to be encountered during excavation, the site layout will be required to have specific areas for materials handling, separation, preparation, and loading. These areas will be considered the exclusion zone.

The areas will have to be lined and bermed to prevent contamination from moving offsite via stormwater runoff. Materials handling will be required to separate the waste according to size, composition, extent of contamination, and ultimate treatment.

The installation of sediment and erosion control devices will be required. These will include silt fences, sediment/stormwater basins, and stormwater diversions to prevent runon and runoff. These measures should be conservatively designed and built, as the potential to contaminate the surface water is great.

As part of the excavation process it will probably be necessary to dewater the waste area, primarily because the site was originally a marsh upon which the refuse was deposited. It is likely that ground water will infiltrate the excavation pit. In addition, rain water will collect in the pit. For these reasons, ground-water containment and pumping provisions should be considered with excavation. Ground water encountered during excavation will be contained onsite and treated with the onsite water treatment system.

During the excavation it will also be necessary to monitor and control organic vapor and fugitive dust emissions. Respirators may be required for onsite personnel. It is anticipated that excavation activities will be conducted in Level C PPE, although Level B may be required as conditions warrant.

Waste material that has been excavated will have to be separated according to contamination level, compatibility, and size, prior to preparing it for transportation to an offsite RCRA-permitted TSD facility. Incineration will probably be the required disposal practice for much of the excavated material. The primary factors to consider are waste size, type of incineration process, and the applicability of the process to the waste obtained from the site. Major types of incinerators are rotary kiln, cement kiln, liquid injection, and gas fueled. Waste applicability considerations include Btu content (generally required to be $\geq$5000 Btu/lb), water content, viscosity, halogen content, ash content, size, shape, and state (solid, liquid) of waste materials.

For disposal at most RCRA-permitted incinerators, waste material must be packaged into containers (usually 55-gal fiberboard). This process has the potential to be time-consuming and hazardous to the onsite workers. There are no RCRA incineration facilities less than 200 mi from the site. The closest facility is the Rollins Environmental site in Bridgeport, New Jersey. Other facilities that could process the waste include the ENSCO facility in Little Rock, Arkansas, and Chem Waste Management's Emelle, Alabama, facility. The closest facility that would accept bulk solid waste is the former LWD facility in Calvert City, Kentucky.

Transportation of the waste to the incinerator requires special considerations relating to the vehicle, such as size and safety features. These features include bed liners, covers, and vents (for liquid containers). Both the vehicle and driver must be DOT approved. Vehicles should also be in excellent mechanical working condition. In addition, if the waste is transported in bulk, compatibility testing is required.

After incineration, it will be necessary to determine if the ash will have a hazardous or nonhazardous classification for landfill disposal. Then the nearest acceptable RCRA permitted facility can be located to receive the remains of the incineration process.

A Hazardous Materials Contingency Plan will be developed during the design phase as a component of this action. The plan will identify procedures and methods for handling, separating, and removing (if necessary) hazardous materials that may be encountered during implementation of the remedial action. Key provisions of the Hazardous Materials Contingency Plan will be developed into the technical specifications for construction activities, and the Contractor will be required to abide by these provisions.

7.12.2 Compliance with ARARs

In particular, the ARARs with which these alternatives comply are the Pennsylvania Hazardous Sites Cleanup Act, RCRA 40 CFR 261 (Identification and Listing of Hazardous Waste), 40 CFR 263 (Standards Applicable to Transportation of Hazardous Waste), and 40 CFR 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities). The alternative will also comply with National Ambient Air Quality Standards during excavation; it will comply with OSHA Health and Safety Requirements for worker safety; it will comply with DOT Rules for Hazardous Materials Transport; it will comply with Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists for all concentrations; it will comply with the Pennsylvania Clean Streams Law for erosion and sediment requirements; it will comply with the Pennsylvania Dam and Safety Encroachments Act of 1978 regarding encroachment of wetlands; it will comply with the Pennsylvania Flood Plain Management Act of 1978 which is concerned with construction within the 100-year floodplain; and it will comply with the Pennsylvania Solid Waste Management Act of 1980 which governs treatment and disposal of hazardous wastes.

This alternative in conjunction with ground water remedial actions (Sections 7.13 through 7.16) will contribute toward achieving MCLs established by EPA and adopted by the Commonwealth of Pennsylvania for ground water quality. This alternative would not likely achieve MCLs without some type of ground-water extraction and treatment in addition to the source area action.

7.13 GROUND-WATER ALTERNATIVE NO. 1: EXTRACTION/CARBON ADSORPTION/ DISCHARGE TO MARSH RUN CREEK

7.13.1 Description

The purpose of the ground-water remediation alternatives is to intercept and contain contaminated ground water moving from the site, thus preventing discharge to the Susquehanna River while removing contaminants for offsite disposal. By placing pumping wells close together, the water table can be lowered, and the combined cones of depressions of each well can result in a depression network effectively lowering the ground-water elevation so that discharge offsite is hydraulically contained.

7.13.1.1 Extraction

To estimate required interceptor wells, pumping rates, and placement of wells to contain the plume, data from slug tests performed for the RI were used in a computer model, RESSQ (Groundwater Treatment, Handbook of Mathematical Models, 1984). The RESSQ model was used with slug test data and other site data obtained during the RI.

Specific contamination source node locations were modeled to correspond to hot spots within the source area. Regional ground-water flow was characterized through a series of ground-water flow nodes. Known aquifer parameters (obtained through RI slug tests) were input to the model. Several model runs were attempted to optimize the number and location of wells. A scenario using three extraction wells and a combined pumping rate of 30 gpm was ultimately chosen as the best approach to controlling ground-water flow based on available data. For purposes of conservative estimating, a fourth extraction well was provided.

It should be noted that these modeling data are not sufficient for remedial design activities. These data are based upon slug test results for permeability and do not account for the complex hydrogeological conditions that could be expected in a fractured bedrock aquifer.

Pre-design testing will be necessary to refine ground-water modeling and to optimize ground-water extraction system design.

Pursuant to the modeling, four extraction wells will be installed along the northwest boundary of the site beyond the waste fill limits. The extraction wells will be drilled to depths between 50 and 100 ft subsequent to pre-design aquifer characterization results. Wells will be 4-in. diameter PVC and will be screened in the bedrock aquifer. The screened intervals will also be determined from aquifer characterization results.

It is likely that a series of shallow wells will also be pumped to dewater the shallow saturated zone. Existing wells may be used, and new wells may be required. Dewatering of the shallow saturated zone will be provided primarily to optimize concurrent source area remedial actions. Shallow saturated zone dewatering will also be helpful in optimizing the bedrock aquifer extraction process.

Ground-water extraction from the bedrock aquifer will be through the new extraction wells. Wells would be designed to draw water down to approximately 50 ft below the ground surface to contain and remediate the plume. Pumps would be placed in each well to maintain the lowered ground-water elevation to a design depth. The objective of ground-water extraction will be to remove and treat contamination within the site boundaries as well as containment/remediation of contamination that has migrated toward the Susquehanna River. The specific locations of bedrock aquifer extraction wells will be refined during the pre-design phase through aquifer characterization to assure that remedial action objectives are achieved. Water would be pumped to pretreatment and VOC-treatment processes and would be ultimately discharged to the wetlands associated with Marsh Run Creek.

It should be stressed that additional aquifer characterization (long-term pumping tests, geophysical well logging, etc.) should be conducted in the pre-design phase to optimize the number and spacing of wells, well depths, screened intervals, and well pumping rates for detailed design.

7.13.1.2 Pretreatment

Prior to volatile organic contaminant removal, extracted water would be pretreated to remove inorganics exceeding MCLs. Pretreatment is also provided to aid the volatile organic treatment process by limiting clogging and buildup of inorganics (particularly iron).

Pretreatment would consist of addition of a caustic agent (lime, sodium hydroxide or soda ash) to raise the pH and allow metals precipitation followed by either filtration or clarification. Pretreated effluent would then be pumped to the selected organic removal system (i.e., carbon adsorption, air stripping, UV oxidation, or aerobic bioreactor).

- Sludges that would require offsite disposal would be created in the pretreatment process.

- Chemical addition and other system operations would require operators to monitor and maintain the system.

- Additional testing would be required to determine contaminant design loadings and final treatment processes.

7.13.1.3 Carbon Adsorption

Granular activated carbon removes dissolved organic pollutants from water through adsorption. Organic contaminants exceeding MCLs can be removed by the carbon adsorption process. As water passes through the porous granules in the carbon, molecules of organic pollutants are held to the

surface of the pores. Over continued contaminant loading to the carbon, saturation occurs in the pores. Then the carbon is discarded or reactivated with a high-temperature process.

Adsorption systems consisting of granular activated carbon are typically in the form of packed beds contained within closed reaction vessels or columns within the reaction vessel. The function of the activated carbon bed is two-fold: the packed bed acts as both a filter medium for organic adsorption and as a filter for suspended particles not removed during pretreatment. Two units would operate in parallel or series depending on final design conditions. Units would have to be serviced periodically to provide fresh carbon and general maintenance.

Pilot testing would be performed to select the best carbon system for application. Organic contaminants exceeding MCLs can be removed by the carbon adsorption process.

Following carbon treatment, water would be discharged to the wetlands associated with Marsh Run Creek.

7.13.1.4 Discharge Technology

Review of available discharge technologies indicated that four possible approaches would be feasible. It was concluded that discharge to Marsh Run would be most feasible from the standpoint of effectiveness, implementability, and cost. Further assessment indicates that discharge to the wetlands associated with Marsh Run will be the optimal configuration to discharging treated effluent under this approach. The primary advantage of discharging to the wetlands instead of the stream is that the discharge has an opportunity to dissipate across a large wetlands area, thus minimizing potential erosive effects of discharge directly to the stream. This will also allow some of the treated ground water to infiltrate into the soil and recharge the wetlands area.

7.13.1.5 Sludge Handling/Residuals Disposal

Ground-water treatment activities will generate some quantity of sludge and other residuals that will require subsequent handling and disposal. Pretreatment by sedimentation or filtration will generate a waste sludge with high metals concentrations. The volume of sludge generated is not expected to be large, but the material will probably require special handling and disposal based upon metals concentrations. RCRA Land Ban restrictions may apply.

In addition to pretreatment sludge, many of the VOC treatment processes will generate a residual waste that will require handling and disposal. VOC treatment by activated carbon transfers contaminants to the carbon medium. In most instances, the carbon can be regenerated and the VOCs burned off. Under certain conditions, spent carbon must be treated as a waste material. As a waste, the carbon would probably be classified as a RCRA characteristic waste due to high TCLP TCE concentrations. Activated carbon is also used often as a polish filter for air stripping off-gas treatment.

7.13.2 Compliance with ARARs

This alternative will meet ground-water cleanup levels in accordance with Section 121 of CERCLA. As such, ground-water treatment will achieve the objective of reducing ground-water contaminant concentrations to equal to or less than MCLs for contaminants in drinking water established by EPA and adopted by the Commonwealth of Pennsylvania under the Safe Drinking Water Act. All extraction, observation, and monitoring wells will be installed in accordance with provisions of Pennsylvania's Water Well Drillers License Act. Construction of the treatment plant structures will be in accordance with the Pennsylvania Clean Streams Law with regard to erosion and sediment control provisions. Wetlands considerations will be in accordance with the Pennsylvania Dam and Safety Encroachments Act,

and any construction within the 100-year floodplain of the Susquehanna River will be in accordance with provisions of the Pennsylvania Flood Plain Management Act.

Construction activities during system installation will comply with OSHA's health and safety requirements for hazardous waste activities 29 CFR, Parts 1910, 1926, and 1904, and ACGIH Threshold Limit Values will be applied to establish respiratory protection standards during construction.

Operation of the treatment plant will be subject to Clean Air Act emission standards, but permits should not be required since this action does not inherently contribute to release of airborne contaminants.

Discharge of treated effluent will comply with NPDES discharge permitting requirements as established under the Federal Clean Water Act and shall meet Pennsylvania Water Quality Standards. Sludge and other residuals handling will be in accordance with all provisions of RCRA, particularly 40 CFR, Parts 261-264 and 268. Land disposal restrictions (40 CFR 268) may impact sludge and residuals disposal.

7.14 GROUND-WATER ALTERNATIVE NO. 2: EXTRACTION/AIR STRIPPING/DISCHARGE TO MARSH RUN CREEK

Ground-water extraction, pretreatment, discharge, and residuals handling considerations are the same as for Ground-Water Alternative No. 1. This alternative differs only in the approach to treatment of volatile organic contaminants. For this alternative, the ground water will be extracted and pretreated as described previously. Following pretreatment, the water will be treated for VOC removal using packed-column air stripping with vapor control. Discharge and residuals handling will be as described previously.

7.14.1 Description

Removing VOCs using packed-column air stripping is a common and established method for treating contaminated ground water. An air stripping system consists of a cylindrical tower of aluminum, fiberglass, or steel filled with high-efficiency packed media. Contaminated waste is evenly distributed from the top of the vessel while forced air is blown from the base of the tower producing a countercurrent air and water flow system. The enclosed medium provides a large surface area for air/liquid contact and enables the transfer of VOCs from the liquid to gas phase. The forced air carries the contaminant from the stripper unit to the atmosphere where it is either dissipated and degraded naturally or treated by an off-gas system (catalytic oxidation, carbon absorption). Treated ground water is discharged to the wetlands associated with Marsh Run Creek.

7.14.2 Treatment Description/Performance Requirements

A prediction of the mass transfer of VOCs to the gas phase is dependent on the contaminant's Henry's Law Constant, which states that the concentration of the contaminant in the gas above the solution is proportional to the concentration of the contaminant in solution. The chlorinated organics defined for cleanup are capable of being treated by an air stripping unit since the Henry's constants of the contaminants of concern are all $>1 \times 10^{-3}$ atm·m³/mole. Three organic compounds which have maximum observed concentrations greater than MCLs are trichloroethene, 1,2-dichloroethane, and vinyl chloride. These compounds must have a final effluent concentration of 5, 70, and 2 µg/L, respectively, to meet MCL criteria prior to discharge. To achieve the above-mentioned concentrations, at conceptual design, a stripping unit would have the following design features:

Tower Diameter:	2 ft
Packing Height:	20 ft
Air/Water Ratio:	30/1
Flow Rate:	30 gpm
Packing:	1-in. rings

These conceptual design parameters were developed from available RI/FS data and the computer model AIRSTRIP (Haarhoff, Schoeller 1988). These parameters are shown for conceptual use only and are not to be used as a basis for detailed design.

It is recommended that a pilot study be conducted prior to initiation of full-scale design. For a pilot study, a variety of air and water loading rates are induced into a scale tower with sampling at varying packing depths and air/water ratios. Analysis of samples is performed to determine final dimensions of the stripper. Pilot scale modeling is a conservative approach to full-scale design due to evaporation in other system components.

Limitations

The stripping unit removes volatile organics only. Although oxidation of metals occurs within the unit, it is not a design component. Pre-treatment units would need to address removal of metals prior to VOC treatment using the air stripper. Typically, design would be based on the maximum observed VOC levels at the site with a selected factor of safety. It is assumed that chemical levels will not be above the design value. Theoretical design removal efficiencies are usually accurate and can be confirmed by pilot testing.

7.14.3 Compliance with ARARs

This alternative will meet ground-water cleanup levels in accordance with Section 121 of CERCLA. As such, ground-water treatment will achieve the objective of reducing ground-water contaminant concentrations to equal to

or less than MCLs for contaminants in drinking water established by EPA and adopted by the Commonwealth of Pennsylvania under the Safe Drinking Water Act. All extraction, observation, and monitoring wells will be installed in accordance with provisions of Pennsylvania's Water Well Drillers License Act. Construction of the treatment plant structures will be in accordance with the Pennsylvania Clean Streams Law with regard to erosion and sediment control provisions. Wetlands considerations will be in accordance with the Pennsylvania Dam and Safety Encroachments Act, and any construction within the 100-year floodplain of the Susquehanna River will be in accordance with provisions of the Pennsylvania Flood Plain Management Act.

Construction activities during system installation will comply with OSHA's health and safety requirements for hazardous waste activities 29 CFR, Parts 1910, 1926, and 1904, and ACGIH Threshold Limit Values will be applied to establish respiratory protection standards during construction.

Operation of the treatment plant will be subject to Clean Air Act emission standards. Vapor phase carbon or catalytic oxidation will be used to control off-gas emissions and comply with CAA requirements.

Discharge of treated effluent will comply with NPDES discharge permitting requirements as established under the Federal Clean Water Act and shall meet Pennsylvania's Water Quality Standards. Sludge and other residuals handling will be in accordance with all provisions of RCRA, particularly 40 CFR, Parts 261-264 and 268. Land disposal restrictions (40 CFR 268) may impact sludge and residuals disposal.

7.15 GROUND-WATER ALTERNATIVE NO. 3: EXTRACTION/AEROBIC BIOREACTOR/ REINJECTION TO AQUIFER

Ground-water extraction and pretreatment considerations are the same as for Ground-Water Alternative No. 1. For this alternative, the ground water will be extracted and pretreated as described previously. Following pretreatment, the water will be treated for VOC removal using an

aerobic bioreactor. This alternative also differs from other groundwater alternatives in the approach to treated effluent discharge. Under this alternative, treated effluent will be recycled through the aquifer by infiltration and/or injection methods.

7.15.1 Description

Once the metals have been removed, the water is pumped into an aerobic bioreactor for treatment of VOCs. The aerobic bioreactor system consists primarily of a mixing tank where oxygen, nutrients, and microorganisms are added to the water to facilitate the biological degradation of VOCs. The mixing tank allows the process to maintain an optimum temperature for the microbes to live and breed, utilizing the VOCs as a substrate for their growth. Depending on the conditions inside the tank, a co-metabolizer may be added to aid the organisms' growth by providing an easily utilized carbon source. In addition, the pH of the system is maintained through the use of analyzers and adjusters.

Various examples of bioreactors include fixed-film, liquid-solid contact (slurry), and trickling filter. These types have been used extensively in public water treatment systems, but with the growth of biotechnology and its application to hazardous waste remediation, methods for bioremediation are becoming increasingly diverse.

In order to design an effective aerobic bioreactor system, it is necessary to perform various tests to determine optimum flow in addition to nutrient, aeration, temperature, and pH requirements. The first step is a pump test to ascertain the maximum and average flow from the aquifers (both shallow and bedrock). Once the flow rates have been obtained, a three-phase approach is conducted to assess the capabilities of the bioremediation process:

- Laboratory screening,
- Bench-scale testing, and
- Pilot-scale testing.

Laboratory screening is first performed to determine which microorganisms are effective in utilizing the contaminant as a substrate and, therefore, causing its breakdown. In addition, various nutrient, oxygen, temperature, and pH combinations are tried to pinpoint optimum conditions.

Once the laboratory screening has narrowed the choices of the previously mentioned parameters, a bench-scale test is run to evaluate and compare the most effective combinations. During this testing, leachate is periodically collected and analyzed to obtain contaminant degradation rates, and the nutrient and oxygen uptake is recorded. In addition, optimum temperature and pH conditions are determined. The primary goal of the bench-scale test is to determine the optimum conditions for the biodegradation of the pollutants.

Upon conclusion of the bench-scale test, a pilot-scale test is conducted in the field to evaluate the treatment process under site conditions. It is necessary to understand the subsurface, from which infiltration and pumping (recovery) rates can be determined. This test is necessary to collect information to assist in the actual design of the treatment system, including pump sizing, treatment system component sizing, and infiltration basin sizing. The use of ground-water models would also be advantageous.

A major component of the aerobic bioremediation system is the infiltration basin which serves to provide the solution containing the microorganisms, nutrients, and oxygen to the source material underground. The basin is built above the waste fill area and the water is able to percolate through the cover soil down into the waste material. The added microbes supplement the indigenous bacteria, yeast, and fungi and provide a healthy and abundant population which can utilize the pollutants as a substrate and cause their breakdowns (degradation) to carbon dioxide and water. The shallow-aquifer pumps act to contain the water around the waste fill and prevent its lateral migration away from the fill.

The pumped water is then run through the above-ground treatment system before being discharged back into the infiltration basin, completing the recycling process.

Feedback controls would be required, analyzing the ground water and adding proper amounts of nutrients, oxygen, and pH adjusters. The system should also be flexible enough to discharge the treated water to the nearby wetlands of Marsh Run Creek if sufficient volume is not available in the infiltration basin.

7.15.2 Compliance with ARARs

This alternative will meet ground-water cleanup levels in accordance with Section 121 of CERCLA. As such, ground-water treatment will achieve the objective of reducing ground-water contaminant concentrations to equal to or less than MCLs for contaminants in drinking water established by EPA and adopted by the Commonwealth of Pennsylvania under the Safe Drinking Water Act. All extraction, observation, and monitoring wells will be installed in accordance with provisions of Pennsylvania's Water Well Drillers License Act. Construction of the treatment plant structures will be in accordance with the Pennsylvania Clean Streams Law with regard to erosion and sediment control provisions. Wetlands considerations will be in accordance with the Pennsylvania Dam and Safety Encroachments Act, and any construction within the 100-year floodplain of the Susquehanna River will be in accordance with provisions of the Pennsylvania Flood Plain Management Act.

Construction activities during system installation will comply with OSHA's health and safety requirements for hazardous waste activities 29 CFR, Parts 1910, 1926, and 1904, and ACGIH Threshold Limit Values will be applied to establish respiratory protection standards during construction.

Operation of the treatment plant will be subject to Clean Air Act emission standards, but permits should not be required since this action does not inherently contribute to release of airborne contaminants.

Discharge of treated effluent will comply with NPDES discharge permitting requirements as established under the Federal Clean Water Act and shall meet Pennsylvania Water Quality Standards. Sludge and other residuals handling will be in accordance with all provisions of RCRA, particularly 40 CFR, Parts 261-264 and 268. Land disposal restrictions (40 CFR 268) may impact sludge and residuals disposal.

7.16 GROUND-WATER ALTERNATIVE NO. 4: EXTRACTION/UV OXIDATION/DISCHARGE TO MARSH RUN CREEK

Ground-water extraction, pretreatment, discharge, and residuals handling considerations are the same as shown for Ground-Water Alternative No. 1. For this alternative, the ground water will be extracted and pretreated as described previously. Following pretreatment, the water will be treated for VOC removal using an ultraviolet light/oxidation process. Treated effluent will be discharged to the wetlands associated with Marsh Run Creek. Discharge and residuals handling will be as described previously.

7.16.1 Description

The treatment of the VOCs is through a process developed by Ultrox International for the SITE program. It utilizes ultraviolet (UV) light combined with the addition of oxygen, either as ozone (OZ) or hydrogen peroxide (H_2O_2), or both, to produce a highly oxidative environment. The UV serves to enhance the ozone and peroxide reactivities by

- transforming them to highly reactive OH^- radicals,
- raising the VOCs to higher energy levels, and
- initially attacking and breaking down the VOCs.

The end products of the process reactions are carbon dioxide, water, and innocuous salts. The unused ozone is treated by a catalytic ozone decomposer unit to reduce discharge levels to acceptable air quality standards.

Prior to designing an ultraviolet treatment system, laboratory-scale treatability studies are preformed to assess the effectiveness of the UV oxidation process for the ground water. If the treatment shows promise, then a pilot plant is installed onsite to collect design and economic data. These data are then used to prepare specifications for a full-scale system. The full-scale system is primarily automated through the use of microprocessors, requiring minimal periodic monitoring. Depending upon site and/or treatment constraints, the UV oxidation system can be designed to operate continuously or in a batch mode.

Components of the system include a reactor module, an air compressor/ozone generator module and/or hydrogen peroxide feed system. The size is based upon flow rates and required residence time.

7.16.2 Compliance with ARARs

This alternative will meet ground-water cleanup levels in accordance with Section 121 of CERCLA. As such, ground-water treatment will achieve the objective of reducing ground-water contaminant concentrations to equal to or less than MCLs for contaminants in drinking water established by EPA and adopted by the Commonwealth of Pennsylvania under the Safe Drinking Water Act. All extraction, observation, and monitoring wells will be installed in accordance with provisions of Pennsylvania's Water Well Drillers License Act. Construction of the treatment plant structures will be in accordance with the Pennsylvania Clean Streams Law with regard to erosion and sediment control provisions. Wetlands considerations will be in accordance with the Pennsylvania Dam and Safety Encroachments Act, and any construction within the 100-year floodplain of the Susquehanna River will be in accordance with provisions of the Pennsylvania Flood Plain Management Act.

Construction activities during system installation will comply with OSHA's health and safety requirements for hazardous waste activities 29 CFR, Parts 1910, 1926, and 1904, and ACGIH Threshold Limit Values will be applied to establish respiratory protection standards during construction.

Operation of the treatment plant will be subject to Clean Air Act emission standards, but permits should not be required since this action does not inherently contribute to release of airborne contaminants.

Discharge of treated effluent will comply with NPDES discharge permitting requirements as established under the Federal Clean Water Act and shall meet Pennsylvania Water Quality Standards. Sludge and other residuals handling will be in accordance with all provisions of RCRA, particularly 40 CFR, Parts 261-264 and 268. Land disposal restrictions (40 CFR 268) may impact sludge and residuals disposal.

8. SUMMARY AND COMPARISON OF REMEDIAL ACTION ALTERNATIVES

It is evident from the previous discussion that there are several feasible approaches to remedial action at the Marsh Run Park site. It is also evident that the final remedial action will need to include both a source-area response and a ground-water response, in order to satisfy the remedial action objectives. The remedial action objectives are as follows:

1. Reduce or eliminate the chlorinated solvent contamination present in the bedrock aquifer to ground-water cleanup levels (MCLs). The cleanup standards to be achieved for volatile organic contaminants are as follows:

   trichloroethene - 5 µg/L
   cis-1,2-dichloroethene - 70 µg/L (Proposed MCL)
   trans-1,2-dichloroethene - 100 µg/L (Proposed MCL)
   vinyl chloride - 2 µg/L
   tetrachloroethene - 5 µg/L (Proposed MCL)

2. Reduce or eliminate metals and volatile organic solvent contamination present in the shallow saturated zone to ground-water cleanup levels (MCLs). VOC cleanup levels are listed above. The cleanup standards to be achieved for inorganic contaminants are as follows:

   Arsenic - 50 µg/L
   Barium - 1,000 µg/L
   Beryllium - 0.5 µg/L
   Cadmium - 10 µg/L
   Chromium - 50 µg/L
   Copper - 1,300 µg/L (Proposed MCL)
   Cyanide - 200 µg/L (Proposed MCL)
   Lead - 5 µg/L
   Mercury - 2 µg/L

3. Reduce or eliminate the threat to future ground-water contamination by containment, treatment, or removal of the solvent contamination source area within the landfill, as identified based on the RI and the VOSS, and refined during design phase activities.

4. Reduce or eliminate future contaminant releases to Marsh Run Creek and the Susquehanna River through surface water or sediment pathways.

5. Reduce or eliminate future contaminant releases to Marsh Run and the Susquehanna River through ground-water pathways.

The selected ground-water alternative must address remedial objectives 1, 2, and 5. The selected source-area alternative must address remedial objectives 3, 4, and 5.

Pursuant to Section 300.430(e)(9)(iii) of EPA's revised National Contingency Plan, the remedial action to be implemented should be selected based upon consideration of nine evaluation criteria. Specifically, remedial actions should address the following:

1. Overall protection of human health and environment
2. Compliance with ARARs
3. Long-term effectiveness and performance
4. Reduction of toxicity, mobility, or volume of contamination
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

Since all of the feasible ground-water alternatives are a variant of "pump and treat," and since ground-water extraction and treatment must

be a component of the final selected remedial action, the final remedial alternative will be selected based upon the most appropriate source area response. For this assessment, the "No Action" alternative may still be appropriate, if it is combined with a ground-water "pump and treat" process. "No Action" without ground-water extraction and treatment will not achieve the ARARs. Table 8-1 lists the combined alternatives that are examined in the comparative assessment. Table 8-2 summarizes key points related to alternative selection. It is understood that ground-water extraction and treatment will be included as a component of the final selected remedial action. The specific treatment process for removal of the VOCs from the ground water may be activated carbon, countercurrent air stripping, UV oxidation, or biological treatment. Biological treatment should only be used in conjunction with the *in situ* biodegradation alternative for source area remediation.

The following sections provide a brief review and comparison of the remedial actions in accordance with EPA's evaluation criteria. Table 8-3 summarizes the comparative evaluation information presented herein.

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All of the alternatives, except Alternative No. 1A (no action - no ground-water action) provide adequate protection of human health and the environment. Risk through ground-water ingestion is reduced to cancer risk levels less than 1×10^{-6} applying all alternatives except Alternative No. 1A. Alternative Nos. 1B and 2 do not provide source area treatment, although Alternative No. 2 (capping) provides source area containment. The baseline risk assessment did not indicate that the source area represents human health or environmental risk in excess of 10^{-6}, therefore source area remediation is not specifically necessary from the perspective of protection of human health and the environment.

Results of the volatile organics source survey indicate that the source area is contributing to continued contamination of the bedrock aquifer. Therefore, alternatives that treat or remove the source area

TABLE 8-1 SUMMARY OF COMBINED REMEDIAL ACTION ALTERNATIVES, MARSH RUN PARK, FAIRVIEW TOWNSHIP, PENNSYLVANIA

Alternative No.	Description
1A	No Action with Site Controls
1B	No Action with Site Controls and[a] Ground-Water Extraction/Treatment
2	Capping with Surface Water and Gas Venting[a] Controls and Ground-Water Extraction/ Treatment
3A	Excavation, Offsite Incineration, and[a] Ground-Water Extraction/Treatment
3B	Excavation, Onsite Incineration, and[a] Ground-Water Extraction/Treatment
4	*In Situ* Soil Venting and Ground-Water[a] Extraction/Treatment
5	*In Situ* Soil Flushing/Bioremediation and[b] Ground-Water Extraction/Treatment
6	*In Situ* Vitrification and Ground-Water[a] Extraction/Treatment
7	Selective Excavation, Offsite Disposal,[a] and Ground-Water Extraction/Treatment

(a) Ground-water extraction/treatment will include pumping and pre-treatment with air stripping, activated carbon, or UV oxidation (Ground-Water Alternative Nos. 1, 2, and 4) for VOC treatment.

(b) Ground-water extraction/treatment will include pumping and pre-treatment with aerobic bioreactor treatment for VOC removal (Ground-Water Alternative No. 3).

TABLE 8-2 COMPARISON OF FEASIBLE REMEDIAL ALTERNATIVES, MARSH RUN PARK, FAIRVIEW TOWNSHIP, PENNSYLVANIA

Alternative No.		Type of Action	Performance Period	Innovative Technology	Subject to LDRs	Requires Offsite Transport/Disposal	Capital Cost ($ x 10^6)	Present Worth O&M Cost ($ x 10^6)	Total Cost ($ x 10^6)
SOURCE AREA									
1	No Action with Site Control	No Action	N/A	No	No	No	0.05	0.85	0.9
2	Capping	Containment	6 months	No	No	No	1.4	0.5	1.9
3A	Excavation/Offsite Incineration	Removal	6 months	No	No	Yes	115.0	0.4	115.4
3B	Excavation/Onsite Incineration	Onsite Treatment	5 years	Yes	Yes	Yes	47.0	0.4	47.4
4	Soil Venting	In Situ Treatment	9-12 months	Yes	No	No	3.9	0.4	4.3
5	Soil Flushing/ Bioremediation	In Situ Treatment	3-5 years	Yes	No	No	1.65	0.4	2.05
6	Vitrification	In Situ Treatment	6 months	Yes	No	No	50.65	0.4	51.05
7	Selective Excavation	Removal	6 months	No	Yes	Yes	43.1	0.4	43.5

Alternative No.		Type of Action	Performance Period	Innovative Technology	Air Discharge	NPDES Discharge	Capital Cost ($ x 10^6)	Present Worth O&M Cost ($ x 10^6)	Total Cost ($ x 10^6)
GROUND WATER									
1	Activated Carbon	Treatment/ Discharge	3-5 years[a] >10 years[b]	No	No	Yes	0.78	0.46 0.75	1.24 1.53
2	Air Stripping	Treatment/ Discharge	3-5 years[a] >10 years[b]	No	Yes	Yes	0.61	0.36 0.57	0.97 1.18
3	Aerobic Bioreactor	Treatment/ Recycle	3-5 years >10 years	Yes	Yes	Yes	0.55	0.32 0.48	0.87 1.03
4	UV Oxidation	Treatment/ Discharge	3-5 years >10 years	Yes	Yes	Yes	0.59	0.30 0.46	0.89 1.05

(a) Ground-water pump and treat is expected to achieve cleanup levels within 5 years for Source-Area Alternative Nos. 3A-7.
(b) Ground-water pump and treat is expected to require a minimum of 10 years to achieve cleanup levels for Source-Area Alternative Nos. 1 and 2.

TABLE 8-3 EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
OVERALL PROTECTIVENESS				
Human Health Protection				
- Direct Contact/ Soil Ingestion	Source area VOC contamination removed and treated.	TCE degradation is not consistently accomplished.	Source area VOC contamination removed/ destroyed. Source area inorganics stabilized into non-leachable matrix.	See Alternative No. 3A.
- Ground-Water Ingestion for Existing Users	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.
- Ground-Water Ingestion for Future Users	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.
Environmental Protection	Continued source area VOC contamination is curtailed by soil vapor extraction. Migration of contaminated ground water is curtailed by pump and treat.	Continued source area VOC contamination is likely degraded by enhanced bioremediation. Migration of contaminated ground water is curtailed by pump and treat.	Source area VOC contamination destroyed by vitrification. Migration of contaminated ground water is curtailed by pump and treat.	Most highly contaminated source area soils and wastes permanently removed from site. Migration of contaminated ground water curtailed by pump and treat.
COMPLIANCE WITH ARARs				
Chemical-Specific ARARs	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.

TABLE 8-3 SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES, MARSH RUN PARK LANDFILL, FAIRVIEW TOWNSHIP, PENNSYLVANIA

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
OVERALL PROTECTIVENESS					
Human Health Protection					
- Direct Contact/ Soil Ingestion	Existing conditions indicated risk $<1 \times 10^{-6}$. No action required. Fencing reduces potential for direct contact.	See Alternative No. 1A.	See Alternative No. 1A.	Source area contamination permanently removed from site and destroyed.	See Alternative No. 3A.
- Ground-Water Ingestion for Existing Users	No existing users directly impacted by ground-water contamination.	See Alternative No. 1A	See Alternative No. 1A.	See Alternative No. 1B.	See Alternative No. 1B.
- Ground-Water Ingestion for Future Users	No significant reduction in risk Some reduction in potential for access through deed restrictions.	Reduction of risk to less than 10^{-6} by pump and treat.	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B
Environmental Protection	Allows continued contamination of surficial and bedrock aquifers.	Source area is not remediated. Migration of contaminated ground water is curtailed by pump and treat.	Source area is not remediated. Leachate production is minimized through capping. Migration of contaminated ground water is curtailed by pump and treat.	Source area contaminated soils and wastes permanently removed from site. Migration of contaminated ground water is curtailed by pump and treat.	See Alternative No. 3A.
COMPLIANCE WITH ARARs					
Chemical-Specific ARARs	Does not meet ground-water standards past the site boundary.	Would meet MCLs at waste boundary in more than 10 years.	Would meet MCLs at the waste boundary in more than 10 years.	Would meet MCLs at the waste boundary in 3-5 years.	See Alternative No. 3A.

(a) VOC treatment for contaminated ground water may be air stripping, activated carbon, or UV oxidation.

TABLE 8-3 (Cont.)

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
Location-Specific ARARs	Would not impact wetlands or flood-plain at the site.	See Alternative No. 1A.	Would need wetlands permit and floodplain requirements.	See Alternative No. 2.	See Alternative No. 2.
Action-Specific ARARs	Would not meet any ARARs since there would be no action.	Would meet NPDES requirements. Would meet air release standards if air stripping or UV oxidation is used.	Capping would meet RCRA landfill closure requirements. Ground-water treatment would meet NPDES requirements and air release standards.	Would meet regulations concerning incineration. Would meet RCRA and DOT transportation and offsite disposal requirements. Ground-water treatment would meet NPDES requirements and air release standards.	See Alternative No. 3A. Would meet RCRA LDRs for onsite placement of incinerator ash.
Other Criteria and Guidance	Would not totally restrict ingestion of ground water exceeding 1×10^{-6}.	Protects against ground-water ingestion above 10^{-6} risk level.	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Magnitude of Residual Risk					
- Direct Contact/ Soil Ingestion	Existing conditions indicate risk $<1 \times 10^{-6}$. No action required.	See Alternative No. 1A.	See Alternative No. 1A.	Excavation, incineration totally removes contaminated soils/wastes from the site.	See Alternative No. 3A.
- Ground-Water Ingestion for Existing Users	Future risk greater as plume migrates toward Susquehanna River; however, direction of plume movement is not toward any existing users.	Risk eliminated by extracting ground water exceeding 10^{-6}. Safe drinking water achieved in more than 10 years.	See Alternative No. 1B.	Risk eliminated by extracting ground water exceeding 10^{-6}. Safe drinking water achieved in 3-5 years.	See Alternative No. 3A.

TABLE 8-3 (Cont.) EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
Location-Specific ARARs	See Alternative No. 2.	See Alternative No. 2.	See Alternative No. 2.	See Alternative No. 2.
Action-Specific ARARs	Ground-water treatment would meet NPDES requirements and air release standards. Would meet air release standards for vapor extraction system.	Ground-water treatment would meet NPDES levels. Infiltration basin would meet air discharge levels.	Ground-water treatment would meet NPDES levels. Vitrification would meet air discharge levels.	See Alternative No. 3A.
Other Criteria and Guidance	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Magnitude of Residual Risk				
- Direct Contact/ Soil Ingestion	Soil vapor venting removes VOC contamination from source area. Existing conditions indicate risk $<1 \times 10^{-6}$.	Bioremediation degrades VOC contamination in source area. Existing conditions indicate risk is $<10^{-6}$.	Vitrification totally destroys VOC contamination and immobilizes inorganic contamination in source area.	See Alternative No. 3A.
- Ground-Water Ingestion for Existing Users	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.

TABLE 8-3 (Cont.)

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
- Ground-Water Ingestion for Future Users	Risk greater as area of contamination increases. Lack of source area treatment does not restrict continuing source area contribution to contamination.	Risk eliminated by extracting ground water exceeding 10^{-6}. Safe drinking water achieved in more than 10 years.	See Alternative No. 1B.	Risk eliminated by extracting ground water exceeding 10^{-6}. Safe drinking water achieved in 3-5 years.	See Alternative No. 3A.
Adequacy and Reliability of Controls	No controls over remaining contamination. No reliability.	Ground-water pump and treat adequately controls ground-water contamination. Lack of source area treatment does not control future source of contaminants. Ground-water pump and treat is reliable and proven.	Ground-water pump and treat adequately controls ground-water contamination. Capping controls against generation of leachate, but does not control future source area contribution to ground-water contamination. Ground-water pump and treat is reliable and proven. Capping is reliable if regularly inspected and maintained.	Ground-water pump and treat adequately controls ground-water contamination. Excavation/incineration removes source area contamination. Incinerator ash may require RCRA waste disposal, due to metal concentrations. Incineration is very reliable since material is destroyed. Ground-water pump and treat is reliable and proven.	See Alternative No. 3A.
Need for Annual Review	Review would be required to ensure adequate protection and human health is maintained.	See Alternative No. 1A. Source area VOCs and metals would remain onsite.	See Alternative No. 1B.	See Alternative No. 1A. Ground-water contamination would require long-term monitoring.	See Alternative No. 3A.

TABLE 8-3 (Cont.) EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
- Ground-Water Ingestion for Future Users	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.
Adequacy and Reliability of Controls	Ground-water pump and treat adequately controls ground-water contamination. Soil vapor extraction is proven technology for removal of VOC contamination from surficial soil. Ground-water pump and treat is reliable and proven. Reliability of vapor extraction is high since no long-term operation and maintenance is required.	Ground-water pump and treat adequately controls contamination. Biodegradation of TCE and other chlorinated solvents subject to site conditions and toxic inhibition. Ground-water pump and treat is reliable and proven. Bioremediation is reliable under proper site conditions for certain contaminants. Treatability testing is essential.	Ground-water pump and treat adequately controls contamination. Vitrification can volatilize and destroy all organics and immobilize inorganics. Ground-water pump and treat is reliable and proven. Vitrification is very reliable because VOC contaminants are destroyed.	See Alternative No. 3A.
Need for Annual Review	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.	See Alternative No. 3A.

TABLE 8-3 (Cont.)

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Treatment Process Used	None	Ground-water pretreatment and VOC treatment[a]	See Alternative No. 1B	Incineration of source area wastes/soils, ground-water pretreatment, and VOC treatment[a]	See Alternative No. 3A.
Amount Destroyed or Treated	None	Over 98% of volatiles in ground water removed and subsequently destroyed.	See Alternative No. 1B.	>99% of source area contaminants destroyed offsite. Over 98% of VOCs in ground water removed and subsequently destroyed.	See Alternative No. 3A.
Reduction of Toxicity, Mobility, or Volume	None	Reduced volume and toxicity of contaminated ground water. Mobility of source area contaminants is not addressed.	Reduced volume and toxicity of contaminated ground water. Mobility of source area contamination is limited by capping. Toxicity and volume of source area not addressed.	Reduced volume and toxicity of contaminated ground water. Reduced volume/toxicity of source area contamination since 48,000 yd^3 of material removed from site and destroyed.	Reduced volume and toxicity of ground water. Incineration reduces toxicity of source area soils/wastes. Volume reduction of 12,500 yd^3 achieved.
Irreversible Treatment	None	Ground-water VOC treatment is irreversible.	Ground-water VOC treatment/destruction is irreversible.	Incineration is irreversible. Ground-water VOC treatment/destruction is irreversible.	See Alternative No. 3A.
Type and Quantity of Residuals Remaining After Treatment	None	Using activated carbon, spent carbon requires regeneration. Using air stripping, spent vapor phase carbon requires regeneration.	See Alternative No. 1B for ground water.	See Alternative No. 1B for ground water. Incinerated soils (17,500 yd^3) and wastes (15,000 yd^3) would be disposed offsite.	See Alternative No. 1B for ground water. Incinerated soils (17,500 yd^3) and wastes (15,000 yd^3) would require onsite or offsite disposal subject to LDRs.

TABLE 8-3 (Cont.) EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
Treatment Process Used	Vapor extraction of VOCs from source area. Ground-water pretreatment and VOC treatment[a]	Biological degradation of VOCs. Biological treatment of ground water[b]	Thermal destruction of VOCs. Stabilization of inorganics. Ground-water pretreatment and VOC treatment[a]	See Alternative No. 3A.
Amount Destroyed or Treated	>99% of VOCs removed from source area. Over 98% of VOCs in ground water removed and subsequently destroyed.	See Alternative No. 4; however, TCE degradation is not consistently demonstrated.	See Alternative No. 4.	>99% of source area contaminants from designated "hot spots" destroyed offsite. Over 98% of VOCs in ground water removed and subsequently destroyed.
Reduction of Toxicity, Mobility, or Volume	Reduced volume and toxicity of ground water. Reduced toxicity and mobility of source area contaminants.	See Alternative No. 4.	See Alternative No. 4.	Reduced volume and toxicity of contaminated ground water. 4,000 yd^3 of waste and 14,000 yd^3 of contaminated soil removed and disposed offsite.
Irreversible Treatment	Soil vapor extraction and ground-water VOC treatment/destruction are irreversible.	Yes.	Yes.	See Alternative No. 3A.
Type and Quantity of Residuals Remaining After Treatment	See Alternative No. 1B for ground water. No detectable residuals in source area.	See Alternative No. 1B.	See Alternative No. 1B for ground water.	See Alternative No. 1B for ground water. 26,000 yd^3 of waste and 3,500 yd^3 of contaminated soil are not treated.

TABLE 8-3 (Cont.)

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
Statutory Preference for Treatment	Does not satisfy.	Source area action does not satisfy. Ground-water action satisfies.	Capping does not satisfy. Ground-water treatment satisfies.	Satisfies.	Satisfies.
SHORT-TERM EFFECTIVENESS					
Community Protection	Risk to community not increased by remedy implementation.	See Alternative No. 1A.	Temporary increase in dust production through cap installation. Contaminated materials undisturbed.	Excavation would release dust and odors, could potentially release hazardous contaminants.	Excavation would release dust and odors, could potentially release hazardous air contaminants. Storage of excavated contaminated materials may present hazards.
Worker Protection	No significant risk to workers.	Dermal protection required during construction/operation of ground-water treatment system.	Dermal protection required during cap installation. Dermal protection required during construction/operation of ground-water treatment system.	Potential hazards associated with containerizing wastes. Dermal and respiratory PPE required during excavation and construction activities.	See Alternative No. 3A.
Environmental Impacts	Continued impact from existing conditions.	Local aquifer drawdown could be expected during ground-water extraction.	See Alternative No. 1B.	See Alternative No. 1B. Excavation activities could adversely affect surrounding environment, will produce odors and dust.	See Alternative No. 3A. Incineration may impact air quality, produce odors, although it will meet emission standards.
Time Unit Action is Complete	Not applicable.	Ground-water treatment system would require more than 10 years to meet MCLs.	See Alternative No 1B.	Ground-water treatment system would require 3-5 years to meet MCLs.	Onsite incineration would require at least 5 years after construction. Ground-water treatment could take 3-5 years.

TABLE 8-3 (Cont.) EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
Statutory Preference for Treatment	Satisfies.	Satisfies.	Satisfies.	Satisfies.
SHORT-TERM EFFECTIVENESS				
Community Protection	No significant risks to public during system implementation. Possible release of dust/ odors during construction.	Infiltration basin will be exposed. Potential for release of odors and insect generation.	Potential for odors during VOC destruction.	See Alternative No. 3A.
Worker Protection	Dermal protection required during construction of soil venting and ground-water extraction/ treatment systems. Respiratory protection may be required for soil venting system installation.	Dermal protection required during construction/operation of ground water and source area biological treatment processes.	Respiratory and dermal protection required during vitrification activities.	See Alternative No. 3A.
Environmental Impacts	Vapor extraction may impact air quality and odors, although it will meet emission standards. Local aquifer drawdown expected during ground-water extraction.	Bioremediation will affect air quality and produce odors, although it will meet emission standards.	Potential for odors and air quality impact, although it will meet emission standards.	See Alternative No. 3A.
Time Unit Action is Complete	Soil venting could be completed in less than 1 year. Ground-water treatment could take 3-5 years.	3-5 years would be required to achieve ground-water MCLs, pursuant to satisfactory results of treatability study.	Vitrification would take 6 months or less. 3-5 years would be required to achieve MCLs in ground water.	See Alternative No. 3A.

TABLE 8-3 (Cont.)

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
IMPLEMENTABILITY					
Ability to Construct and Operate	No construction or operation.	Onsite ground-water treatment system requires operation over system lifetime.	See Alternative No. 1B for ground-water considerations. Cap construction would require about 40,000 yd^3 of cover soil. Capping is relatively standard construction activity.	See Alternative No. 1B for ground-water considerations. Excavation will require specialty contractor to excavate landfill wastes.	See Alternative No. 1B for ground-water considerations. Excavation requires specialty contractor to excavate landfill wastes. Onsite mobile incineration system must be provided, constructed, operated. Incineration difficult to operate.
Ease of Doing More Action if Needed	If monitoring indicates additional action required, may need to go through the FS/ROD process again.	Additional extraction wells or pretreatment units could be provided.	See Alternative No. 1B.	See Alternative No. 1B.	System can handle varying volumes or concentrations.
Ability to Monitor Effectiveness	Additional downgradient well constructed as an indicator of contaminant migration. Extensive existing well network.	Proposed monitoring will give notice of failure before significant exposure occurs.	See Alternative No. 1B.	See Alternative No. 1B.	See Alternative No. 1B.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approval required.	Need an NPDES permit.	Need NPDES permit. Need wetlands and E&S permit.	Need NPDES, wetlands, and E&S permits. May need to include special E&S provisions during excavation.	Requires test burn and incineration permit. Requires NPDES wetlands, E&S permits.

TABLE 8-3 (Cont.) EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
IMPLEMENTABILITY				
Ability to Construct and Operate	Vapor extraction requires some operation, is relatively straightforward to construct. See Alternative No. 1B for ground-water water considerations	See Alternative No. 1B for ground-water considerations. In situ bioremediation relatively simple to construct but requires attention during operation.	See Alternative No. 1B for ground water considerations. Vitrification is very specialized and difficult during operation.	See Alternative No. 3A.
Ease of Doing More Action if Needed	Simple to expand soil venting system and ground-water treatment system.	Simple to expand bio-treatment area and upgrade water treatment processes.	System can handle varying volumes or concentrations.	See Alternative No. 1B.
Ability to Monitor Effectiveness	See Alternative No. 1B.	May be difficult to determine effectiveness of source area remediation.	See Alternative No. 1B.	See Alternative No. 1B.
Ability to Obtain Approvals and Coordinate with Other Agencies	Need onsite treatment period. Need NPDES, wetlands, E&S permits.	Onsite treatment permit will be required. Stormwater/E&S provisions essential. NPDES, wetlands permits required.	Onsite treatment permit required. NPDES, wetlands, E&S permits needed.	See Alternative No. 3A.

TABLE 8-3 (Cont.)

Criteria	Alternative No. 1A No Action with Site Control	Alternative No. 1B No Action, Site Control, Ground-Water Pump and Treat	Alternative No. 2 Capping with Surface/Gas Controls, and Ground-Water Pump and Treat	Alternative No. 3A Excavation, Offsite Incineration, and Ground-Water Pump and Treat	Alternative No. 3B Excavation, Onsite Incineration, and Ground-Water Pump and Treat
Availability of Services and Capacities	No services or capacities required.	See Alternative No. 1A.	See Alternative No. 1A.	Need offsite RCRA incineration. Closest facility is more than 200 mi from site.	Need mobile incinerator.
Availability of Equipment, Specialists, and Materials	Needs legal assistance to establish deed restrictions.	Needs treatment system operators.	Need ground-water treatment system operators. No special equipment or materials needed for capping. Liner installation specialists required. Cap materials available within 50 mi.	Need ground-water treatment system operators. Need specialty excavation contractors.	Need ground-water treatment system and incinerator operators. Need specialized excavation contractors.
Availability of Technologies	None required.	Ground-water treatment technology readily available. Treatability testing required.	Capping and pump and treat technology readily available. Treatability testing required.	Pump and treat technology readily available. Treatability testing required. Incineration sources well developed and available although not locally available.	Incineration and ground-water pump/treat well developed. Will require pilot testing.
COST					
Capital Cost	$50,000	$870,000	$2,220,000	$115,820,000	$47,820,000
Present Worth O&M Cost	$900,000	$1,360,000	$860,000	$700,000	$700,000
Total Present Worth Cost	$950,000	$2,230,000	$3,080,000	$116,520,000	$48,520,000

TABLE 8-3 (Cont.) EXTENDED

Criteria	Alternative No. 4 In Situ Soil Venting, Ground-Water Pump and Treat	Alternative No. 5 In Situ Soil Flushing/ Bioremediation, Ground-Water Pump and Treat	Alternative No. 6 In Situ Vitrification, Ground-Water Pump and Treat	Alternative No. 7 Selective Excavation Offsite Disposal, Ground-Water Pump and Treat
Availability of Services and Capacities	No services or capacities required.	Specialized biotreatment technology/ equipment required.	Specialized vitrification equipment required.	See Alternative No. 3A.
Availability of Equipment, Specialists, and Materials	Need ground-water treatment system operators. Needs readily available specialists to install and monitor vapor extraction system.	Specialized operators required for ground-water and in situ biotreatment.	Highly specialized technology. Requires experts to implement/operate.	See Alternative No. 3A.
Availability of Technologies	Vapor extraction and ground-water pump/ treat well developed. Will require pilot testing.	Relatively few vendors have demonstrated experience in biologically degrading TCE. Pilot testing is required.	Only one commercial vendor of this technology. Pilot testing required.	See Alternative No. 3A.
COST				
Capital Cost	$4,720,000	$2,420,000	$51,470,000	$43,920,000
Present Worth O&M Cost	$700,000	$720,000	$700,000	$700,000
Total Present Worth Cost	$5,420,000	$3,140,000	$52,170,00	$44,620,00

contamination will increase the effectiveness of the ground-water extraction/treatment component of the remedial action. Alternative Nos. 3A, 3B, and 7 (excavation/incineration options) are source area removal actions. Alternative Nos. 4 through 6 (soil venting, bioremediation, and vitrification) are in situ treatment actions. It is estimated that ground-water treatment could be achieved in less than 5 years with source area extraction and treatment. Ground-water treatment would require more than 10 years to reach health-based cleanup levels without source area extraction or treatment, and could require significantly longer depending on the volume of contaminant actually remaining within the source area.

The primary advantage to removal actions over treatment actions is that the source of contamination is permanently removed. Significant disadvantages of removal actions are that offsite disposal will probably require incineration due to concentrations of metals and VOCs in the wastes; permitted disposal facilities are not proximate to the site; and the metals content of wastes will still require RCRA-regulated disposal of ash. Alternative Nos. 4 through 6 (soil vapor venting, soil flushing/bioremediation, and vitrification) could all be effective in removing VOCs from the source area. Pilot testing should be conducted. Bioremediation may require 3-5 years to reduce contaminants to health-based levels. Bioremediation would need to be conducted in conjunction with an onsite aerobic bioreactor for VOC treatment of ground water. Soil venting could be completed in less than 1 year. Vitrification could be completed in 6 months or less.

8.2 COMPLIANCE WITH ARARS

The evaluation of the ability of the alternatives to comply with ARARs included a review of chemical-specific and action-specific ARARs that was presented earlier. Location-specific ARARs pertaining to wetlands and floodplains were also considered. All alternatives will meet their respective ARARs except for Alternative No. 1A (no action).

8.3 LONG-TERM EFFECTIVENESS AND PERFORMANCE

All alternatives (except No. 1A) are equally effective with respect to ground-water treatment actions. The excavation/incineration alternatives (Nos. 3A, 3B, and 7) and the in situ treatment alternatives (Nos. 4, 5, and 6) afford the highest degree of long-term effectiveness and performance, because these alternatives use treatment processes to reduce hazards posed by all known wastes at the site. The primary differences among the alternatives are the approach to removing VOC contamination from the source area.

Alternative Nos. 3A, 3B, and 7 are excavation/incineration alternatives. All of these options require that contaminated material be excavated and removed from the designated source area. In Alternative No. 3A, waste is taken to a RCRA-permitted offsite facility. In Alternative No. 3B, waste is incinerated onsite and any resultant ash that cannot be replaced due to RCRA Land Ban restrictions is taken to a RCRA-regulated ash disposal facility. Alternative No. 7 includes excavation and offsite incineration similar to Alternative No. 3A, except that the extent of source area waste removed is limited. All of these alternatives provide for permanent removal of the source of VOC contamination from the site.

Alternative No. 4 uses in situ soil venting to remove VOC contamination from the source area. Soil venting is a proven technology that has demonstrated effectiveness in remediation of sites contaminated with TCE and TCE-breakdown products (i.e., DCE, vinyl chloride). This technology would provide for permanent removal of source area VOC contamination. The depth to ground water within the waste matrix may impact system performance.

Alternative No. 5 applies soil flushing and enhanced bioremediation to degrade VOC contamination within the source area. Bioremediation is an innovative treatment technology that has been demonstrated to be effective in degrading certain organic contaminants. TCE and related solvents have been successfully degraded under certain conditions but has not been

consistently demonstrated effective for TCE degradation. Treatability testing and pilot testing are essential to assess the viability of this technology for conditions at the Marsh Run Park site.

In situ vitrification (ISV) (Alternative No. 6) provides for permanent removal of VOCs and for stabilization of metals and other inorganics. ISV has not been applied for large-scale projects, but has been highly effective in treatment and stabilization of high levels of contaminants in small areas. ISV may be adversely affected by the presence of inclusions (i.e., metal, wood, organic debris, water) within the waste matrix at Marsh Run Park.

The remaining alternatives (Nos. 1A, 1B, and 2) do not provide as great a degree of permanence since source area contaminants are not removed or treated.

Alternative No. 1A (no action) does not provide any reduction of contamination. Therefore, long-term effectiveness and permanence is not applicable to this alternative. Alternative No. 1B is similar to No. 1A except that it does provide for effective, long-term control of ground-water contamination.

Alternative No. 2 (capping) provides an impermeable barrier to prevent rainfall and surface infiltration. This barrier should effectively minimize leachate generation from the source area. Capping is an effective long-term action provided that regular inspection and maintenance is conducted. Ground-water monitoring is a significant component of this alternative. The primary disadvantage of capping in comparison to removal or treatment actions is that the time required to achieve ground-water cleanup to health-based levels will be longer (>10 years vs. <5 years). [An estimate of time required for cleanup without source area removal or treatment is very difficult to predict since it is not known with any degree of certainty how much contamination remains within the source area.]

8.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative Nos. 3A and 3B provide the highest reduction of toxicity, mobility, and volume, since these alternatives provide for removal and destruction of contaminated soils and wastes, and treatment of contaminated liquids. Alternative Nos. 4, 5, and 6 do not provide for complete removal of source area wastes, but provide for reduction of source area toxicity through removal of VOC contamination within the source area. Alternative Nos. 4 through 6 also provide for treatment and destruction of VOC contamination from the bedrock aquifer.

Alternative No. 4 (soil venting) is the most proven technology for site conditions at Marsh Run Park. Off-gas treatment (activated carbon or catalytic oxidation) will provide for removal/destruction of contaminants. Alternative No. 5 (bioremediation) should be effective but will require a much longer time frame for remediation. Alternative No. 6 (vitrification) will provide treatment of VOCs and stabilization of metals.

Alternative No. 7 (selective excavation/incineration) is similar to Nos. 3A and 3B except that it does not address the entire source area. A total of approximately 18,000 of the 47,500 yd^3 of identified source area are removed and treated under this alternative.

Alternative Nos. 1B (no action/ground-water treatment) and 2 (capping) provide for reduction of the volume and toxicity of contaminated ground water. Alternative No. 1A does not apply any treatment technologies and does not provide for reduction of toxicity, mobility, or volume of contaminants from the site.

8.5 SHORT-TERM EFFECTIVENESS

Alternative No. 1B (no action and ground-water pump and treat) and No. 2 (capping) are anticipated to have the greatest short-term effectiveness. These alternatives present the least amount of risk to workers, the

community, and the environment. Some particulate emissions from cap installation (Alternative No. 2) is anticipated during implementation; however, dust control methods should reduce this risk. Construction of this alternative could be completed in a short time period (6 months or less). Alternative No. 1B could be completed in a comparable time period. The entire time required for completion of remedial action under these alternatives, however, would be in excess of 10 years, since the source area contamination is not removed or treated.

The in situ treatment actions (Alternative Nos. 4 through 6) also provide good short-term effectiveness. Alternative No. 4 (soil venting) provides the best short-term effectiveness of the in situ treatment alternatives. This action requires minimal exposure to contaminants for workers, the surrounding community, and the environment. It can be completed in 9-12 months, and it does not require significant site disturbance to implement. Bioremediation (Alternative No. 5) requires a longer time period for source area treatment (3-5 years) and it presents more potential for exposure through the infiltration basin. Bioremediation does not require source area disturbance and minimizes contaminant exposure. Vitrification (Alternative No. 6) could be completed within 6 months. With proper controls, vitrification provides good protection to the community and environment. Risk to workers is not significant, but is greater than for soil venting.

Total remedial action performance time (including ground-water actions) for in situ treatment methods is expected to be 5 years or less.

The excavation/incineration alternatives (Nos. 3A, 3B, and 7) present the greatest short-term risks to site workers, the public, and the environment. Releases of volatile contaminants during excavation will be very difficult to control. Workers will be directly exposed to dermal and respiratory hazards during excavation, materials separation, and drumming of wastes. Hazards associated with offsite transport of hazardous wastes must be considered. Alternative Nos. 3A and 7 could be completed within 6 months. Alternative No. 3B would require at least 5 years. Another

short-term risk associated with Alternative No. 3B is storage of excavated wastes prior to incineration.

Total remedial action performance time (including ground-water actions) for excavation/incineration alternatives is expected to be about 5 years.

8.6 IMPLEMENTABILITY

Alternative No. 1B (no action with ground-water pump and treat) would be the simplest to construct and operate. Alternative No. 1B requires only the ground-water extraction and treatment system. A system operator would be required. This alternative would include long-term monitoring to assess performance. Additional wells or system components could easily be provided if operating conditions warranted.

Alternative No. 2 (capping) would also be relatively simple to construct and operate. Alternative No. 2 includes the ground-water considerations described for No. 1B and also includes construction of an impermeable cap in conformance with RCRA closure requirements. This activity is not a difficult construction practice and does not require specialized expertise, except for liner installation. Long-term monitoring and maintenance is an essential component of this alternative.

Alternative No. 4 (soil venting) is another alternative that is relatively easily implemented. Soil venting is proven for remediation of chlorinated organic solvents. Treatability and pilot testing would be required. Effectiveness can be monitored through sampling of soils and ground water, during the remedial action process. Specialized equipment or materials are not required. A system operator is required. Since the site is subject to floodplain considerations, appropriate provisions should be made. Ground-water considerations are as indicated for Alternative No. 1B.

Alternative No. 5 (bioremediation) is more complex than Alternative Nos. 1B, 2, or 4, but is still relatively simple to implement. Bioremediation of chlorinated organic solvents will, however, require close observation to optimize system performance. This alternative may be subject to toxic inhibition due to metals concentrations within the source area, and will require optimization of the liquid recycling rate, microbe concentration, nutrient concentration, and oxygen concentration. Treatability and pilot testing is essential. Since the site is subject to floodplain considerations, appropriate provisions should be made. Ground-water considerations are as indicated for Alternative No. 1B.

In situ vitrification (Alternative No. 6) is more complex than alternatives previously discussed, particularly due to the inhomogeneity of the waste area and the presence of inclusions (metal, wood, organic debris, water) within the waste matrix. Sufficient electrical supply will be required to generate the large energy demand necessary for this alternative. Treatability testing is required. Since the site is subject to floodplain considerations, appropriate provisions should be made. Ground-water considerations are as indicated for Alternative No. 1B.

Alternative Nos. 3A and 7 (excavation/offsite incineration) present significant difficulties during excavation and handling of waste materials. Excavation of a former landfill with a shallow ground-water level of 4-10 ft below ground surface will present construction-related and health-related concerns. Transport and offsite disposal of hazardous materials will require permitting and coordination with other states and the RCRA-permitted facility. Distance to a RCRA-permitted facility is a concern since no facilities are located less than 200 mi from the site.

Alternative No. 3B (onsite incineration) presents the most difficulties in implementation. Excavation and materials handling concerns described above apply to this alternative. Onsite incineration will also result in ash with concentrated metals levels. A trial burn and permitting would be required. Onsite incineration is susceptible to frequent down time

due to mechanical complexities. Provisions for storage of excavated wastes would be required. Since the site is subject to floodplain considerations, appropriate provisions should be made.

Ground-water considerations for all excavation/incineration alternatives are as indicated for Alternative No. 1B.

8.7 COST

Examination of costs indicates that the capital costs for Alternative Nos. 3A, 3B, 6, and 7 (excavation/incineration options and in situ vitrification) are one to two orders of magnitude more than the capital costs for Alternative Nos. 1A, 1B, 2, 4, and 5 (no action, capping, soil venting, and bioremediation). Operation and maintenance costs for all alternatives are fairly comparable, although the operation and maintenance costs for Alternative Nos. 1B and 2 are somewhat higher, since these alternatives include ground-water treatment but do not include source area treatment. Alternative No. 1B is a "no action" alternative, while Alternative No. 2 is a capping alternative.

The in situ treatment methods (excluding Alternative No. 6, vitrification) appear to represent the most cost-effective alternatives that address both ground-water and source-area treatment. Alternative No. 4 uses soil venting technology to remove VOCs from the source area. Alternative No. 5 uses soil flushing and enhanced biodegradation to biologically degrade VOC contamination present within the source area.

A summary of costs for each of the remedial alternatives is provided in Table 8-2. For consistency in evaluation, costs for UV oxidation are used for the ground-water treatment technology. This does not mean that UV oxidation would be the selected ground-water technology. Choice of the appropriate VOC treatment technology for ground water at the Marsh Run Park site should be based upon results of treatability testing.

8.8 STATE ACCEPTANCE

The Commonwealth of Pennsylvania, through its Department of Environmental Resources (DER) concurs with the selected remedy. Appendix A includes a summary of regulatory agency correspondence.

8.9 COMMUNITY ACCEPTANCE

A public meeting for the Proposed Remedy was held on 30 October, 1990 in Fairview Township, Pennsylvania. The meeting was attended by approximately twenty residents and no adverse comments to the alternative were received at the meeting or during the following comment period. In general, the community is pleased to see that remediation will occur at the site. Appendix B summarizes the comments and responses from the public review period during the RI/FS.

9. SELECTED REMEDY

9.1 DESCRIPTION

The selected remedy for the remediation of the Marsh Run Park site consists of a ground-water pumping and treatment system for bedrock aquifer remediation and soil venting for source area remediation. Both air stripping (Ground-Water Alternative No. 2) and UV oxidation (Ground-Water Alternative No. 4) should be considered during the pre-design phase for ground water VOC treatment. Soil venting (Source-Area Alternative No. 4) is recommended for source area remediation. In addition, a perimeter fence will be constructed to protect equipment at the site, and a long term monitoring program will be established to monitor the ground-water quality and the effectiveness of the treatment system.

The selected remedy will be an integrated site clean-up system: Figure 9-1 shows a conceptual layout of what the treatment system configuration may look like. Initially, water will be pumped to dewater the shallow saturated zone using the same wells that will be used for the source area venting system (Figure 9-2). Once the shallow saturated zone is dewatered, the extraction well system along the northern portion of the site will pump out contaminated water from the bedrock aquifer for treatment in a two-stage ground-water treatment system. The wells will be placed to intercept contaminated bedrock aquifer flow on its way toward the Susquehanna River, and will serve to contain the contaminated ground water (Figure 9-3). The objective of ground-water extraction will be to remove and treat contamination within the site boundaries as well as containment/remediation of contamination that has migrated toward the Susquehanna River. The specific locations of bedrock aquifer extraction wells will be refined during the pre-design phase through aquifer characterization to assure that remedial action objectives are achieved. The two-stage ground-water treatment system consists of a pretreatment unit to remove metals and

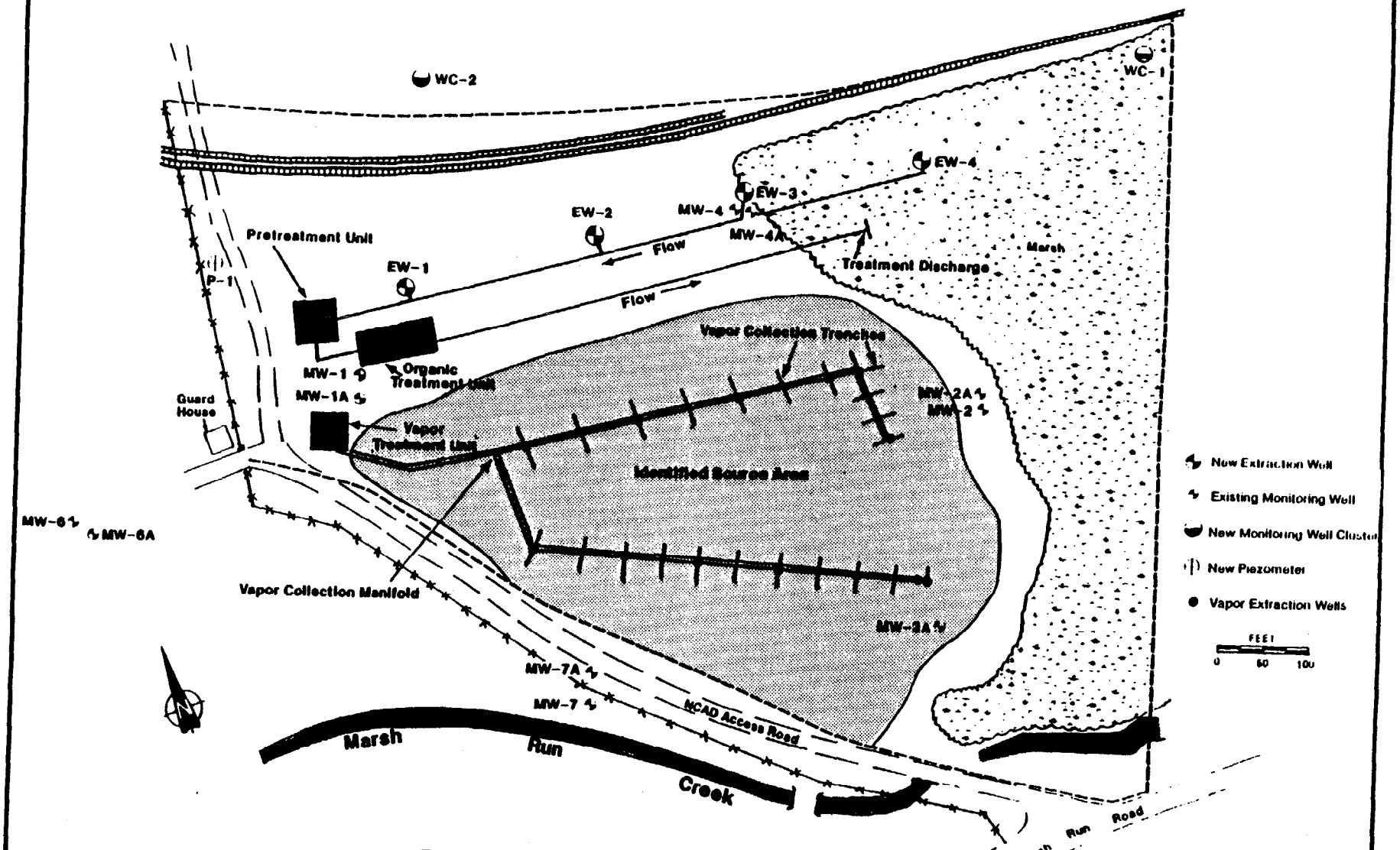

Figure 9-1. Conceptual Layout of Treatment System Configuration

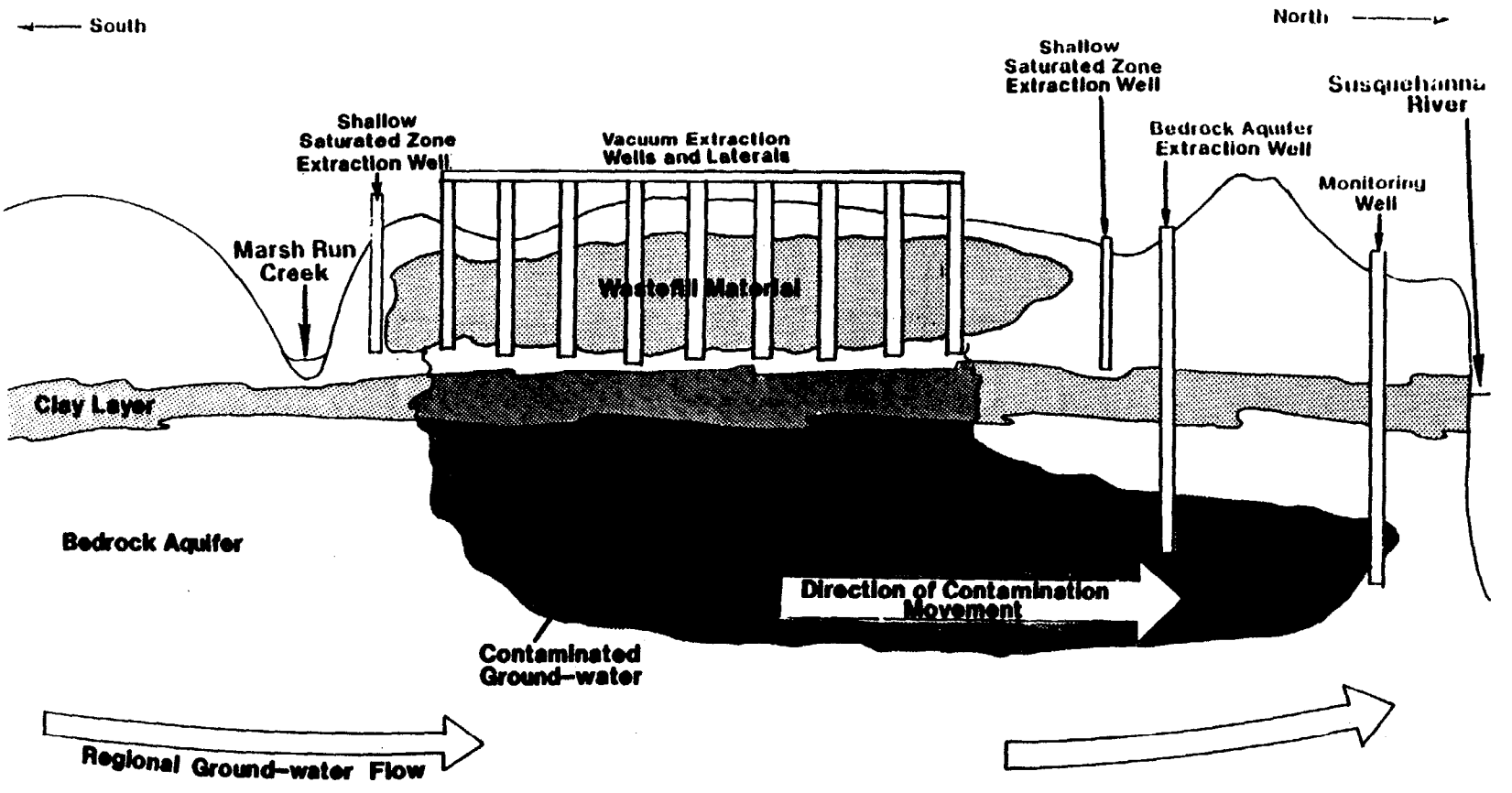

Figure 9-2. Cross-Section View of Conceptual Source Area and Groundwater Treatment System

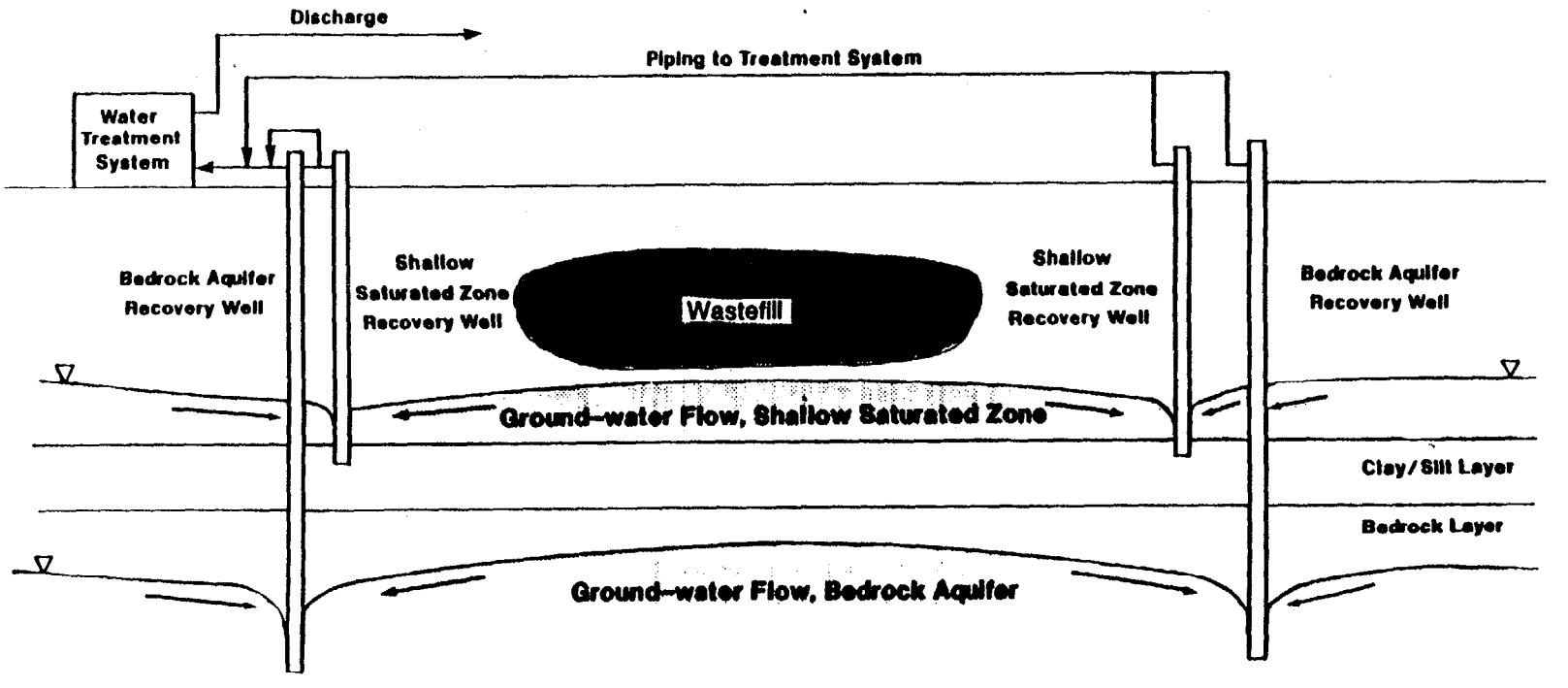

Figure 9-3. Schematic Showing Cross-Section of Groundwater Pumping System

solids, and an organic treatment unit to remove volatile organic contamination (VOC). The VOC treatment system will be either UV oxidation (Ground-Water Alternative No. 4), or air stripping (Ground-Water Alternative No. 2) pursuant to decisions during the pre-design phase of the remedial design. At the same time as ground water pumping, the soil venting system will remove organic contamination from the source area using vacuum extraction (Figure 9-4). Once extracted, the contaminants will then be treated using the vapor treatment system (Source-Area Alternative No. 4).

9.2 PERMIT REQUIREMENTS

The system will be designed in accordance with all federal and state regulations and will require several permits before it can begin operations:

- Well permits will be needed to drill the extraction wells and monitoring wells.

- Construction permits would be required to build the vacuum extraction system and the ground-water treatment system.

- Sediment and erosion control measures and permits would be required.

- Surface water discharge permits will be needed to assure that treated water meets state discharge standards.

- Air permits will be required to assure that ground water and vapor treatment systems meet clean air standards.

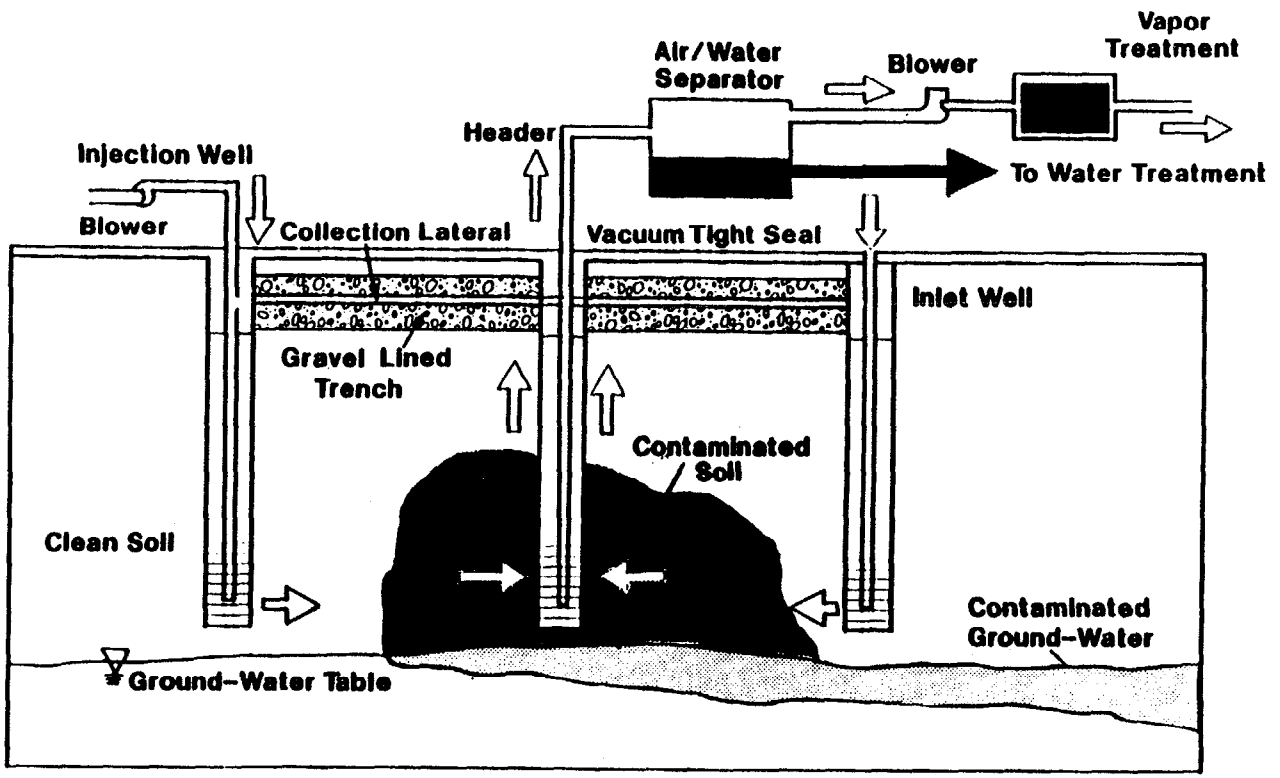

Figure 9-4. A Typical Soil Vapor Extraction System Configuration

9.3 LONG TERM MONITORING PROGRAM

A long term monitoring program will be implemented to characterize bedrock aquifer contamination over time. Figure 9-5 shows the proposed monitoring well locations and surface water sample locations for the selected remedy. The objective of the monitoring program is to assure that contamination is being contained and treated and it will consist of the following items:

- The use of existing wells in the shallow saturated zone and the bedrock aquifer.

- The installation of two new well clusters, each having a shallow saturated zone well and a bedrock aquifer well.

- Annual monitoring of all wells for a period of 30 years. This is long after the projected cleanup completion date and provides assurance that this problem will not recur over time.

- Annual monitoring of surface water samples from Marsh Run Creek for a period of 30 years.

9.4 REMEDIATION GOALS

9.4.1 Cleanup Objectives

Based upon the remedial objectives identified in the FS, the following goals have been identified:

- Ground Water--Containment and remediation of bedrock aquifer contamination through ground-water extraction and subsequent treatment. The ground water treatment system will be operated at a minimum until ground-water samples reach levels of less than the maximum contaminant levels (MCLs) specified by U.S. EPA in the Safe Drinking Water Act and in accordance with the PaDER

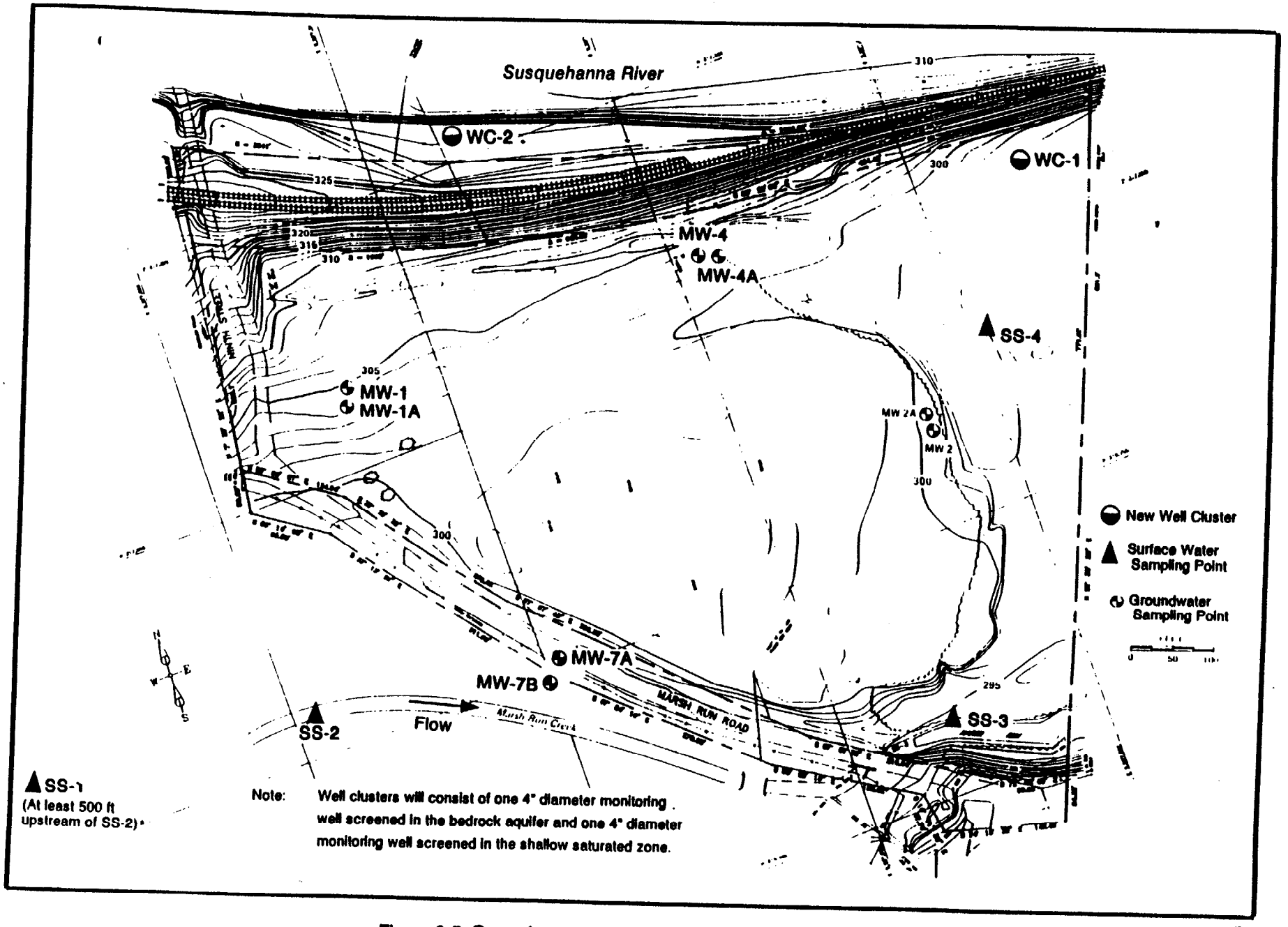

Figure 9-5. Groundwater and surface water monitoring locations.

proposed Groundwater Quality Protection Strategy. If after yearly reviews the system appears to be capable of removing contaminants to a value of less than MCLs, the system will be operated to achieve these goals until the U.S. Army Corps of Engineers (USACE) determines that the treatment system effectiveness is limited in achieving any relative improvement in contaminant removal. At that time USACE will formally petition PaDER to conclude remediation.

As new standards are established, and new and more effective treatment technology is developed, treatment design will be evaluated and revised to achieve these objectives, if feasible and justified as cost effective.

- Source Area--Treatment of VOC contamination in the identified source area (Figure 5-8) through soil vacuum extraction (SVE) with off-gas treatment (Activated carbon or catalytic oxidation) to meet PaDER air discharge standards. Performance goals for the removal of volatiles in the source area will be based on a pilot study and subsequent evaluation of the technological and engineering feasibility of the SVE system.

  1. An SVE system will be utilized to clean up volatile contaminants in the soil. To obtain the required data for the design of an SVE system a pilot study will be accomplished. The pilot study will determine the effectiveness of the SVE system in removing volatile contaminants from the soil and how much vacuum can be produced in the system. These data will be used to design the RA SVE system.

  2. The performance of the SVE system will be evaluated continuously during the first year of operation to fine tune the operating parameters. In addition data will be collected to quantify the mass of contaminants removed and plotted against time to evaluate the effectiveness of the system.

Periodically the system will be shut down if a plot of mass of extracted contaminants vs. time becomes asymptotic indicating that the efficiency of the system is deteriorating. After allowing the system to recover the system will be turned back on and monitored for additional recovery of volatiles.

3. At the end of one year of operation a Technical Memorandum will be submitted to PaDER that presents the data on the performance of the SVE system. Included in the report will be a recommendation by USACE with respect to continued operation of the system. The operating parameters of the system will be evaluated at this time and adjustments will be made as required. If USACE determines that continued operation of the SVE system is no longer justified based on technological/engineering feasibility and cost effectiveness USACE will petition PaDER to shut down the system. This petition process can be implemented at any time between the first-year review of the SVE system and the five-year review of the ground water treatment system.

- Total System--The installation and operation of the two treatment processes for ground water and source area would be phased. The dewatering of the site would have to be in operation for a period of time before the pilot SVE system becomes operational. This is to allow sufficient dewatering to develop site conditions comparable to actual SVE system operating conditions. The actual operation and evaluation periods could be coordinated to run concurrently after the SVE system is in operation to allow simultaneous adjustments in the Operation and Maintenance (O&M) standards.

The complete operational time period for the SVE system should be scheduled to end when the ground water treatment system is scheduled for its five-year evaluation.

Treatment System

9.4.2 Ground-Water Treatment Performance Assessment

- 30yr monitoring

It is estimated that ground-water remediation will be able to meet cleanup standards within 5 years. This estimate will be refined pursuant to aquifer characterization and treatability testing to be performed during the pre-design phase of the remedial action. The ground-water extraction/treatment system will remain onsite ~~throughout the 30-year monitoring period~~ until the State is petitioned and agrees as indicated for conclusion of treatment in accordance with 9.4.1. If ground-water monitoring indicates that ground-water quality does not continue to meet the treatment objectives, the system may need to be restarted to maintain water quality.

- 40CFR264

To adequately assess ground-water extraction/treatment performance, several milestones can be established. The first milestone will be at the completion of one year of operation of the system. Ground water quality data will be examined to assess system performance and the need for process modifications. Interim monitoring of system performance will be provided as a component of system operation and through the annual ground-water monitoring program, which will fulfill this requirement.

A second milestone to be established will be a 5-year review. Results of ground-water quality samples at the 5-year review will be examined in conjunction with previous sample results to assess system performance. If it is determined at this time that the system performance is unsatisfactory, modifications to the Record of Decision/remediation requirement/specification will be required.

9.4.3 Source-Area Treatment Performance Assessment

It is estimated that source area treatment should meet target treatment objectives to minimize source area contribution to ground-water contamination in approximately 1 year. This estimate will be refined once pilot testing is initiated during the pre-design phase of the ROD. Since it is not uncommon for adsorbed contaminants to desorb at differing rates from

soil/waste particles over time, it is anticipated that it may be necessary to periodically restart portions of the venting system. As such, the source area treatment system will need to remain in place.

To adequately assess soil vapor extraction performance, several milestones will be established. The first action will be to perform a treatability study. The first milestone should be at the completion of one year of operation of the extraction system. If system performance at the end of the 1-year period indicates that the source area treatment performance objectives have not been met, additional treatment will be provided in portions of the site where treatment objectives have not been achieved, and additional source area evaluation will be conducted on a periodic basis until treatment objectives are achieved. Interim monitoring of system performance will be provided as a component of system operation (measurement of contaminants extracted in vapor phase) and through the annual ground-water monitoring program.

The second milestone will be a petition to shut down the source area treatment system based upon system performance records. The second milestone will occur after the one-year review and prior to the five-year review of the ground-water treatment system. The system may continue to operate until the 5-year review of the ground-water treatment system, at which time the operation of the SVE system will be terminated.

9.5 COSTS

Costs for the source area and ground-water components of the selected remedy are presented in Tables 9-1 through 9-3. The total estimated remediation cost will include the source area remedial action plus the ground-water remedial action. Costs for two different ground-water remedial actions are provided since final selection of ground-water VOC

TABLE 9-1a PRELIMINARY ESTIMATE OF CAPITAL COSTS FOR SOURCE-AREA SELECTED REMEDY: IN SITU SOIL VENTING

Item	Description	Quantity	Unit Cost	Total
1	Security Fence	1,500 ft	$ 12.40/ft	$ 18,600
2	Surface Preparation	LS	LS	2,000
3	Erosion/Sediment Control	LS	LS	25,000
4	Venting System[a]	48,600 CY	$ 50 CY	2,430,000
5	SUBTOTAL			$2,475,600
6	Mobilization/Demobilization, Construction Management, Site Services		10%	247,560
7	Implementation, Design, Permits		22%	544,632
8	Contingency		25%	618,900
9	TOTAL			$3.89 X 10^6

(a) Cost includes equipment, construction of the system, and costs for labor, materials and supplies, analytical testing, effluent treatment, residual disposal, and facility modifications during the operational period of the system (estimated at 1 year).

TABLE 9-1b PRELIMINARY ESTIMATE OF OPERATION AND MAINTENANCE COSTS FOR SOURCE-AREA SELECTED REMEDY: IN SITU SOIL VENTING

Item	Description	Quantity	Unit Cost	Total
FIRST YEAR				
1	Quarterly Inspection	96 hours	$40/hr	$ 3,840
2	Ground-Water Monitoring			
	. Labor	80 hours	40/hr	3,200
	. Analysis	24 samples	905/sample	21,720
3	Surface Water Sampling			
	. Labor	40 hours	40/hr	1,600
	. Analysis	16 samples	905/sample	14,480
4	Lawn Mowing			
	. Labor	384 hours	20/hr	7,680
	. Equipment	384 hours	8/hr	3,072
5	Confirmatory Soil Sampling			
	. Labor	96 hours	40/hr	3,840
	. Analysis	40 samples	220/sample	8,800
6	TOTAL			$ 68,232
O&M FOR YEARS 2-30				
1	Quarterly Inspection	96 hours	$40/hr	$ 3,840
2	Ground-Water Monitoring			
	. Labor	20 hours	40/hr	800
	. Analysis	6 samples	905/sample	5,430
3	Surface Water Sampling			
	. Labor	10 hours	40/hr	400
	. Analysis	4 samples	905/sample	3,620
4	Lawn Mowing			
	. Labor	384 hours	20/hr	7,680
	. Equipment	384 hours	8/hr	3,072
5	TOTAL			$24,842

TOTAL 30-YEAR PRESENT WORTH O&M COSTS =
$68,232 + $24,842 (P/A, 8%, 29 yrs) = $345,429 ~ $350,000

TABLE 9-2a PRELIMINARY ESTIMATE OF CAPITAL COSTS FOR GROUND-WATER SELECTED REMEDY: AIR STRIPPING

Item	Description	Quantity	Unit Cost	Total
1	Aquifer Characterization			
	. Deep Observation Wells (2)	200 ft	$100/ft	$20,000
	. Shallow Observation Wells (2)	60 ft	$60/ft	3,600
	. Borehole Geophysics (6 wells)	LS	LS	5,000
	. Discrete Fracture Sampling (2 wells)	LS	LS	8,000
	. Long-Term Pump Testing (1 well)	LS	LS	15,000
	. Ground-Water Modeling (3-D MODFLOW)	LS	LS	15,000
				$66,600
2	Extraction Wells	400 ft	$ 100/ft	$ 40,000
3	Pumping System	4	5,500/ea.	22,000
4	Piping			
	. Pressure Pipe	550 ft	20/ft	11,000
	. Gravity Pipe	500 ft	13.80/ft	6,900
5	Outfall Structure	1 ea.	LS	1,000
6	Metering	LS	LS	10,000
7	Electrical	LS	LS	30,000
8	Pretreatment	LS	LS	175,000
9	Treatability Testing for Ground Water	LS	LS	5,000
10	Air Stripping System (tower, foundation, blower, media)	1 each	44,000/ea.	44,000
10a	Off-Gas Treatment			
11	System Operator	1,000 hours	$45/hr	45,000
12	SUBTOTAL			$456,500
13	Mobilization/Demobilization, Construction Management, Site Services		10%	45,650
14	Implementation, Design, Permits		22%	100,430
15	Contingency		50%	228,250
16	TOTAL			$830,830
			SAY	$835,000

TABLE 9-2b PRELIMINARY ESTIMATE OF OPERATION AND MAINTENANCE COSTS FOR GROUND-WATER SELECTED REMEDY: AIR STRIPPING

Item	Description	Quantity	Unit Cost	Total
YEARS 1-5				
1	Ground-Water Monitoring			
	. Labor	80 hours	$ 40/hr	$ 3,200
	. Analysis	16 samples	905/sample	14,480
2	Treatment Costs			
	. Pretreatment	15,770,000 gal	2.25/1,000 gal	35,483
	. VOC Treatment	15,770,000 gal	0.50/1,000 gal	7,885
	. Off-Gas Treatment	15,770,000 gal	1.00/1,000 gal	15,770
3	System Maintenance (10% of capital equipment cost)	LS	LS	4,400
4	TOTAL			$81,218/yr
O&M FOR YEARS 6-30				
1	Ground-Water Monitoring			
	. Labor	20 hours	$ 40/hr	$ 800
	. Analysis	4 samples	905/sample	3,620
2	TOTAL			$4,420/yr

TOTAL 30-YEAR PRESENT WORTH O&M COSTS =
$81,218 (P/A, 8%, 5 yrs) +
$4,420 (P/A, 8%, 25 yrs) (P/F, 8%, 5 yrs) = $360,410

SAY $360,000

TABLE 9-3a PRELIMINARY ESTIMATE OF CAPITAL COSTS FOR GROUND-WATER SELECTED REMEDY: UV OXIDATION

Item	Description	Quantity	Unit Cost	Total
1	Aquifer Characterization			
	. Deep Observation Wells (2)	200 ft	$100/ft	$20,000
	. Shallow Observation Wells (2)	60 ft	$60/ft	3,600
	. Borehole Geophysics (6 wells)	LS	LS	5,000
	. Discrete Fracture Sampling (2 wells)	LS	LS	8,000
	. Long-Term Pump Testing (1 well)	LS	LS	15,000
	. Ground-Water Modeling (S-D MODFLOW)	LS	LS	15,000
				$66,600
2	Extraction Wells	400 ft	$ 100/ft	$ 40,000
3	Pumping System	4	5,500/ea.	22,000
4	Piping			
	. Pressure Pipe	550 ft	20/ft	11,000
	. Gravity Pipe	500 ft	13.80/ft	6,900
5	Outfall Structure	1 ea.	LS	1,000
6	Metering	LS	LS	10,000
7	Electrical	LS	LS	30,000
8	Pretreatment	LS	LS	175,000
9	Treatability Testing for Ground Water	LS	LS	5,000
10	UV/Oxdidation (UV/oxidation reactor, oxidation source, system operator)	LS	LS	80,000
11	SUBTOTAL			$447,500
12	Mobilization/Demobilization, Construction Management, Site Services		10%	44,750
13	Implementation, Design, Permits		22%	98,450
14	Contingency		50%	223,750
15	TOTAL			$814,450
			SAY	$820,000

TABLE 9-3b PRELIMINARY ESTIMATE OF OPERATION AND MAINTENANCE COSTS FOR GROUND-WATER SELECTED REMEDY: UV OXIDATION

Item	Description	Quantity	Unit Cost	Total
YEARS 1-5				
1	Ground-Water Monitoring			
	. Labor	80 hours	$ 40/hr	$ 3,200
	. Analysis	16 samples	905/sample	14,480
2	Treatment Costs			
	. Pretreatment	15,770,000 gal	2.25/1,000 gal	35,483
	. VOC Treatment (oxidation, electrical)	15,770,000 gal	0.30/1,000 gal	4,731
3	System Maintenance (10% of capital equipment cost)		LS	8,000
4	TOTAL			$65,894/yr
O&M FOR YEARS 6-30				
1	Ground-Water Monitoring			
	. Labor	20 hours	$ 40/hr	$ 800
	. Analysis	4 samples	905/sample	3,620
2	TOTAL		—	$4,420/yr

TOTAL 30-YEAR PRESENT WORTH O&M COSTS =
$65,894 (P/A, 8%, 5 yrs) +
$4,420 (P/A, 8%, 25 yrs) (P/F, 8%, 5 yrs) = $295,228

SAY $296,000

treatment technology will be made as a component of the pre-design phase of the remedial design. Table 9-4 compares total estimated remediation costs using both ground-water VOC treatment technologies.

Contingencies for the ground-water treatment component are high (50 percent) due to the preliminary state of the treatment system design, and will be refined based upon results of pre-design activities (i.e. bedrock aquifer characterization and treatability studies).

TABLE 9-4 SUMMARY OF TOTAL ESTIMATED COSTS FOR SELECTED REMEDY

Cost Item	VOC Treatment Technology	
	Air Stripping	UV Oxidation
1. Capital Costs		
. Source Area	$3.89 x 10^6	$3.89 x 10^6
. Ground Water	835,000	820,000
2. O&M Costs (Present Worth Value)		
. Source Area	350,000	350,000
. Ground Water	360,000	296,000
TOTAL	$5.43 x 10^6	$5.36 x 10^6

10. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, attains all applicable or relevant and appropriate requirements (ARARs) for this site, is cost-effective, will utilize permanent solutions and alternative treatment technologies to the maximum extent practical and satisfies the preference for treatment as a principal element.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy will be protective of human health and the environment through the pumping and treatment of the ground water to drinking water standards and through the treatment of the source area through soil venting.

10.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The selected alternative will be consistent with the ARARs identified for this site previously in Chapter 7.

10.3 COST EFFECTIVENESS

The selected remedy will afford a high degree of overall effectiveness proportional to its cost, as source area contamination is treated to prevent future contaminant migration to the ground water and the ground water is treated to drinking water standards. This compares favorably with other alternatives considered which would achieve these remediation goals at much higher costs.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICAL

The selected remedy is believed to be the most appropriate solution for remediation of the VOC contamination of the source area and treatment of the ground water for conditions at this site. The selected remedy is

expected to be a permanent solution and employs innovative treatment technologies. The selected remedy has long-term effectiveness and permanence; it reduces toxicity, mobility, and volume of contamination through treatment; it has short-term effectiveness; has a high degree of implementability; and it has a relatively low cost. All five of these criteria were decisive factors in the selection decision. State and community acceptance of the selected remedy were also decisive factors in the selection decision.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The statutory preference for treatment is satisfied by the selected remedy. VOC contamination of the source area is treated by soil venting and ground-water contamination is treated by pumping with metals and inorganic removal through pretreatment processes and VOC treatment by either air stripping or UV oxidation.

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APPENDIX A

SUMMARY OF REGULATORY CORRESPONDENCE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF WASTE MANAGEMENT
Harrisburg Regional Office
One Ararat Boulevard
Harrisburg, Pennsylvania 17110
(717) 657-4588
September 4, 1990

RECEIVED 9-10-90

Mr. S. L. Carlock, P.E.
Chief, Environmental Branch
Department of the Army
Corps of Engineers, Omaha District
215 North 17th Street
Omaha, NE 68102-4978

Re: Draft FS Report
Marsh Run Park
Fairview Township, York County

Dear Mr. Carlock:

The following comments were generated as a result of our technical review of the subject document as well as our meeting of August 23, 1990:

✓1. The Feasibility Study identified "hot-spots" within the landfill based on the VOSS (Volatile Organics Source Survey) investigation. The limits of any source areas identified on the basis of this survey is speculative since only 50% of the survey points yielded a sample. No evidence is provided to indicate a good correlation between shallow groundwater sampling results and definitive source areas. Therefore, insufficient information exists at this time to evaluate removal of "hot-spots" as a remediation alternative.

✓2. The report references MCL (Maximum Contaminant Levels) values under the Safe Drinking Water Act as goals which the groundwater extraction and treatment system will attain. Pennsylvania uses "background" values as the level of contamination which is acceptable in groundwater.

✓3. The report (page 2-19) indicates no specific soil cleanup levels are proposed. However, under the soil washing section (page 2-34), the report states treatability testing is necessary to determine if target cleanup standards can be achieved. What is the difference between "soil cleanup levels" and "target cleanup standards"? How and when would these target cleanup standards be decided?

4. Section 1 of the report concludes that trace metals are not mobile at this site. A specific evaluation of the geochemical conditions governing the solubility (and mobility) of trace metals at the Marsh Run Landfill should be made. This becomes more important when considering appropriate remedial measures for insuring the long term isolation of landfill wastes from the environment. The stability fields and the Eh and pH conditions under which they occur should be plotted for each trace metal found above background levels in the waste material.

5. The possibility of underflow of Marsh Run Creek by groundwater from the south should be evaluated. If this occurs, a mechanism to erode contaminants from beneath an impermeable cap would be present.

6. To properly evaluate the feasibility of removal and off-site disposal of waste, hazardous waste determinations by the TCLP procedure may be necessary.

7. Although not technically regulated by RCRA, a closure cap for this landfill would be evaluated by the Department of Environmental Resources according to RCRA standards and plans would need to be approved by the Department before implementation.

8. The in site soil venting section indicates the fill material at the Marsh Run Park site is porous enough to permit sufficient air flow for soil venting. How was this determined? How would the saturated soil conditions at the site affect soil venting techniques? The report indicates remediation of VOC contamination could be achieved in 9-12 months. How was this estimate derived? Please supply any calculations. This technology does not address the high metal concentrations in the fill.

   The cost estimates do not include verification borings which will be needed to show remediation has occurred. If this technology is chosen, an end date at which point all parties agree that remediation has either occurred or has failed to occur must be designated. At that point, a more conventional remediation technique will need to be implemented if successful remediation has not been accomplished.

9. The Department's concern at this facility is related to the poorly defined extent and nature of the landfilled waste. It is possible that these concerns can be addressed during installation of a soil vapor recovery system which will necessitate the use of additional borings for recovery points and possibly trenches for horizontal extraction lines. A Hazardous Materials Contingency Plan designed

200-1a

October 25, 1990

Environmental Branch

Mr. Francis P. Fair
Regional Environmental Protection Manager
Pennsylvania Department of Environmental
Resources
Harrisburg Regional Office
One Ararat Boulevard
Harrisburg, Pennsylvania 17110

Dear Mr. Fair:

Enclosed for your information are responses to your comments and concerns on the Draft-Final Feasibility Study (FS) Report for the former New Cumberland Army Depot Landfill (Marsh Run Park), Fairview Township, Pennsylvania, Contract Number DACW45-88-D-0009, Delivery Order Number 5020.

As you know, the FS Public Review Meeting is scheduled for October 30, 1990 to allow the U.S. Army Corps of Engineers, Omaha District to present the FS to the local community. The State and community acceptance will be addressed in the Record-of-Decision (ROD). The ROD is scheduled for final approval and signature in January 1991 by the Deputy Assistant Secretary of the Army for the Environment, Safety, and Occupational Health. As per your phone conversation, October 12, 1990, with Mr. Ed McNutt, of my staff, a bilateral signature of approval from the Pennsylvania Department of Environmental Resources was requested. Please inform this office, at your earliest convenience, of your intent to fulfill our request. The draft ROD is scheduled for review in mid-November 1990.

Should you have any questions regarding these matters, please contact Mr. McNutt at telephone number (402) 221-7699.

Sincerely,

✓MCNUTT/sb/221-7699

LITTLE/CEMRO-ED-EC

S. L. Carlock, P.E.
Chief, Environmental Branch
Engineering Division

SMART/CEMRO-ED-E

CARLOCK/CEMRO-ED-E

Enclosure

CF:
NCAD (COL Joseph)
CEMRD-ED-E (Winnike)

USACE, OMAHA DISTRICT RESPONSES TO PADER COMMENTS

SUBJECT: Draft-Final Marsh Run Park Feasibility Study (FS)

REVIEWER: Commonwealth of Pennsylvania
Department of Environmental Resources

1. **COMMENT**: "The feasibility study identified "hot-spots"..."

Response: The primary objective of the volatile organics source survey (VOSS) was to refine characterization of the contaminant source area. Two approaches were considered before selecting the VOSS approach. One approach was to perform a soil vapor survey over the source area to assess the distribution of contamination in the vadose zone. While it was felt that this approach would be useful as an indicator of source area contamination, the soil vapor survey would not provide direct data on actual source area ground water or leachate conditions. It was also felt that the seasonally high water table (4-10 ft below ground) might make it difficult to obtain meaningful vadose zone samples.

The second approach was to perform the VOSS. The VOSS survey uses the same equipment and procedures that are used for soil vapor surveys (small diameter sample collection points, vacuum extraction for sample collection, portable field gas chromatography (GC)). The primary difference between a VOSS and a soil vapor survey is that samples of ground water from the shallow saturated zone are collected, instead of vadose zone gas samples. These water samples are then injected into the "purge and trap" unit for the GC for analysis. The depth at which samples were collected was a function of the shallow saturated zone water level and the depth of fill. In general, the approach taken at Marsh Run Park was to attempt to collect water samples from the shallow saturated zone at or near the bottom of the "waste fill".

By using this approach, it was possible to collect water samples that are representative of liquid that has leached from the source area at each of the sample locations. Through interpretation of the VOSS data, it was also possible to identify specific areas within the source area ("hot spots")_ that provide the greatest contribution to bedrock aquifer contamination. Since the water table is relatively high and fluctuates through the fill (which is only 4-7 feet thick) and has been doing so for quite some time, this leaching affords a very good correlation to definitive source areas.

One problem that was encountered at the Marsh Run Park site was that it was not possible to collect shallow saturated zone water samples at all of the locations originally proposed for sampling (see Fig 1). This was largely due to the heterogeneous nature of the "waste fill" and the fact that the ground water level was too far below surface (9-11 ft) in certain portions of the site, to be collected using the equipment that was available at the time of the Marsh Run (VOSS).

It should be noted that although approximately half of the proposed sample locations did not yield water quality data, samples were obtained from 48

random points within the source area (see Fig 2). These data provide thorough coverage and characterization of the source area. Furthermore, when examined in conjunction with the results of the EM survey and shallow and deep ground water monitoring results, the VOSS data provide an accurate assessment of localized contaminated areas "hot spots" within the source area.

Please note that paragraphs 1.2.8 and 2.4.1 of the final FS have been revised to more thoroughly discuss the procedures and implications of the VOSS survey and its implications for source area characterization. Based on this information, it is believed that the concerns raised by PADER in this comment have been thoroughly addressed.

2. Comment: "The report references MCL (Maximum Contaminant Levels)..."

Response: Review of Pennsylvania State regulations indicated that the current legally binding ground water treatment levels in accordance with the Pennsylvania Hazardous Sites Cleanup Act are the same cleanup standards specified in Section 121 of CERCLA and the subsequent revisions to CERCLA contained in SARA.

It is understood that PADER has developed a Draft Policy (January 1990) which specifies that ground water shall be cleaned up to "background" levels. The actual cleanup level to be attained by the ground water treatment system at the Marsh Run Park site will be a function of the final established policy at such time as the system approaches an acceptable level of treatment.

For purposes of this study, the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (which are the current criteria for ground water cleanup under CERCLA/SARA) will be indicated.

3. Comment: "The report (page 2-19) indicates no specific ..."

Response: Based upon the RI risk assessment, the only media and pathway that were identified as representing potential human health risk was ingestion of ground water from the bedrock aquifer directly below the source area at the site. Consequently, remedial activities at this site have been designed to address remediation of the bedrock aquifer contamination.

In order to most effectively remediate bedrock aquifer contamination, a second objective of remedial actions at this site is to perform remedial activities to treat or remediate the contaminant source. This action is not required from a risk assessment perspective, but it is merited from a technical perspective since it will significantly improve the efficiency and completeness of bedrock aquifer remediation. Based upon these circumstances, specific risk based "soil" or "source area" cleanup levels are not proposed. However, performance based "target treatment levels" will be developed for each source area remedial technology. These "target treatment levels" will be specified in the ROD. The terminology "target cleanup standards" is not used in the final FS.

Please note that specific verbiage describing the approach that will be used in identifying "target treatment levels" for each source area alternative has been added to the discussion on the specific alternatives (see paras 4.6.1, 4.7.1, 4.8.1, 4.9.1).

4. Comment: "Section 1 of the report concludes that ..."

Response: It would be difficult if not impossible to obtain a reliable Eh measurement from this landfill. The sample would begin to oxidize almost immediately. A further barrier to construction of an Eh-pH diagram is that we really cannot characterize the solid metallic species present. The ground-water treatment system will remove any dissolved metals from the waters pumped from the shallow and bedrock aquifers. Once the treatment phase is completed, the environment in the lanfill will return to the Eh-pH conditions that are present now which would make it unlikely that any significant amount of metals would enter the ground water. An examination of available data (total and dissolved metal concentrations in shallow saturated zone water and bedrock ground water, pH, water level data, and historical site information) indicates that the trace metals of concern are not (and have not historically been) readily mobile in the ground water environment at this site. A thorough discussion of this topic is presented in paragraph 1.2.3 (p 1-11 through 1-12 of the final FS report.

5. Comment: "The possibility of underflow of Marsh Run..."

Response: Site characterization data from the RI indicates that the bottom of Marsh Run Creek is below the bottom level of "waste fill" at the site. Consequently, Marsh Run Creek acts as a hydraulic barrier to shallow saturated zone water flow from the south. Therefore, there is little possibility of ground water flow "eroding" contaminants laterally from the waste fill.

Bedrock aquifer flow, on the other hand is from the south, and will carry dissolved bedrock aquifer contamination in the direction of prevailing ground water flow. Since all of the proposed remedial actions at this site (except the "no action" alternative) include a ground water extraction and treatment system with extraction wells located downgradient of identified site contamination. The proposed extraction system should effectively contain bedrock aquifer contamination at the site.

6. Comment: "To properly evaluate the feasibility of removal..."

Response. We concur that it will be necessary to conduct TCLP analyses of removed wastes prior to offsite disposal. However, based upon results of the VOSS survey (water samples of liquid that was leached through site wastes) it is believed that sufficient information is available to indicate that a significant portion of waste removed from the site would be classified as a RCRA characteristic waste using TCLP.

Please review revised section included in paragraphs 2.2.2 (page 2-4 second paragraph); paragraph 4.5.1 (page 4-18, last paragraph); paragraph 4.9.1 (page 4-58, third paragraph).

7. Comment: "Although not technically regulated by RCRA..."

Response: Sections of the report that address closure capping (para 2.5.3.1, para 3.1.2, para 4.4) have been modified to reflect that closure capping would be in accordance with PADER and RCRA requirements.

8. Comment: "The in situ soil venting section indicates..."

Response: In situ soil venting is most effective in silty or sandy soils with hydraulic conductivities greater than $1x10^{-7}$ cm/sec. Data from source area soil samples and test pits conducted during the confirmation study and RI phases indicates that the hydraulic conductivity of waste fill at the site ranges from $7x10^{-4}$ to $7x10^{-2}$ cm/sec at locations that were sampled. Since much of this site was an uncontrolled waste fill, permeability conditions should not limit the effectiveness of in situ soil venting (see Final FS p 4-31).

Saturated conditions have been shown to negatively impact soil venting operations. However, there are also documented case studies of effective soil venting performance under high water table conditions. To mitigate source area saturation considerations at this site, the shallow saturated zone will be dewatered prior to initiating soil venting. Extracted shallow saturated zone water will be treated in the ground water treatment system. Ground water extraction from the bedrock aquifer will contribute to lowering of the water table in the site vicinity, which will help keep the shallow saturated zone dewatered. Soil venting activities can then proceed without disturbances (see final FS paragraph 4.6.1, page 4-29).

The estimated performance period indicated for the soil venting component of this remedial action was estimated to be 9-12 months based upon site contaminants, observed contaminant concentration in site ground water, discussions with system suppliers, review of case studies of similar applications, and previous experience in implementing soil venting for remediation of petroleum contamination. This estimate should be refined during the pre-design phase based upon results of treatability testing that will be done for system optimization. The actual treatment time will be a function of final system design and configuration, Vadose zone flow characteristics, and target treatment level considerations since the primary site contaminants (TCE and other volatile organic solvents) are readily strippable, and ground water concentrations are relatively low (<400 ug/L) the estimate shown is a reasonable estimate of time required based on available information at this time.

This technology does not address remediation of metal contamination within the "waste fill" area. Since the objective of source area remediation is to improve the technical effectiveness of bedrock aquifer contamination, not to remediate health based risks in the source area, and since it has been

determined that source area metals contamination is not readily mobile, (see response to comment #4) source area metals treatment is not warranted at this site verification borings will be required to assess the effectiveness of source area remediation. This item has been added to the cost estimate. The need for verification borings has been addressed for relevant treatment options in the final FS (see paras 4.6.1, 4.7.1, 4.8.1, 4.9.1).

The methodology for establishing an end date for source area treatment alternatives (4.6, 4.7, 4.8, and 4.9) will be the technologically based target treatment levels that will be specified in the ROD. Paragraphs 4.6.1, 4.7.1, 4.8.1, and 4.9.1 in the final FS address this topic.

9. Comment: "The Department's concern at this facility is ..."

Response: Review of data from the Confirmation Study and RI/FS at the Marsh Run Park site indicates that a very thorough characterization of the nature and extent of source area contamination has been conducted. The combination of four test pits during the confirmation study, seven monitoring wells and three well points in the shallow saturated zone and seven monitoring wells in the bedrock aquifer and an electromagnetic survey during the RI, and the VOSS during the FS has yielded a significant body of data that does provide a good characterization of the nature and extent of source area contamination.

Provision of a Hazardous Materials Contingency Plan is a practical recommendation and will be a component of the selected remedial action at this site. Paragraphs 4.6.1, 4.7.1, 4.8.1, and 4.9.1 have been revised to indicate that this plan will be developed.

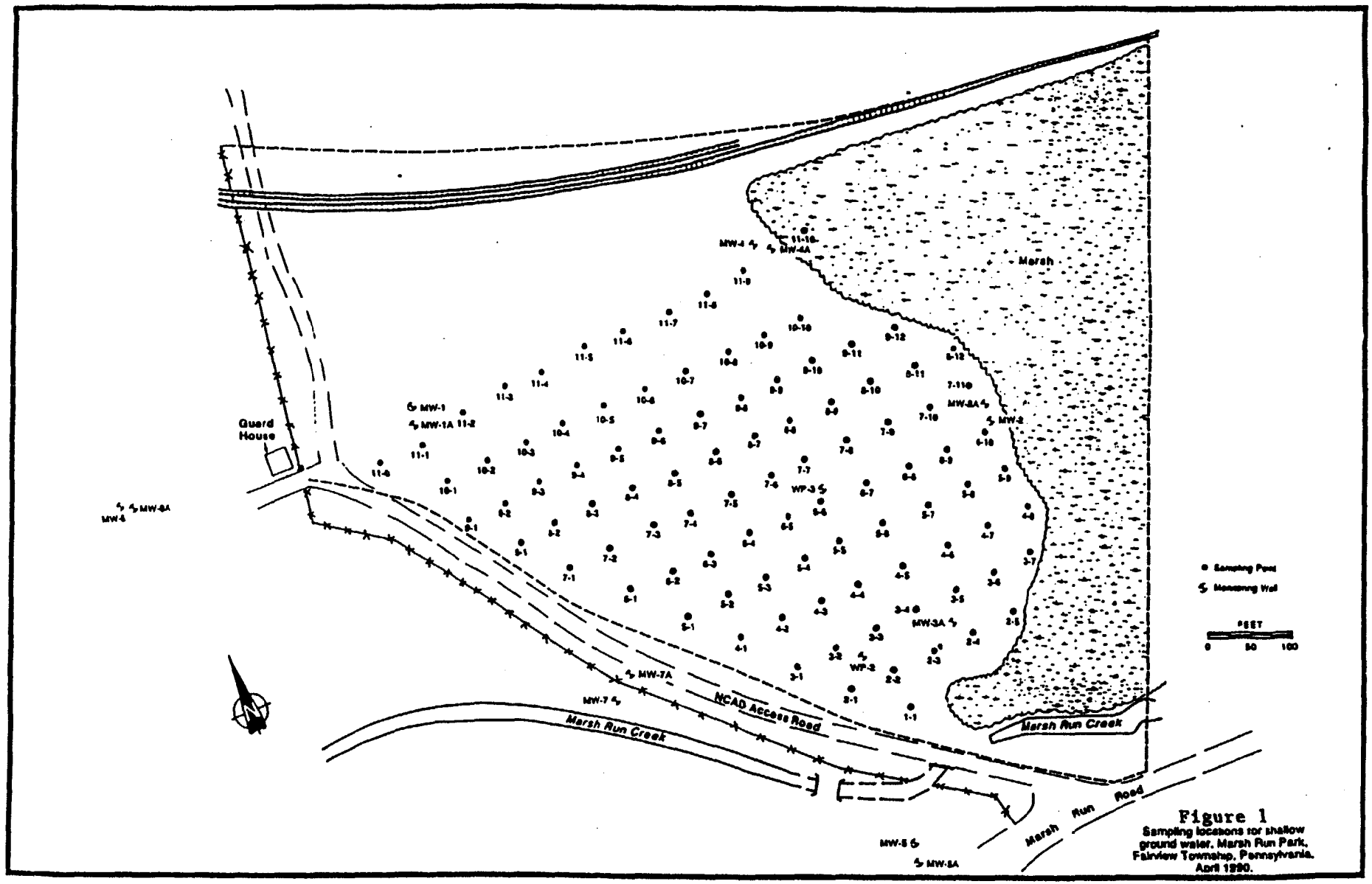

Figure 1
Sampling locations for shallow ground water, Marsh Run Park, Fairview Township, Pennsylvania, April 1990.

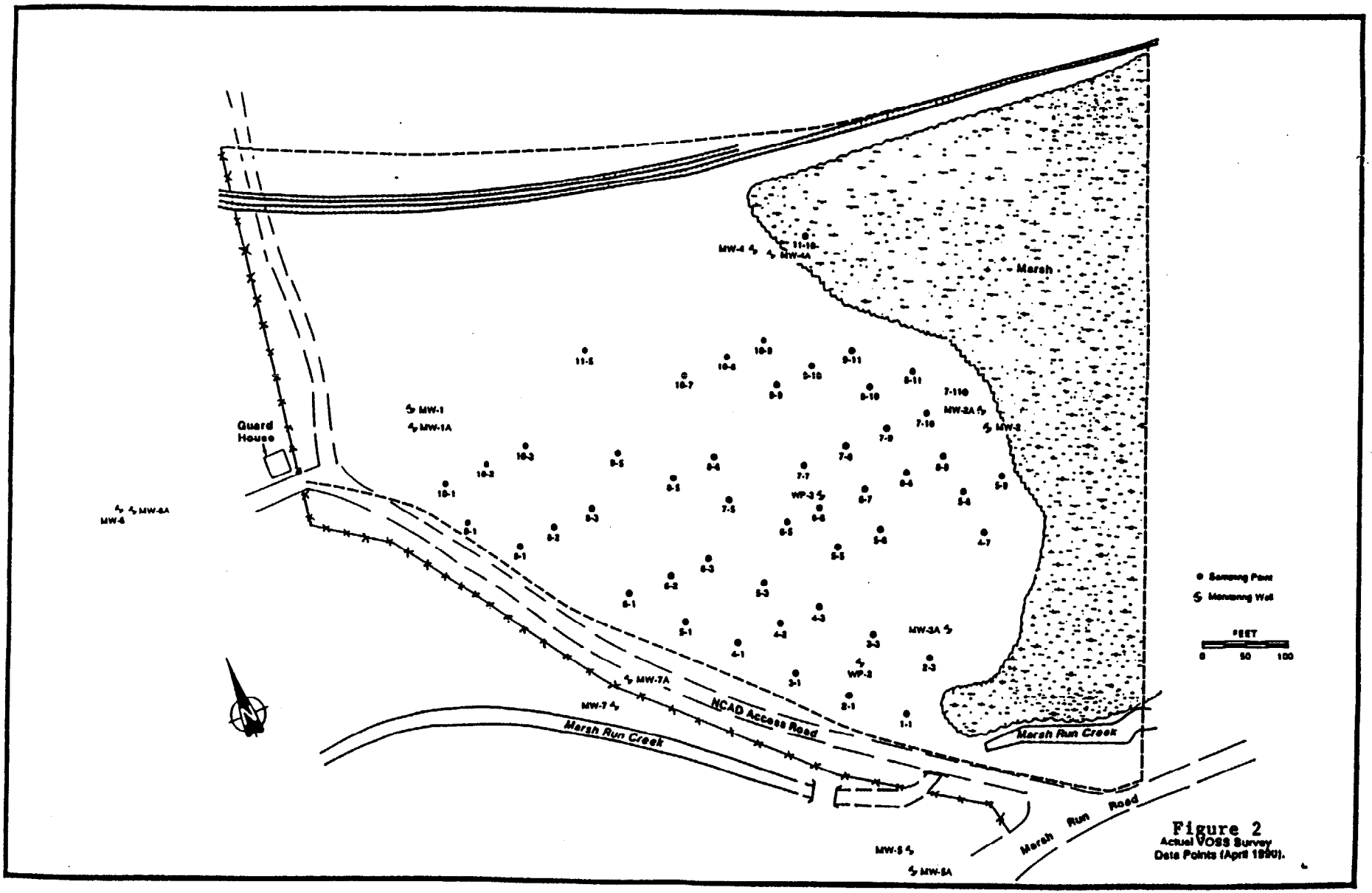

Figure 2
Actual VOSS Survey
Data Points (April 1990).

3/8/91

200-1c

March 8, 1991

Environmental Branch

Mr. Francis P. Fair
Regional Environmental Protection Manager
Pennsylvania Department of
Environmental Resources
Harrisburg Regional Office
One Ararat Boulevard
Harrisburg, Pennsylvania 17110

Dear Mr. Fair:

This letter transmits the responses to concerns addressed in your letter, dated January 22, 1991, regarding the Draft Record of Decision (ROD) for the New Cumberland Army Depot, former Landfill (Marsh Run Park) project located in New Cumberland, Pennsylvania. These responses were prepared by the engineering firm EA Engineering, Science, and Technology, Incorporated. We have reviewed these and concur with the substance of the responses as well as attachments 1 and 2.

These responses, with attachments, are furnished for your advance review prior to our meeting on Tuesday, March 12, 1991 in the engineering firm's office in Sparks, Maryland.

If you have any questions regarding these responses, prior to the meeting, please contact Mr. Fred Henry at telephone number (402) 221-7666.

Sincerely,

HENRY/sb/221-7666

MAYBERRY/CEMRO-ED-EE

S. L. Carlock, P.E.
Chief, Environmental Branch
Engineering Division

SMART/CEMRO-ED-E

CARLOCK/CEMRO-ED-E

Attachments

CF (w/attach):
NCAD (Col Joseph)
CEMP-RE (Tom Wash)
CEMRD-MD-H (Winnike)

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

6 March 1991

MEMORANDUM

TO: Fred L. Henry, USACE-Omaha - Project Manager

FROM: Gregory E. Johnson, PE, EA Engineering, Science, and Technology, Inc. - Project Manager

SUBJECT: Marsh Run Park Draft ROD
Responses to PaDER Comments

We have reviewed the comments submitted on 22 January 1991 on the draft ROD for the Marsh Run Park site. We wish to point out that it is not the Army's intention to minimize remedial activities at the site, but to comply to the fullest extent with applicable or relevant and appropriate Federal and State regulations. It appears that some of the wording used in the draft document may have been unclear. The following clarifications/responses are provided to revise/clarify issues of concern noted in the 22 January 1991 letter.

1. The wording describing ground-water extraction/treatment to "...remediate to MCLs at the property line ..." is not intended to imply that ground-water treatment is provided only to the degree necessary to attain drinking water quality standards at the property line. The objective of ground-water extraction/treatment at this site is to treat contamination within the site boundaries as well as to provide containment and remediation of contamination that has migrated toward the Susquehanna River. The locations proposed for extraction wells were designed based upon this philosophy. The specific locations of bedrock aquifer extraction wells will be refined during the pre-design phase to assure that remedial action objectives are achieved. The above statement will be included in the final ROD. In addition, all references to "...reducing ground-water contaminant concentrations at the property line to equal or less..." will be replaced by "...reducing ground-water contaminant concentrations to equal or less than MCLs..."

2. It is understood that PaDER is developing a Proposed Ground-Water Quality Protection Strategy with the objective of minimization of risk to human health and the environment. It is also understood that, at the present time, under Pennsylvania's Hazardous Substance Cleanup Act, PaDER has adopted the ground-water cleanup standards as outlined in

Section 121 of CERCLA and Section 300.430 (e)(i)(B) and 300.430 (e)(i)(C) of the March 1990 Revision to the NCP. As such, ground-water remediation goals for ground or surface waters that are current or potential sources of drinking water will be the MCLs as established under the Safe Drinking Water Act (SDWA). It is understood that if the State revises ground-water cleanup standards at some point in the future, ground-water cleanup standards would need to be modified to maintain compliance with identified ARARs of this site, and would be incorporated during the periodic review of the effectiveness of remediation.

3. Pursuant to review of the comment regarding source area treatment objectives, we have reassessed the approach to be used as a measure for achievement of compliance with site ARARs. A methodology to calculate target soil treatment levels based upon the results of ground-water modeling at the site and soil/water adsorption/partitioning considerations has been used. The source area soil target remediation goal has been modified accordingly pursuant to the results of this assessment. Appendix A to the final ROD (Attachment 1) explains this methodology and identifies the preliminary source area soil treatment concentrations.

4. It is agreed that a milestone for evaluating the effectiveness of the remedial activity must be developed and specified in the ROD. This will be included in Section 9.4 (Remediation Goals).

   The following section will be added as Section 9.4.2 (Ground-water Treatment Performance Assessment):

   "It is estimated that ground-water remediation will be able to meet cleanup standards within five years. This estimate will be refined pursuant to aquifer characterization and treatability testing to be performed during the pre-design phase of the remedial action. The ground-water extraction/treatment system will remain onsite throughout the 30-year monitoring period. If ground-water monitoring indicates that ground-water quality does not continue to meet the treatment objectives, the system may need to be restarted to maintain water quality.

   To adequately assess ground-water extraction/treatment performance, several milestones can be established. The first milestone will be at the completion of one year of operation of the system. Ground-water quality data will be examined to assess system performance and the need for process

modifications. Interim monitoring of system performance will be provided as a component of system operation and through the annual ground-water monitoring program, which will fulfill the requirement.

A second milestone to be established will be a 5-year review. Results of ground-water quality samples at the 5-year review will be examined in conjunction with previous sample results to assess system performance. If it is determined at this time that the system performance is unsatisfactory, modifications to the Record of Decision/remediation requirement/specification will be required.

The following section will be added as Section 9.4.3 (Source Area Treatment Performance Assessment).

"It is estimated that source area treatment should meet target treatment objectives to minimize source area contribution to ground-water contamination in approximately 1 year. This estimate will be refined once pilot testing is initiated during the pre-design phase of the ROD. Since it is not uncommon for adsorbed contaminants to desorb at differing rates from soil/waste particles over time, it is anticipated that it may be necessary to periodically restart portions of the venting system during the 30-year monitoring period. As such, the source area treatment system will need to remain in place.

To adequately assess soil vapor extraction performance, several milestones can be established. The first action will be to perform a treatability study. The first milestone should be at the completion of one year of operation of the extraction system. At this time, soil samples will be taken from the source area and analyzed. The number and locations of samples will be specified in the remedial design. Results from this sampling event will be compared with RI/FS source area evaluation results and the source area remedial objectives. If chemical results at the end of the 1-year period indicate that the source area treatment objectives have not been met, additional treatment will be provided in portions of the site where treatment objectives have not been achieved, and additional source area sampling/analysis will be provided on a periodic basis until treatment objectives are achieved. Interim monitoring of system performance will be provided as a component of system operation (measurement of contaminants extracted in vapor phase) and through the annual ground-water monitoring program.

A second milestone to be established will be the 5-year review. ARARs will be reviewed. Effectiveness of remediation will be evaluated based on the results of the conclusion of remedial treatment activities.

5. Pursuant to the comment concerning geochemical conditions and potential mobility of metals from the shallow saturated zone, a review of stability fields (Eh, pH diagrams) and metal compound solubilities was conducted. (See Attachment 2). Eh-pH diagrams were reviewed for the compounds of concern. From these diagrams, it was possible to identify metal species that would be stable under the conditions present in the "waste fill." Solubilities of these metal species were then examined. This information was then compared to analytical results observed from the shallow saturated zone monitoring well samples. The observed data correlated well with theoretical calculations, thus indicating that the assumption of anaerobic conditions is appropriate. This assumption is further substantiated based upon observed TCE and DCE biodegradation since biodegradation of chlorinated aliphatics at the rates observed at this site occur only under anaerobic conditions.

   Based upon this analysis, it appears that the dissolved fraction of barium, copper, and zinc in the shallow saturated zone are somewhat mobile in this environment. Analytical data from bedrock aquifer monitoring wells confirms this assessment. It should be noted that the observed concentrations of all of these compounds in the bedrock aquifer are less than MCLs, and, therefore, do not represent a risk to human health. All other metal compounds that were examined were not, found to be mobile inthe site subsurface environment based on pH-Eh relationships and solubility of metal species.

6. The following discusiion will be added to Section 5.1.5 to better address the assessment of ground-water underflow of Marsh Run Creek.

   "Site characterization data from the RI indicate that the bottom of Marsh Run Creek is below the bottom level of "waste fill" at the site (see figure 5-9). Consequently, Marsh Run Creek acts as a hydraulic barrier to prevent shallow saturated zone water flow through the landfill from the south. Furthermore, ground-water modeling data indicate that 98 percent of all flow through the shallow saturated zone travels vertically rather than horizontally. Therefore, there is little possibility of ground-water flow "eroding" contaminants laterally from the waste fill.

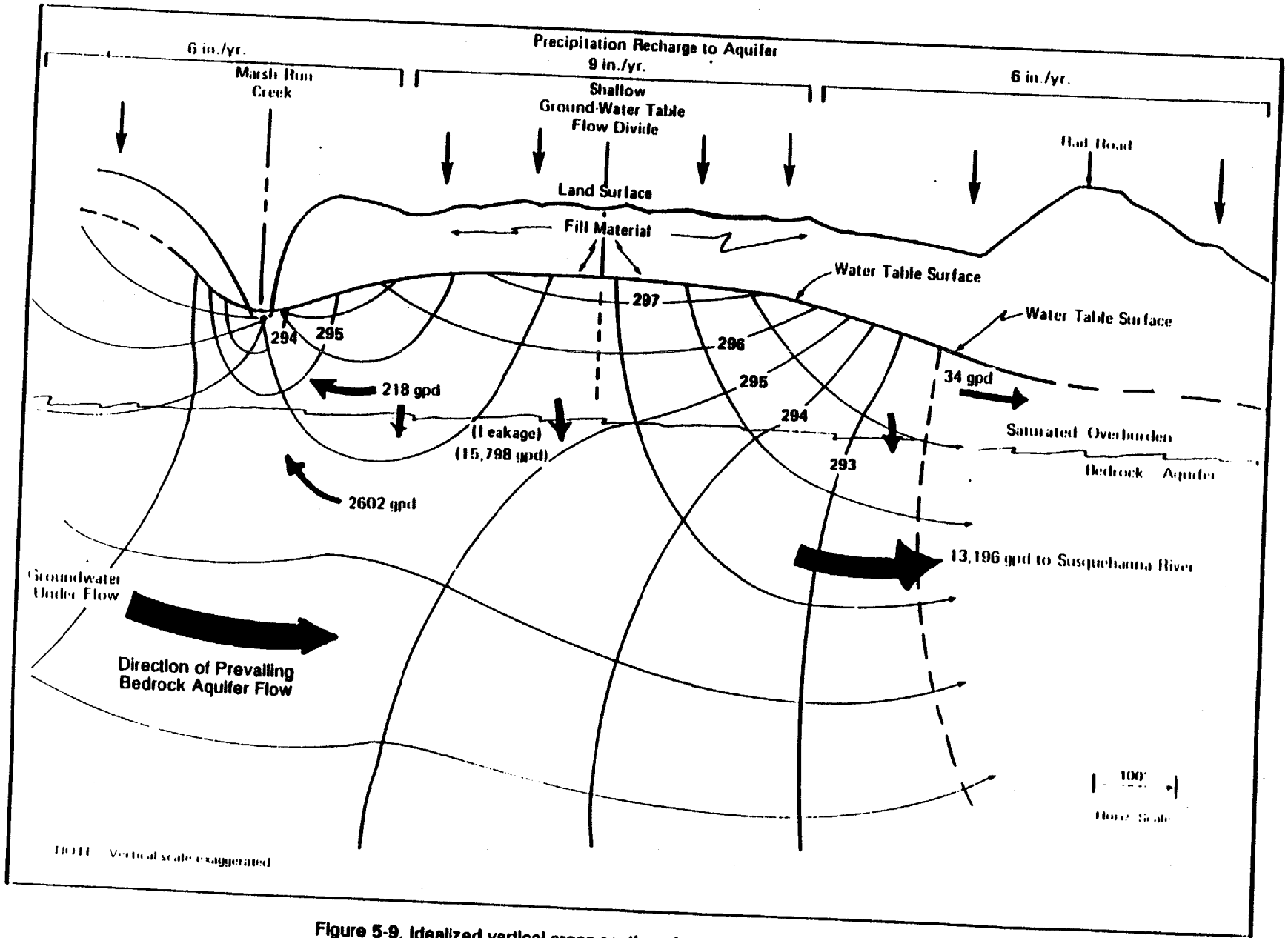

Figure 5-9. Idealized vertical cross section of ground water balance model.

Bedrock aquifer flow is from the south (flowing toward the Susquehanna River) and will carry dissolved bedrock aquifer contamination in the direction of prevailing ground-water flow (see attached figure). Since the proposed remedial action at this site includes a ground-water extraction and treatment system with extraction wells located downgradient of identified site contamination, the proposed extraction system should effectively address bedrock aquifer contamination. Flow in the bedrock aquifer will also not contribute to "eroding" of contaminants from the waste fill because bedrock aquifer flow occurs below the silty clay strata that lies between the shallow saturated zone and the bedrock aquifer.

10424.27(165)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

BUREAU OF WASTE MANAGEMENT
arr .rg Regional Office
(ırarat Boulevard
Harris , Pennsylvania 17110
.717) 657-4588
January 22, 1991

Mr. S. L. Carlock, P.E.
Chief, Environmental Branch
Engineering Division
Department of the Army
Corps of Engineers, Omaha I ict
Omaha, NE 68102-4978

Re: Draft Record of Decision
Marsh Run Park
New Cumberland Army Depot
Fairview T nship, York County

Dear Mr. Carlock:

The Draft Record of Decision (ROD) has been reviewed by this office.

We have a fundamental difficulty with the approach of the draft Record of Decision. The philosophy expressed in the ROD is to remediate the site to the minimum extent to comply with some standard which is not really appropriate to remedial activity. For example, the draft proposes to remediate groundwater to MCL's at the property line. Likewise, the draft Record of Decision proposes source remediation until the waste no longer exhibits hazardous waste characteristics and could result in a rather questionable result of leaving source material to leach contaminants at 99.9 times the MCL limits while continuing to treat groundwater to MCL levels.

The goal of the remedial action should be to return the site to the conditions which existed prior to the introduction of contaminants into the environment. In the event that it is not possible to achieve the goal, the Army must commit to come as close as possible to the goal.

The goal of groundwater remediation applies to the groundwater at the site as well as the water off site or at the property line.

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We also have difficulty with accepting the proposed remedial actions without some milestone for evaluating the effectiveness of the remedial activity and making appropriate modifications or changes in the remedial action. The establishment of an end date for such an evaluation is prudent in any case. In this instance it is vital due to the relatively new technology of venting which is proposed and due to unanswered questions relative to the nature of the waste on site.

Additional concerns which were previously raised but remain unresolved include our request for an evaluation of the solubility and mobility of trace metals and our request for an evaluation of the possibility of groundwater underflowing Marsh Run Creek.

We request that you incorporate changes into the final Record of Decision to address the foregoing comments and rewrite the Record of Decision to address these concerns.

Please contact me if you have any questions.

Sincerely,

Francis P. Fair

Francis P. Fair
Regional Environmental Protection Manager
Harrisburg Regional Office

FPF:tlb

cc: Fairview Township

ATTACHMENT 1

Project Marsh Run Park RI/FS Project No. 10424.27
Subject Metals Mobility Calcs Sheet No. 1 of 14
Drawing No.
Computed by GEJ Date 3/7/91 Checked by Date

OBJECTIVE : EXAMINE GEOCHEMICAL CONDITIONS AND POTENTIAL MOBILITY OF METALS FROM SHALLOW SATURATED ZONE

APPROACH :

1.) - REVIEW Eh- pH DIAGRAMS ON METAL - BY- METAL BASIS

- IDENTIFY PROBABLE METAL SPECIATION UNDER SITE CONDITIONS

2.) EXAMINE SOLUBILITY OF PROBABLE METAL SPECIES

3.) ASSESS POTENTIAL CONTAMINANT MOBILITY AND ENVIRONMENTAL IMPACT

GIVEN :

1.) WATER pH RANGE 6-7.5 (RI SAMPLE RESU

2.) SHALLOW SATURATED ZONE METALS CONCENTRATIONS AS SHOWN IN TABLE 5-4 OF ROD

3.) Eh- pH DIAGRAMS AS PROVIDED IN "EQUILIBRIUM DIAGRAMS FOR MINERALS" - GEOLOGICAL CLUB OF HARVARD, 1962

ASSUMPTION : ANAEROBIC CONDITIONS WITHIN SHALLOW SATURATED ZONE -

- BASED ON TCE/DCE BIODEGRADATION AND FACT THAT SITE IS FORMER LANDFILL WITH 2' COVER SOIL

Project Marsh Run Park RI/FS Project No. 10424.27
Subject Metals Mobility Calcs. Sheet No. 2 of 14
Drawing No.
Computed by GEJ Date 3/7/91 Checked by Date

COMPOUND - BY - COMPOUND ASSESSMENT

1.1 BARIUM

1.1 At pH 6-7.5 and anaerobic conditions, stable metal species as predicted by Eh-pH diagram are:

BaS
Ba^{2+}
$Ba(OH)_2 \cdot 8H_2O$

1.2 From Handbook of Chemistry and Physics, 64th ed. CRC Press, solubilities of stable species are: (Solubility @ STP)

BaS - decomposes
$Ba(OH)_2 \cdot 8H_2O$ - 56,000 mg/L
Ba^{2+} - decomposes

Other Barium/sulfur compounds that could be present include:

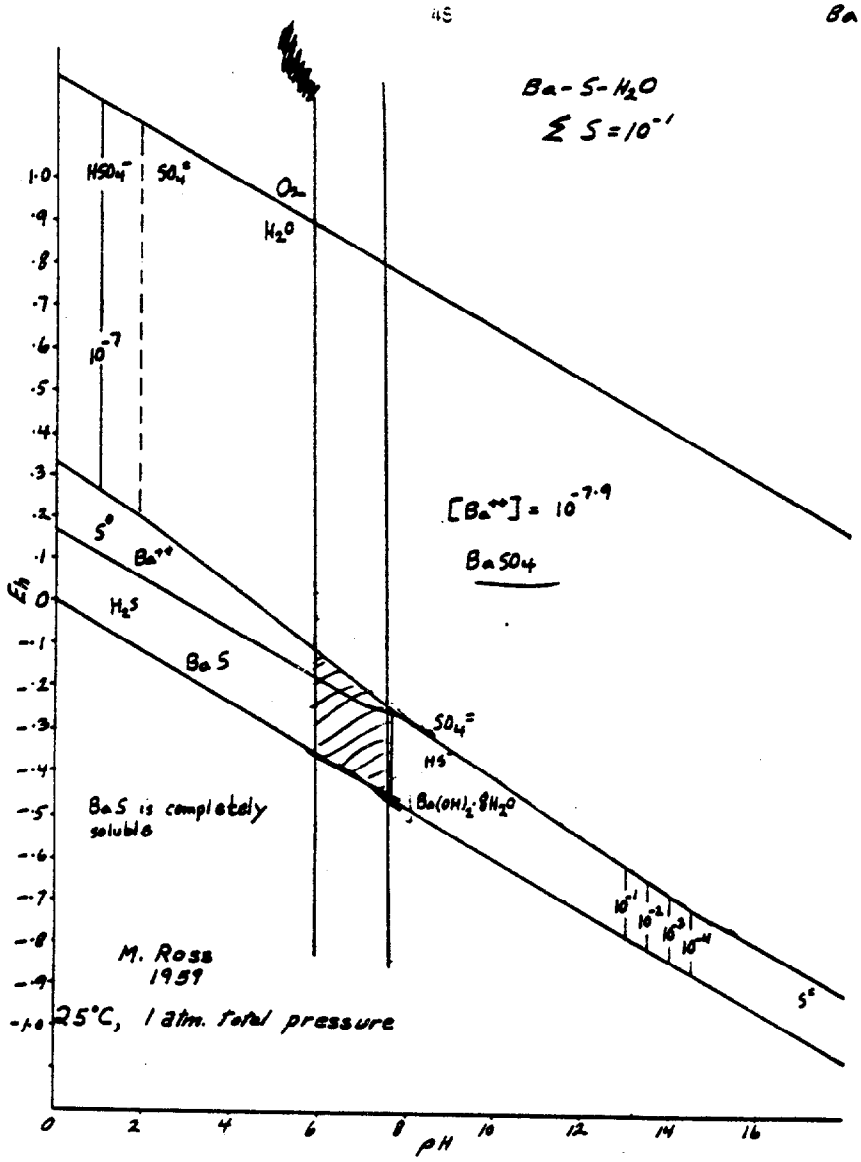
$Ba(HS)_2 \cdot 4H_2O$ - completely soluble
$BaS_4 \cdot H_2O$ - 410 µg/L
BaS_3 - completely soluble

- The maximum dissolved barium concentration as analyzed from shallow saturated zone water samples was 668 µg/L with an average of 179 µg/L
- The average % dissolved barium was 30%

1.3 CONCLUSIONS

① Actual analytical data supports the Eh-pH prediction, particularly because bedrock aquifer barium was found to exhibit an average % dissolved of 89%

Sr 48 Ba


Ba-S-H2O
Σ S = 10^-1
HSO4^-
SO4^=
O2
H2O
10^-7
S^0
Ba^++
H2S
BaS
[Ba^++] = 10^-7.9
BaSO4
SO4^=
HS^-
Ba(OH)2·8H2O
BaS is completely soluble
10^-1
10^-2
10^-3
10^-4
S^=
M. Ross
1959
25°C, 1 atm. total pressure
Eh
pH

② BARIUM IS SOMEWHAT MOBILE IN THE SHALLOW SATURATED ZONE

③ - Max. Barium concentration in bedrock aquifer (total) (561 µg/L) is 11% of MCL (5000 µg/L)

- Max. Barium concentration in shallow saturated zone (2360 µg/L) is 47% of MCL (5000 µg/L)

2.1 CADMIUM

2.1 At pH 6-7.5 and anaerobic conditions, stable metal species as predicted by Eh-pH diagram are:

CdS compounds

2.2 from CRC Handbook, solubility of stable species is:

CdS - 1,300 µg/L
Cd^{2+} - insoluble

Other cadmium/sulfur compound that could be present is

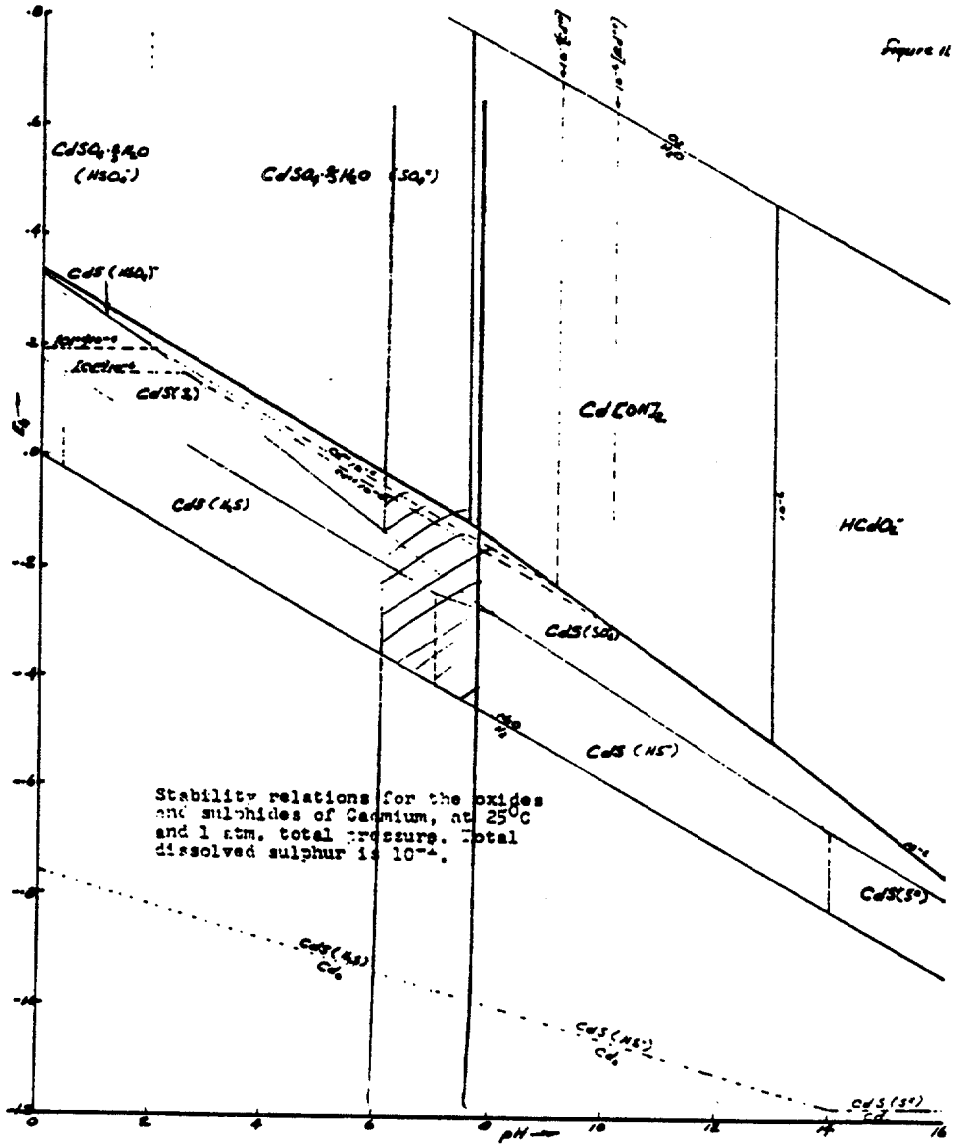
$CdSO_2$ - slightly soluble

Analytical Data from RI	Shallow Sat. Zone	Bedrock Aquifer
Max. Cad. (Dissolved)	0	0
Avg Cd (Dissolved)	0	0
Percent Dissolved	0	0

2.3 Conclusions

① The fact that no dissolved cadmium was observed indicates that cadmium is either complexed with other compounds or may exist in elemental form, bound within crystal lattice structures

Figure 11



Stability relations for the oxides and sulphides of Cadmium, at 25°C and 1 atm. total pressure. Total dissolved sulphur is 10^{-4}.

(2) Under anticipated Eh-pH range, cadmium may be expected to be somewhat mobile in the shallow saturated zone groundwater. However, observed data indicates that this is not the case (i.e. cadmium primarily exists in the Cd^{2+} state bound into crystal lattice structures)

3. CHROMIUM

3.1 At pH 6-7.5, and anaerobic conditions, stable metal species as predicted by Eh-pH are:

CrS -
Cr + S

3.2 From CRC Handbook, solubility of stable species is

CrS - insoluble
Cr^{+3} - insoluble
Cr^{+6} - insoluble

Other Chromium/Sulfur compounds that could be present are:

Cr_2S_3 - insoluble

Analytical Data from RI

	Shallow Sat Zone	Bedrock Aquifer
Max Cr (dissolved)	0	0
Avg Cr (dissolved)	0	0
Percent Dissolved	0	0

3.3 CONCLUSIONS

(1) As expected, chromium was not observed in dissolved ph

(2) Under anticipated Eh-pH range, chromium is Not expected to be mobile in shallow saturated zone groundwater.

one atmosphere at pressure. Total dissolved sulphur species [illegible]

Cornelis Klein Jan. 1961

Document indicates that Eh-pH diagram not appreciably varied for Lead and chromium

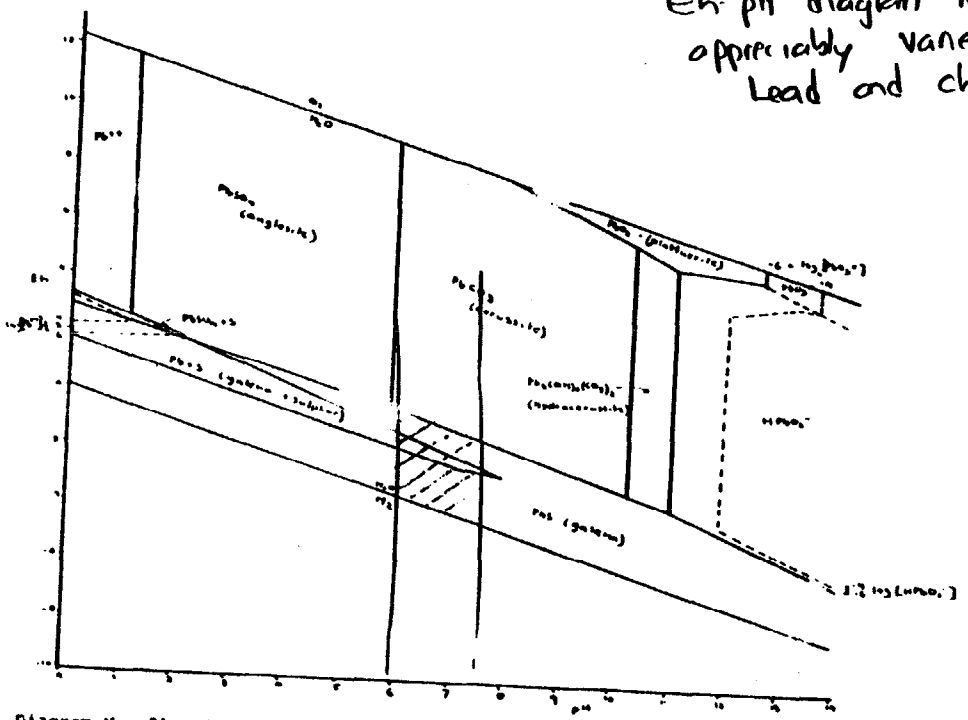


Diagram No 21: Stability relations among lead compounds in water at 25°C and one atmosphere [illegible] al pressure. Total dissolved sulphur species = 10^{-1}, total dissolved carbonate species 10^{-2}.

Cornelis Klein Jan. 1962

7 of 14

Project Marsh Run Park RI/FS Project No. 10424.27
Subject Metals Mobility Calcs. Sheet No. 8 of 14
Drawing No.
Computed by GEJ Date 3/7/91 Checked by Date

4.) COPPER

- ALL OBSERVED COPPER CONCENTRATIONS WERE LESS THAN 15% OF MCL's.
  (Max Cu was 199 µg/L total copper in one sample from shallow saturated zone)

5.) LEAD

5.1 At pH 6-7.5, and anaerobic conditions, stable metal species as predicted by Eh-pH are:

PbS
Pb + S

5.2 from CRC Handbook, solubility of stable species are:

PbS	124.4 mg/L
$Pb^{2+ \text{ or } 4+}$	insoluble

Analytical Data from RI

	Shallow Sat. Zone	Bedrock Aquifer
Max dissolved Pb	33.4	16.6 (a)
Avg dissolved Pb	5.0	3.2
Percent Dissolved	13.2%	100%

(a) one sample W-6 (dup) exhibited 16.6 µg/L
All other samples < 3 µg/L

5.3 CONCLUSIONS

(1) As expected, lead exhibited some degree of solubility. This confirms Eh-pH predictions through analytical data.

EA 02998 7/13/88

(2) Lead is somewhat mobile in the shallow saturated zone, although most lead appears to be bound to organic complexes or soil crystal structures.

(3) Observed water concentr in bedrock aquifer for total lead samples were at or near reporting limits (< 3 µg/L) for 6 of 7 samples. One sample exhibited a concentration of 16.6 µg/L. Since average dissolved (potentially mobile) concentration in shallow saturated zone is 5 µg/L and MCL is 5 µg/L, likelihood of contaminant transport in excess of drinking water standards is minimal.

(4) Any lead that is mobile and travels from shallow saturated zone to bedrock aquifer will be captured in groundwater extraction wells and treated in the pretreatment unit of the groundwater treatment system.

6| MERCURY

- All observed Mercury concentrations were less than MCLs for both shallow saturated zone and bedrock aquifer. No dissolved mercury was observed in any samples

  - Eh-pH diagram indicates HgS as likely compound
  - CRC indicates HgS is insoluble

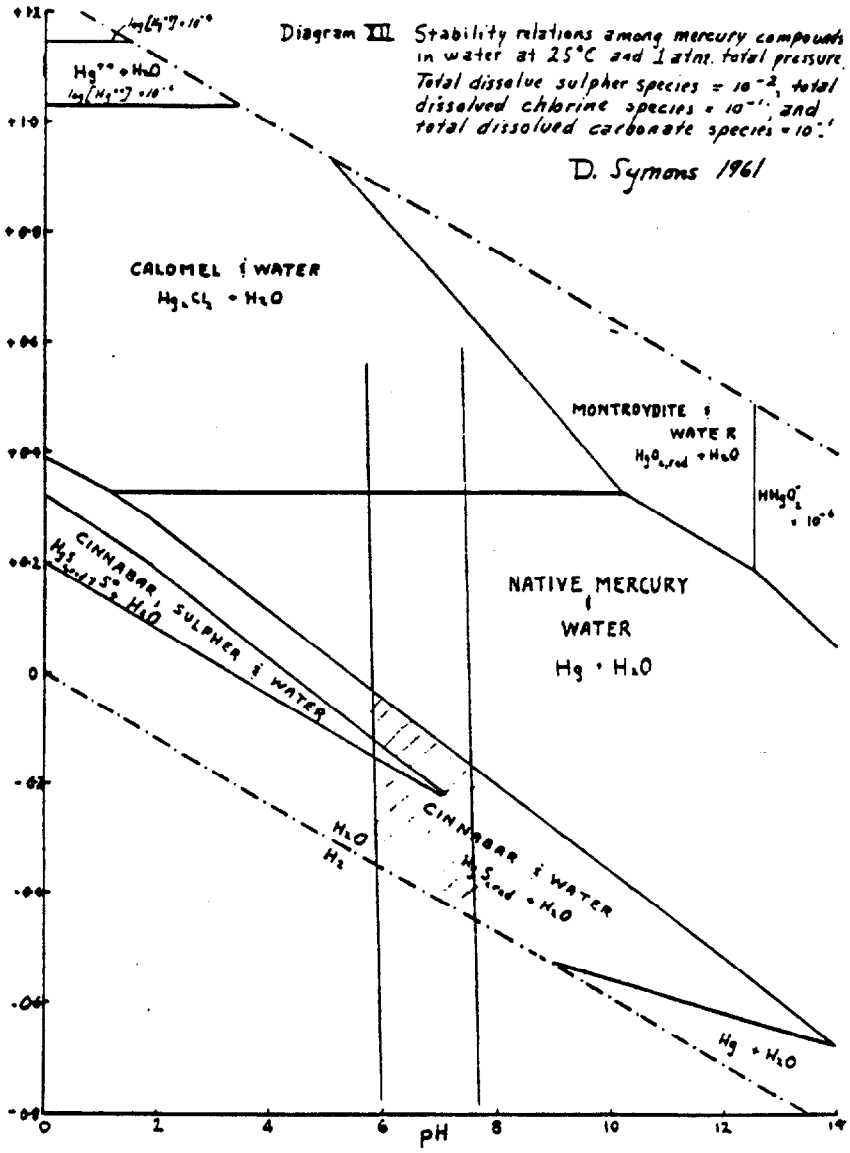


Diagram XII Stability relations among mercury compounds in water at 25°C and 1 atm. total pressure. Total dissolve sulpher species = 10^{-2}, total dissolved chlorine species = 10^{-1}, and total dissolved carbonate species = 10^{-1}.

D. Symons 1961

Project Marsh Run Park RI/FS Project No. 10424.27
Subject Metals Mobility Calcs Sheet No. 11 of 14
Drawing No.
Computed by GEJ Date 3/7/91 Checked by Date

7] VANADIUM

7.1 At pH 6-7.5, and anaerobic conditions, Vanadium compounds could be:

VS
V_2S_5
V_2S_3

(No Stability Diagram including SO_4^{2-}, CO_3^{2-}, OH^- availible)

7.2 from CRC Handbook, solubility of Vanadium/Sulfur species are:

VS - insoluble
V_2S_5 - insoluble
V_2S_3 - insoluble

From RI Analytical Data

	Shallow Sat Zone	Bedrock Aquifer
Max Dissolved Vn	0	0
Avg Dissolved Vn	0	0
Percent Dissolved	0	0

7.3 Conclusions

① Vanadium compounds that are expected are all insoluble. Actual data confirms this assumption. Concentrations up to 523 µg/L total Vanadium are observed in shallow saturated zone monitoring wells. Dissolved vanadium was not observed. Vanadium was also not observed in bedrock aquifer well sm

② Vanadium is not readily mobile in the shallow saturated zone groundwater under anticipated geochemical conditions.

EA 02698 7/13/89

Project Marsh Run Park RI/FS — Project No. 10471.77
Subject Metals Mobility Calcs — Sheet No. 12 of 14
Drawing No.
Computed by GEJ — Date 3/7/91 — Checked by — Date

8) ZINC

- All observed Zinc concentrations were less than EPA's SMCL's (taste + odor considerations)

  (Max Zn was 1,170 µg/L total zinc in one sample from shallow saturated zone)

8.1 from eH-pH, expect to find:

ZnS (wurtzite)
ZnS (sphalerite)

8.2 from CRC, solubilities are:

ZnS (wurtzite)	6900 µg/L
ZnS (sphalerite)	650 µg/L

Other Zn/S compounds that could be expected are:

$ZnS \cdot H_2O$ - insoluble

Analytical RI Data

	Shallow Sat Zone	Bedrock Aquifer
Max Dissolved Zn	122 µg/L	40.5 µg/L
Avg Dissolved Zn	40 µg/L	22.3 µg/L
Percent Dissolved	11.3 %	31.6 %

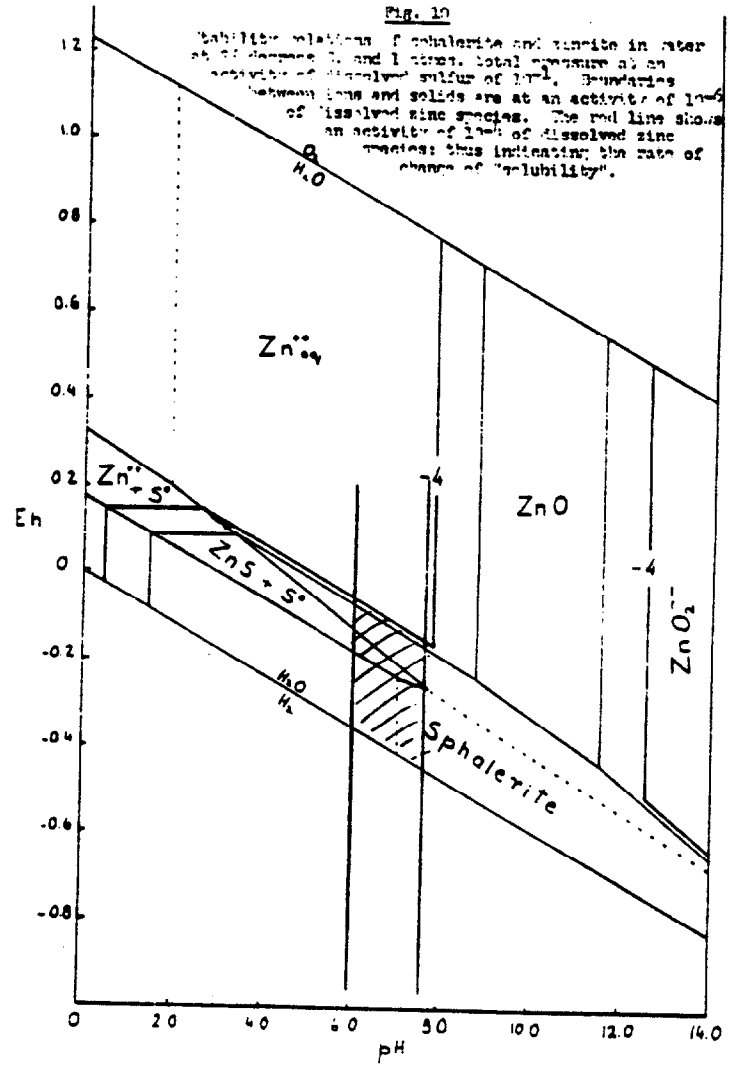
8.3 Conclusions

① Actual analytical data supports the Eh-pH prediction, based on observed concentrations and percent dissolved species.

EA 0289B 7/13/89

Fig. 10

[illegible] stability relations of sphalerite and zincite in water at 25 degrees C and 1 atmos. total pressure at an activity of dissolved sulfur of 10^{-1}. Boundaries between ions and solids are at an activity of 10^{-4} of dissolved zinc species. The red line shows an activity of 10^{-6} of dissolved zinc species: thus indicating the rate of change of "solubility".



R Kothavala, 1960

Project Marsh Run Park RIFS Project No. 10424.27
Subject Metal's Mobility Calcs Sheet No. 14 of 14
Drawing No.
Computed by GEJ Date 3/7/01 Checked by Date

(2) Zinc is somewhat mobile in the shallow saturated zone

(3) - Max. zinc concentration (total) in bedrock aquifer (225 µg/L) is 4.5% of SMCL (5000 µg/L)

- Max. zinc. concentration (total) in shallow saturated zone (1,170 µg/L) is 23% of SMCL (5000 µg/L)

EA Engineering, Science, and Technology

EA Mid-Atlantic Regional Operations
Hunt Valley/Loveton Center
15 Loveton Circle
Sparks, MD 21152
Telephone: 301-771-4950
Fax: 301-771-4204

AGENDA

Marsh Run Park Landfill
Draft ROD Review Meeting

Date:	12 March 1991	
Time:	1300	
Location:	EA Engineering, Science, and Technology, Inc. Mid-Atlantic Regional Operations Office Sparks, Maryland	
Objective:	To discuss PaDER Review Comments and Responses	
Schedule:	1300 - 1310	- Welcome/Project Status
	1310 - 1440	- Presentation/Discussion of Responses to PaDER Comments
	1440 - 1450	- Project Schedule/Future Activities
	1500	- Adjourn

DEPARTMENT OF THE ARMY
Corps of Engineers, Omaha District
215 North 17th Street
Omaha, Nebraska 68102-4978

April 24, 1991

Environmental Branch

Mr. Francis P. Fair
Regional Environmental Protection Manager
Commonwealth of Pennsylvania
Department of Environmental Resources
Bureau of Waste Management
Harrisburg Regional Office
One Ararat Boulevard
Harrisburg, Pennsylvania 17110

Dear Mr. Fair:

This letter transmits our revised position regarding clean-up goals for groundwater and soil at the New Cumberland Army Depot, former Landfill (Marsh Run Park) project located at New Cumberland, Pennsylvania. This revised position is in response to your review comments developed for the Draft ROD and input provided by you and other PaDER representatives at the review meeting on March 12, 1991.

Details of our position and rationale for the clean-up goals are provided in an enclosure. These goals are summarized here for your information.

a. Groundwater Treatment. It is our intention to reduce risks and impacts to the environment to levels indistinguishable from background to the extent technically and engineeringly feasible. We believe the remedial action chosen for the site is the best engineering alternative. We propose to operate the groundwater treatment system at a minimum until groundwater samples reach levels less than MCLs. Periodic yearly reviews will determine the effectiveness and continued operation of the system. New treatment technologies that may be developed over the life of this treatment will be evaluated for application to this project and implemented if feasible and justified as cost effective.

b. Soil Treatment. The clean-up goals for the Soil Vapor Extraction (SVE) system will be based on a pilot study and subsequent periodic evaluations of the effectiveness of the installed system. After one year of operation a Technical Memorandum (TM) will be submitted to PaDER documenting the performance of the system. Recommendations regarding the continued operation of the system will be included in the TM. The continued operation of the system will be based on technological and engineering feasibility and cost effectiveness.

Please provide your comments regarding these clean-up goals to this office by May 3, 1991. The Final ROD will be developed from the Draft ROD with incorporation of approved review comments and resolution of any comments you provide on this transmittal.

RECEIVED APR 2 9 1991

If you have any questions regarding our position as defined in the enclosure, please contact Mr. Fred Henry at telephone number (402) 221-7666.

Sincerely,

S. L. Carlock, P.E.
Chief, Environmental Branch
Engineering Division

Enclosure

Copies Furnished w/Enclosure:
Commander, New Cumberland Army Depot, Bldg No. 81,
New Cumberland, PA 17070-5001
Commander, USACE, ATTN: CEMP-RF, 20 Massachusetts
Avenue NW, Casimir Pulaski Bldg, Washington, DC 20314-1000
CEMRD-MD-H (Winnike)
EA, Engineering, Science and Technology, Inc., Corporate
Headquarters, Hunt Valley/Loveton Center, ATTN: Greg Johnson)
15 Loveton Circle, Sparks, MD 21152
CEMRO-OC (Hostyk)
CEMRO-ED-EF (Cotter)
CEMRO-ED-EG (Peters)
CEMRO-ED-GC (White)

NEW CUMBERLAND ARMY DEPOT
FORMER LANDFILL
MARSH RUN PARK
NEW CUMBERLAND, PENNSYLVANIA

24 APRIL 1991

1. Clean-up goals, specified herein, for groundwater and soil provides our revised position to incorporate review comments developed in response to the DRAFT ROD and subsequent input provided by the Pennsylvania Department of Environmental Resources (PaDER) representatives at the review meeting on 12 March 1991. There were two areas of concern identified by PaDER at the review meeting regarding the philosophy expressed in the ROD to remediate the site. These two areas are:

a. Levels of contaminants in groundwater which would allow for conclusion of the groundwater extraction and treatment.

b. Performance goals for the Soil Vapor Extraction (SVE) system that would be used to determine the criteria for shutting down the treatment system.

2. The primary objective of the Department of Defense's (DOD) Environmental Restoration Program (DERP) is to remediate past contaminated areas to effectively reduce or mitigate risks to the public and the environment. To achieve this objective, the DOD, under section 211, and 120 of Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA), has adopted the U.S. Environmental Protection Agency's (EPA) established approach in investigation and remediation of hazardous waste sites. This approach is used for both National Priorities List (NPL) and non-NPL sites.

3. Remediation levels are determined after evaluating the nature and extent of contamination, fate and transport, and current and future potential risks to the public and the environment. Identified, unacceptable risks are mitigated or reduced by proposing and implementing, specific remediation alternatives, based on available technology, implementability, cost effectiveness, and ability to meet required legally enforceable standards.

4. With consideration for PaDER's input and DOD policy to follow EPA's approach for investigation and remediation of hazardous waste sites, the proposed procedures for remediation of the two areas of concern identified in paragraph 1 are explained in the following subparagraphs.

a. Levels of contaminants in groundwater which would allow for conclusion of the groundwater extraction and treatment.

(1) We believe DOD's policy is consistent with the "Proposed Groundwater Quality Protection Strategy" issued by your agency in December of 1989. To substantiate this consistency of policy, reference is made to paragraph four of the "Completion of Remediation" and is quoted for ready reference.

"When remediation results in contaminants remaining on the site above background levels, the owner/operator will not be released from liability. It is assumed that, where it is technologically infeasible to achieve background levels, and where health and environmental protection levels have been achieved, additional remediation to approach background levels will not be required unless the Department finds additional information or unforeseen or changed circumstances, such as newly identified contaminants on the site, new toxicological information on the contaminants that shows that a risk to public health or the environment still exists, a determination that information about the site has been falsified or a determination that additional remediation has become technologically feasible. In such cases, the Department may require the application of any newly developed technology at the site as it becomes available and technologically feasible for the owner/operator to do so, provided that application of the new technology will not cause more environmental harm than the contaminants.

Human health-based protection levels will be based on the more stringent of promulgated Maximum Contaminant Levels (MCLs) or Secondary Maximum Contaminant Levels (SMCLs). If no promulgated MCL or SMCL for a parameter exists, the Department will develop protection levels for threshold (non-carcinogen) and non-threshold (carcinogen) parameters as follows:

1. Threshold - application of margins of safety to the results of toxicity testing to prevent the occurrence of a threshold effect.

2. Non-threshold - Use of a risk management level on one excess case of cancer in a population of one million ($1x10^{-6}$) over a 70-year lifetime. For those carcinogens for which cancer potency (slope factor) values have not been developed, the Department will set protection levels as not detectable by the most sensitive analytical procedure or at a background, whichever is greater.

For parameters with insufficient toxicity data, the Department may use data on related chemicals in developing protection levels."

(2) It is our intention to reduce risks and impacts to the environment to levels indistinguishable from background, to the extent technically and engineeringly feasible. The "Proposed State Groundwater Quality Protection Strategy", similar to the concept of MCLG's, is a desirable objective for site groundwater remediation. We would prefer to reach agreement with PaDER

concerning end of treatment levels. However, we believe site data concerning contaminant levels, contaminant distribution, and geologic conditions can never be defined to a degree allowing engineering certainty. We believe performance of remedies can only be evaluated after the remedy has been implemented and monitored for a period of time. Therefore, we believe the remedial action chosen for the site is the best engineering alternative, however we also believe offering you a "guarantee" of treatment to non-detection levels would be irresponsible.

(3) We therefore propose to operate the groundwater treatment system at a minimum until groundwater samples reach l[illegible]els of less than the MCLs. If after yearly reviews the system a[illegible]pears to be [illegible]pable of removing contaminants to MCLG's or detection limits, the system will be operated to achieve these goals until the U.S. Army Corps of Engineers (USACE) determines that continued operation is no longer technologically feasible or cost effective. At that time USACE will petition PaDER [illegible] shutdown the system.

(4) As new standards are established, and new and more effective treatment technology is developed, treatment design will be evaluated and revised to achieve these objectives, if feasible and justified as cost effective.

b. Performance goals for the removal of volatiles in the soil will be based on a pilot study and subsequent evaluation of the technological and engineering feasibility of the SVE system.

(1) A SVE system will be utilized to clean-up volatile contaminants in the soil. To obtain the required data for the design of a SVE system a pilot study will be accomplished. The pilot study will determine the effectiveness of the SVE system in removing volatile contaminants from the soil and how much vacuum can be produced in the system. This data will be used to design the RA SVE system.

(2) The performance of the SVE system will be evaluated continuously during the first year of operation to fine tune the operating parameters. In addition data will be collected to quantify the mass of contaminants removed and plotted against time to evaluate the effectiveness of the system. Periodically the system will be shut down if a plot of mass of extracted contaminants vs. time becomes asymptotic indicating that the efficiency of the system is deteriorating. After allowing the system to recover the system will be turned back on and monitored for additional recovery of volatiles.

(3) At the end of one year of operation a Technical Memorandum will be submitted to PaDER that presents the data on the performance of the SVE system. Included in the report will be a recommendation by USACE with respect to continued operation of the system. The operating parameters of the system will be evaluated at this time and adjustments will be made as required. If USACE determines that continued operation of the SVE system is no longer justified based on technological/engineering feasibility and cost effectiveness USACE will petition PaDER to shutdown the system. This petition process can be implemented at any time between the first year review of the SVE system and the five-year review of the groundwater treatment system.

5. The installation and operation of the two treatment processes for groundwater and soil would be phased. The dewatering of the site would have to be in operation for a period of time before the pilot SVE system becomes operational. This is to allow sufficient dewatering to develop site conditions comparable to actual SVE system operating conditions. The actual operation and evaluation periods could be coordinated to run concurrently after the SVE system is in operation to allow simultaneous adjustments in the Operation and Maintenance (O&M) standards.

6. The complete operational time period for the SVE system should be scheduled to end when the groundwater treatment system is scheduled for its five year evaluation.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
WASTE MANAGEMENT PROGRAM
Southcentral Region
One Ararat Boulevard
Harrisburg, Pennsylvania 17110
(717) 657-4588
May 2, 1991

Mr. S. L. Carlock, P.E.
Department of the Army
Corps of Engineers, Omaha District
215 North 17th Street
Omaha, NE 68102-4978

Re: Response to DER Comments on ROD
Marsh Run
New Cumberland Army Depot
Fairview Township, York County

Dear Mr. Carlock:

We have reviewed your revised position regarding clean-up goals for remediation at the Marsh Run Facility dated April 24, 1991.

We concur with the restatement of remediation goals as presented.

You may proceed with the development of the final ROD with the inclusion of the restated goals.

Thank you for considering our comments in the development of the final ROD.

If you have any questions, please contact me at the above number.

Sincerely,

Francis P. Fair
Regional Environmental Protection Manager

FPF:jsm

Recycled Paper

APPENDIX B

RESPONSIVENESS SUMMARY

30 May 1991

MEMORANDUM

TO: Fred Henry - USACE - Omaha, Project Manager

FROM: G.E. Johnson PE - EA Engineering, Science, and Technology, Inc. - Project Manager

SUBJECT: Summary of Question and A er Period of Public Hearings and Public Comment Period Ma. Run Park RI/FS

The following is a brief synopsis of the questions/statements which were made at the two public hearings on Marsh Run Park and the responses to those questions/statements. Whenever possible the person asking the question and the respondent(s) are identified by name or the group they are representing. A 30 day review period was held prior to both meetings. Written comments were solicited both before and after the public meetings. No written comments were received for this project.

The first public hearing, October 1990:

Statements:

1. Mr. Bender, representing the local government, pointed out that the appearance of the park was allowed to deteriorate to discourage use. He went on to question the EPA limits on toxic chemicals pointing our that TCE was found at 80 times the EPA standard on site and he wondered what was going to be done with the landfill.

Questions/Responses:

1. Mr. Jim Clein wanted to know if the Army is planning to perform any health study or medical action on the children who used Marsh Creek Park. The Army response was that the risk assessment was adequate in addressing health concerns and based upon the results a health study is highly unlikely.

2. Mrs. Sue Morell raised the issue of a 1979 water quality survey which she had been told was done on Marsh Run and had listed it as one of the ten dirtiest sites with high concentrations of cadmium. She also raised the question of why the Army allowed an old landfill to be used as a soccer field. She went on to say that the exposure periods used in the risk assessment were too low. The Army response was that it is a standard, accepted practice to use a sealed landfill for similar purposes and that the methodology assumptions used in the risk assessment were appropriate based upon EPA guidance for risk assessment. Dr. Graves added that the types and concentration of chemicals identified in the 1979 water quality report referred to

water/sediment samples taken from Marsh Run Creek upstream of the site and not the topsoil of the park. Dr. Graves went on to say that many of the chemicals are naturally occurring and not harmful.

3. Mr. Dewitt asked if the site was going to be put on the EPA superfund list. The Army said that the report on the site had been submitted to the DER and EPA and the EPA did not put the site on its superfund list. The site is a priority of the Army which is evidenced by the funding of the study/cleanup.

4. An unidentified person wanted to know why didn't the Army tell the town what had been deposited in the landfill and why weren't records kept. The Army said that although records were kept they did not include the breakdown substances of things deposited in landfill and that the Army dealt with material in accordance with the technology of the time. Mr. Bender said that the topsoil was checked in 1977 when the town got the site and that the town acted as soon as a possible problem was detected.

5. Mrs. Morell wanted to know how the Army knew there was a canister of Potassium Cynide in the landfill to remove it in 1978 and did the township know of the canister. The Army said that a record of the canister's exact location in the landfill was kept and Mr. Bender added that the township did not know the canister was there.

6. An unidentified man asked if the Susquehanna River served as a natural barrier to groundwater and the difference in elevation between the river and the site. The man went on to ask if north of the site would be a better place to study and the relative solubilities/densities of compounds mentioned. Mr. Greg Johnson said that the river did serve as a natural barrier to groundwater and the difference in elevation was approximately 30 ft. Mr. Johnson also said that the study addressed the site itself and populated areas but the highest concentration of TCE was found at the northern most well. Mr. Johnson went on to say that chlorinated organics are relatively soluble in water and TCE is more dense than water.

7. An unidentified man told the town and Army not to use his kids as bargaining chips. Mr. Bender of the town said that the kids will not be used as bargaining chips because his number one concern is the health and welfare of the people and the town wants the site cleaned up which the feasibility study will address. The Army added that everyone should wait and see the feasibility study to see how best the park should be cleaned.

The second public hearing, March 1990:

Statements:

1. Mrs. Donna Cisorak stated that she felt that the meeting was not made public enough, she had only heard of the meeting through a friend. She also wanted a fund to be set up by the Army to be used in case any children developed health problems and wanted legislation introduced which would require the donator/seller of land to release all records on the land to the purchaser/recipient of land. A representative of the local government responded by stating that two news releases regarding the meeting had been made in the past week. Another representative of the town stated that the feasibility study had been available to the public since October 1 at four public libraries in the area. Mr. Bender informed Mrs. Cisorak that a bill entitled the Marsh Run Park bill was introduced by Senator Hines and passed the Senate in 1989. This bill requires the Defense Department to inform the state's environmental commission and the local government officials of any contamination found on land which they own.

Questions:

1. Mrs. Patricia Pomme asked what the weather conditions were when the soil samples were taken and if the topsoil on a windy day could differ from the topsoil used in the testing. She also wanted to know if it was possible for the wind to have brought in contaminated soil from offsite without it being detected. Mr. Ken Kilmer said that if there was a process which was bringing in contaminated topsoil it would have shown up in the soil tests because some of this transported soil would have stayed on site and been detected. He went on to say that because no contamination was found in topsoil if such a process was occurring it was doing so to a very small extent. Mr. Bender said that the town had the topsoil checked in 1988 when it received the field and again when they had topsoil brought in to smooth it. Mr. Bender voiced his concern about the possibility of the water table rising during the rain and stated that the thought the people now using well water should be switched over to a public well source.

2. Mr. Dean Newhouse wanted to know after cleanup if someone was going to be able to build a house on the land or if the land was going to be used as a park again. Mr. Kilmer responded by saying that the land would never have a house on it because it is still a landfill and the deed on landfills only allow for surface use. A representative of the Army said at such time as the site is assured to be totally clean it should be used as a park once again. Mr. Bender said that he didn't think it would be used as a park again because of insurance reasons.

3. Mr. Dean Newhouse then asked what the purpose of cleaning up the site was if it is not going to be used again. Mr. Kilmer said that the groundwater will be cleaned to drinking water standards by the end of cleanup. Mr. Bender said that the cost of cleaning up the site, thereby, protecting public health and welfare was approximately six million dollars as opposed to the 48 million dollars it would have cost to excavate/remove and dispose offsite all of the landfilled material.

cc: K. Kilmer
File 10424.27/188