FEASIBILITY STUDY
FOR
HARDER TREE SERVICE SITE
63 JERUSALEM AVENUE
HEMPSTEAD, NEW YORK

NYSDEC REGISTRY # 1-30-035

FOR SUBMITTAL TO

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PREPARED BY

FPM group

909 MARCONI AVENUE
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MARCH 2003

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SECTION 1.0
INTRODUCTION

1.1 Feasibility Study Purpose and Organization of the Report

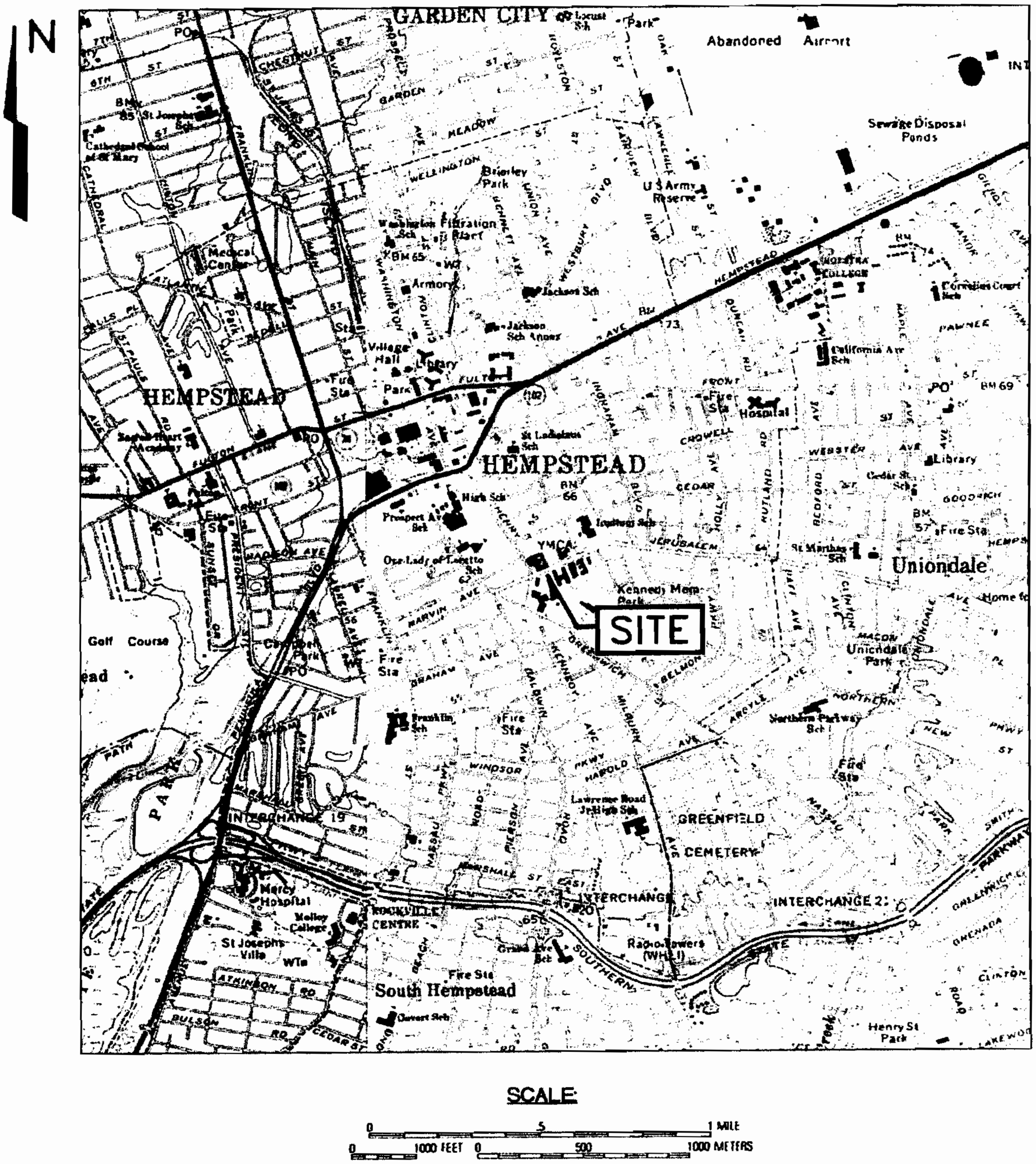
This Feasibility Study (FS) Report has been prepared by FPM Group (FPM) for the New York State Department of Environmental Conservation (NYSDEC) Inactive Hazardous Waste Disposal Site (IHWDS) identified as Harder Tree Service (Harder), Registry #1-30-035 (the Site). The Site was placed on the NYSDEC Registry as a Class 2 IHWDS. The Harder Site is located at 63 Jerusalem Avenue in Hempstead, New York and consists of approximately 1.3 acres. The Site location is shown in Figure 1.1.1. Previous investigations include a Site Assessment Update Investigation (FPM, May 1999), a Remedial Investigation (RI) report (FPM, September 2001), and a Revised RI Report (FPM, August 2002).

The purpose of this FS is to document the basis and procedures used to identify, develop, screen, and evaluate remedial alternatives to address contamination at the Site. This FS provides Harder and the NYSDEC with sufficient data to select feasible and cost-effective remedial alternatives to protect human health and the environment.

This FS includes seven sections. Section 1.0, Introduction, provides site background information. Section 2.0 provides a summary of the nature and extent of contamination, an evaluation of the potential for human health risk, a fish and wildlife impact analysis, a discussion of Applicable or Relevant and Appropriate Requirements, and a discussion of remediation goals. Section 3.0 presents objectives for remedial actions, a summary of applicable health and environmental protection criteria and standards, and identifies general response actions. Potentially feasible technologies are presented for each of the general response actions. Section 4.0 presents a discussion of the remedial alternatives developed for each of the impacted Site media using the technologies that passed the screening described in Section 3.0. Section 5.0 presents a detailed evaluation of the feasible alternatives for each of the targeted areas to be remediated. Section 6.0 summarizes the results of the FS and provides recommendations for remedial options. Section 7.0 includes the references utilized in the FS.

1.2 Site Setting

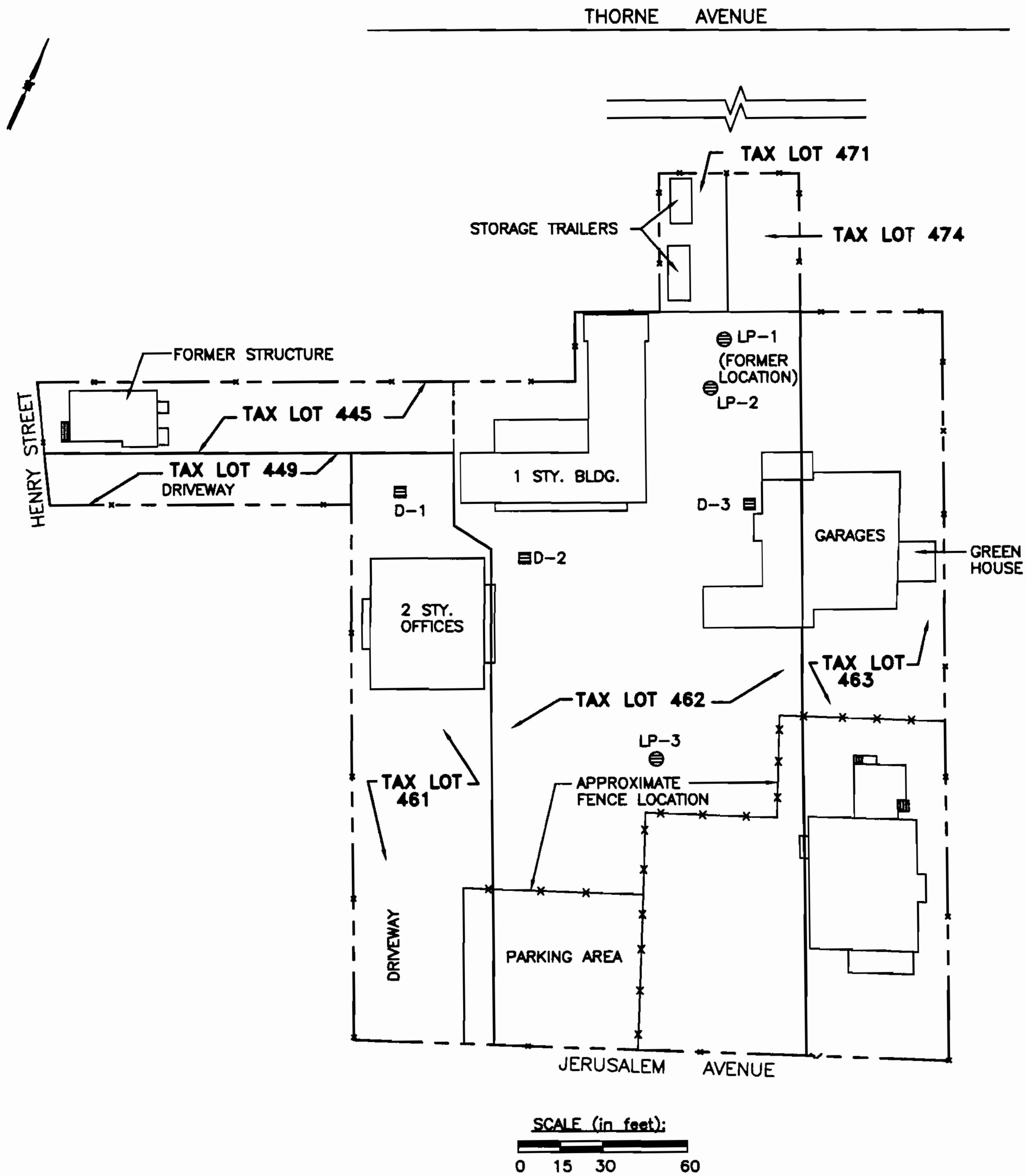
Buildings on the Site include one residential structure, one multi-bay garage, one garage with an attached greenhouse shed, and a two-story office building as shown in Figure 1.2.1. A residence was formerly located on the western portion of the Site but has been removed. The Site is currently used for office space and storage of various landscaping machinery, equipment, and materials. The surface grade at the Site is generally flat and the majority of the Site is paved or covered by the Site buildings. Most of



FPM GROUP

FIGURE 1.1.1
SITE LOCATION
HARDER TREE SERVICES SITE
63 JERUSALEM AVENUE
HEMPSTEAD, NEW YORK

Drawn By:JDS	Checked By:KAS	Date: 6/5/01



SOURCE:
OCTOBER 18, 1988
SURVEY BY JOHN P. FERRANTELLO, P.C.
SECTION 31, BLOCK 401, LOTS 445, 449, 461, 462, 463, 471 & 474

FPM GROUP

FIGURE 1.2.1
SITE PLAN
SHOWING APPROXIMATE LOT BOUNDARIES
HARDER TREE SERVICES SITE
HEMPSTEAD, NEW YORK

Drawn By:H.C.	Checked By: S.D.	Date: 7/11/02

C:\Draw\MRHR\Harder Services\LOT BOUNDARY.dwg, 09/16/02 12:13:44 PM, 1:30

the surface water runoff is captured by on-site stormwater leaching pools. The Site surface elevation is approximately 65 feet above Mean Sea Level (MSL) and the topographic gradient in the vicinity of the Site slopes gently to the southwest at the average rate of approximately 26 feet per mile (0.5 percent) (USGS, 1979). There are no natural surface water bodies (streams, rivers, or lakes) within one-mile downgradient of the Site.

The Site geology and soil types are described in detail in the Revised RI Report (FPM, August 2002). In general, fill material consisting of brown to dark brown sandy loam is present to a depth of approximately two to three feet beneath the Site. Beneath the fill material is approximately 100 feet of upper Pleistocene Glacial Deposits. These deposits consist of well-graded to poorly-graded fine to coarse-grained sand with gravel. Generally, a brown/gray to orange-brown silt and fine sand with fine gravel is present in the Magothy Formation below the Upper Glacial Deposits.

The depth to groundwater below ground surface at the Site is approximately 30 feet. The generalized regional horizontal groundwater flow direction in the Site area is south-southwest. The estimated average hydraulic conductivity for the Site area (USGS, 1972) is 250 cubic feet per day per square foot ($ft^3/d/ft^2$).

1.3 Site History and History of Investigations

Harder Services, Inc. has operated at 63 Jerusalem Avenue, Hempstead since 1939. Over time, the configuration of the property has changed. A site plan showing the lots comprising the Site is included in Figure 1.2.1. Between 1945 and 1952 the rear portion of this property, including the area behind the office building and the area behind the garages, was paved. The areas to the west and south of the garages and the western portion of the area to the south of the office building have also been paved since about 1952. In 1965, three lots on the north side of the Site, including lots 445, 471, and 474, were acquired. By 1966, the remainder of the area to the south of the office building and much of the area of the former residential property on the northwest side of the Site (lots 445 and 449) had also been paved. Pesticide operations managed at the Site have varied over time. A variety of materials associated with pesticide control and tree-related services, including chlordane, have been present at the Site.

In 1984, a several-hundred-gallon spill of methoxychlor occurred on the Site (EEA, 1987). Most of the spilled material was collected and returned to its original containers. Some of the methoxychlor entered a stormwater leaching pool, LP-1, located immediately south of a 50 by 50-foot area on the north side of the Site (see Figure 1.2.1). The NYSDEC subsequently conducted a Phase I Investigation at the Site during 1984 and 1985. The results from drain and sludge pile soil samples collected in December 1985 were presented in the 1987 Phase II Investigation Report (EEA, March, 1987) and indicated the presence of methoxychlor, technical chlordane, and heptachlor in the sampled materials. A Consent Order was executed on January 22, 1986.

A Phase II Investigation was performed by EEA in 1986 and 1987. Six groundwater monitoring wells (wells 1 through 6) were installed and associated soil and groundwater samples were collected and analyzed. The groundwater monitoring well locations are shown on Plate 1. Concentrations of chlordane and other pesticides were detected in the soil samples.

Additional soil and groundwater samples were collected by EEA in 1988. The soil samples were collected at various depths in the 50 by 50-foot area and the data indicated that the soil had been impacted by pesticides, primarily chlordane. The locations of these samples within the 50 by 50-foot area are not known and, therefore, these data cannot be utilized to accurately define the lateral and vertical extent of contamination. Two additional groundwater monitoring wells (wells 7 and 8) were installed during this investigation and all of the groundwater monitoring wells were sampled in 1988.

The Site Assessment was performed in 1999 (FPM, May 1999) to provide additional soil and groundwater data to characterize the Site. Near-surface soil samples were collected from several areas of the Site during the Site Assessment. The RI was performed in 2001 (FPM, September 2001) and additional sampling was performed in 2002 (FPM, August 2002) to provide additional on-site and off-site soil and groundwater data. The soil and groundwater chemical analytical results from these investigations are discussed in more detail in Sections 2.1 through 2.3 of this report.

SECTION 2.0
EVALUATION OF IMPACTS TO MEDIA OF CONCERN AND DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

2.1 Soil Contamination

A summary of the soil chemical analytical data from the RI and additional sampling is presented in Table 2.1.1. These data are also summarized on Plate 2. For comparison, data collected during the previous investigations are also discussed in the following sections.

2.1.1 50 by 50-Foot Area

Table 2.1.2.1 summarizes all of the soil sample chemical analytical data collected from the GP-1 through GP-4 locations in the 50 by 50-foot area. Samples collected from the GP-1 through GP-3 locations showed lower pesticide concentrations than at GP-4, with the most elevated concentrations detected in the near-surface (zero to two feet below grade) samples, although the deeper samples at GP-3 showed increasing pesticide concentrations. The GP-4 results indicate that although elevated concentrations of pesticides were detected at up to 10 feet below grade, none of the detected pesticides in the deeper samples exceeded the NYSDEC Objectives. Based on these data, soil pesticide contamination at GP-4 extends to somewhat more than 10 feet below grade, but is reduced to below the NYSDEC Objectives by 18 feet below grade. In comparison, the detected concentrations at the off-site locations (see Section 2.1.2) were significantly lower than the concentrations detected on site at GP-1 through GP-4.

Based on this information, it appears that the most impacted soil is limited to the 50 by 50-foot area, with the concentrations nearest to the pesticide storage area (GP-4) being the highest. Pesticide concentrations decrease away from the 50 by 50-foot area and also generally decrease with increasing depth.

2.1.2 Adjoining the 50 by 50-Foot Area

The shallow (0 to 0.25 feet below grade) soil borings performed during the RI near the 50 by 50-foot area included SS-8, SS-9, and SS-10, which are each located off-site approximately five to ten feet from the fence surrounding the 50 by 50-foot area. Deeper soil samples were also collected at SS-8 and SS-10 (3 to 4 feet below grade) during the RI sampling.

TABLE 2.1.1
SOIL SAMPLE CHEMICAL ANALYTICAL DATA
REMEDIAL INVESTIGATION
HARDER TREE SERVICE SITE
HEMPSTEAD, NEW YORK

Sampling Area	Adjoining 50 by 50-Foot Area									SS-4 Area								NYSDEC Recommended Soil Cleanup Objectives
Location	SS-8		SS-9	SS-10		SS-28	SS-29	SS-30	SS-31	SS-4	SS-11		SS-12	SS-13	SS-14	SS-32	SS-33	
Sample Depth (feet)	0-0.25	3-4	0-0.25	0-0.25	3-4	0-0.25	0-0.25	0-0.25	0-0.25	3-4	0-0.25	3-4	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	
TCL Pesticides in mg/kg																		
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3
Heptachlor	0.012 JB	0.00057 J	**0.760 B**	ND	0.012	ND	ND	ND	ND	0.830	**3,300.000 B**	**7.600**	**10.000 JB**	**1.400 J**	**0.230 B**	**0.370**	**0.360 J**	0.10
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.041
Heptachlor Epoxide	**0.099**	ND	**3.100**	**0.790**	0.010 J	**0.230 J**	**0.093**	**0.580**	**0.440**	ND	ND	ND	**2.600 J**	**2.200**	**0.370**	ND	ND	0.02
Endosulfan I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9
Dieldrin	**0.120 B**	0.0014 J	**8.600 B**	**1.700 B**	0.015	**0.170 J**	**0.140**	**0.740**	**1.200**	**3.300**	**2,700.000 B**	**7.600**	**120.000 B**	**5.600**	**0.640 B**	**1.300**	**1.200 J**	0.044
4,4'-DDE	0.210	0.011 J	**3.300**	**2.700**	0.047	ND	**0.510**	**3.200 J**	**4.400 J**	ND	ND	ND	1.400 J	**2.000 J**	0.320 J	ND	ND	2.1
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.200 J**	**87.000 J**	ND	**3.500 J**	ND	ND	ND	ND	0.10
Endosulfan II	0.024 J	ND	ND	0.470 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9
4,4'-DDD	0.042 J	0.0057 NJ	2.300	0.980 J	0.015 J	0.670 J	ND	0.760	ND	0.540 J	**410.000**	ND	**21.000 J**	ND	1.000	ND	ND	2.9
Endosulfan Sulfate	ND	ND	ND	0.290 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0
4,4'-DDT	0.340	0.014 J	**7.300**	**7.700**	0.065	0.670	0.680 J	**3.800**	**7.000 J**	0.940	**370.000 J**	1.900 J	**24.000**	**17.000**	**3.200**	1.400	1.800 J	2.1
Methoxychlor	ND	ND	ND	0.350 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.053 J	ND	ND	10
Endrinaldehyde	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	+
Endrin Ketone	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.110 J	17.000 J	ND	0.690 J	ND	ND	ND	ND	+
alpha-Chlordane	0.260 B	0.0035 NJ	**4.800 B**	**3.000 B**	0.043 J	**2.000 J**	**0.640 NJ**	**2.200 J**	**2.500 NJ**	**2.100 J**	**630.000 B**	**22.000 J**	**11.000 B**	**12.000**	**1.200 B**	**7.000 J**	**6.800 J**	0.54
gamma-Chlordane	0.240 B	0.0023	**4.700 B**	**3.000 B**	0.023	**1.100**	0.270	**1.100**	**1.000**	**2.000**	**1,100.000 B**	**21.000**	**17.000 B**	**11.000**	**1.200 B**	**5.200**	**4.800**	0.54
Total Pesticides	1.347	0.038	**34.86**	**20.98**	0.23	4.84	2.333	**12.38**	**16.54**	**10.02**	**8,614**	**60.1**	**211.19**	**51.200**	8.213	**15.27**	**14.96**	10

Notes:

TCL = Target Compound List.
mg/kg = Milligrams per kilogram.
ND = Not Detected.
B = Analyte was detected in blank sample(s).
J = Concentration is estimated
Bold values exceed the NYSDEC Recommended Soil Cleanup Objectives.
+ = No Soil Cleanup Objective is available.
* = Not Sampled
N = Analyte is tentatively identified based on presumptive evidence.

TABLE 2.1.1 (CONTINUED)
SOIL SAMPLE CHEMICAL ANALYTICAL DATA
REMEDIAL INVESTIGATION
HARDER TREE SERVICE SITE
HEMPSTEAD, NEW YORK

Sampling Area	SS-1/MW-8 Area																			Adjoining the SS-1/MW-8 Area			NYSDEC Recommended Soil Cleanup Objectives
Location	SS-1	SS-15		SS-16		SS-17		SS-18		SS-19		SS-20		SS-21		SS-22		SS-23		SS-35	SS-36	SS-37	
Sample Depth (feet)	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	3-4	0-0.25	0-0.25	0-0.25	
TCL Pesticides in mg/kg																							
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.046	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3
Heptachlor	0.025 JB	**0.190 JB**	0.0081 JB	0.008 JB	0.040 B	0.084 JB	**3,100.000 B**	**360.000 B**	**13.000 B**	**0.250 B**	0.085 B	**7.900 B**	**0.110 B**	**0.970 JB**	0.020 JB	**1.800 B**	ND	0.047 JB	0.0058 JB	**0.360 J**	**0.290 J**	0.008 J	0.10
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**5.300 J**	**0.043 J**	**0.088 J**	ND	ND	ND	ND	ND	ND	0.041
Heptachlor Epoxide	0.018 J	ND	ND	ND	ND	ND	ND	**38.000**	**0.480 J**	**0.130**	ND	**5.200**	**0.110**	ND	ND	**0.450 J**	ND	ND	ND	**0.690 J**	ND	**0.038**	0.02
Endosulfan I	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.210	ND	**18.000**	0.071	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9
Dieldrin	**0.150 B**	**1.800 JB**	**0.064 JB**	**0.290 B**	**0.099 B**	**0.420 B**	**2,400.000 B**	ND	**0.120 JB**	**0.730 B**	**0.058 JB**	**38.000 B**	**0.440 B**	ND	0.031 JB	**8.000 B**	**1.800 JB**	**0.970 B**	**0.110 B**	**0.610 J**	**0.620**	**0.078**	0.044
4,4'-DDE	0.280	**4.500**	0.051 J	0.260	0.110	**3.000**	ND	**4.800 J**	0.190 J	0.120	0.019 J	**4.200 J**	0.036 J	**3.700 J**	0.035 J	**3.000**	**2.800 J**	**4.600**	0.390	0.540 J	0.690 J	0.190 J	2.1
Endrin	ND	ND	ND	ND	ND	ND	**96.000 J**	ND	ND	0.040 J	ND	**3.000 J**	0.016 J	ND	ND	ND	ND	ND	ND	ND	**0.210 J**	ND	0.10
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.150	ND	**14.000**	0.080 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9
4,4'-DDD	0.120	**5.200**	0.130	1.600	0.600	0.860	ND	**59.000 J**	1.700 J	0.180	0.190	**7.600 J**	0.049 J	**32.000**	0.280	**3.900**	**61.000**	**3.100**	0.220	ND	0.750 J	ND	2.9
Endosulfan Sulfate	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.019 J	ND	**4.400 J**	0.034 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0
4,4'-DDT	0.290 B	**21.000 B**	0.210 B	1.600	0.750	1.900	**390.000 J**	**64.000 J**	1.800	0.790 B	0.630 B	**30.000 B**	0.230	ND	ND	**4.100 B**	**190.000 B**	**2.800 B**	0.240 B	**3.200**	**4.100 J**	0.640 J	2.1
Methoxychlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Endrinaldehyde	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	+
Endrin Ketone	ND	ND	ND	ND	ND	ND	15.000 J	ND	ND	0.0074 J	ND	0.580 J	0.0082 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	+
alpha-Chlordane	0.066 B	**5.200 B**	0.270 B	0.340 B	0.130 B	**0.550 B**	**530.000 B**	**42.000 B**	**1.400 B**	**0.590 B**	0.280 B	**4.500 B**	0.200 B	**63.000 B**	0.490 B	**1.400 B**	ND	**1.500 B**	0.120 B	**0.950 J**	**1.100 J**	0.160 NJ	0.54
gamma-Chlordane	0.100 B	**4.900 B**	0.210 B	**0.900 B**	0.190 B	**1.200 B**	**990.000 B**	**150.000 B**	**5.100 B**	**0.570 B**	0.230 B	**10.000 B**	0.170 B	**52.000 B**	0.410 B	**3.200 B**	ND	**1.400 B**	0.180 B	**1.100**	**0.910 J**	0.089	0.54
Total Pesticides	1.049	**42.79**	0.9431	4.998	1.919	8.014	**7,521**	**717.8**	**23.79**	3.7864	1.538	**147.38**	1.5542	**156.97**	1.309	**25.938**	**255.600**	**14.417**	1.2658	7.45	7.23	1.19	10

Notes:

TCL = Target Compound List.
mg/kg = Milligrams per kilogram.
ND = Not Detected.
B = Analyte was detected in blank sample(s).
J = Concentration is estimated
Bold values exceed the NYSDEC Recommended Soil Cleanup Objectives.
+ = No Soil Cleanup Objective is available.
N = Analyte is tentatively identified based on presumptive evidence.

TABLE 2.1.1 (CONTINUED)
SOIL SAMPLE CHEMICAL ANALYTICAL DATA
REMEDIAL INVESTIGATION
HARDER TREE SERVICE SITE
HEMPSTEAD, NEW YORK

Sampling Area	**SS-6 Area**			**SS-7 Area**			**D-2 Area**							**NYSDEC Recommended Soil Cleanup Objectives**
Location	**SS-6**	**SS-24**	**SS-25**	**SS-7**	**SS-26**	**SS-27**	**D-2**			**D-2A**		**D-2B**		
Sample Depth (feet)	**3-4**	**0-0.25**	**0-0.25**	**3-4**	**0-0.25**	**0-0.25**	**3-4 (below top of sediment) 14-15 (below grade)**	**8-10 (below top of sediment) 19-21 (below grade)**	**14-16 (below top of sediment) 25-27 (below grade)**	**9-10**	**14-15**	**9-10**	**14-15**	
TCL Pesticides in mg/kg														
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
delta-BHC	0.0026	ND	0.210	ND	**0.740**	ND	ND	ND	ND	ND	ND	ND	ND	0.3
Heptachlor	0.0012 JB	**0.990 B**	ND	0.005 JB	0.060 JB	0.038 JB	ND	**1.300 J**	0.087 NJ	0.0090 B	0.011 JB	0.00031 JB	0.020 B	0.10
Aldrin	ND	ND	ND	ND	ND	ND	**11.000 J**	ND	ND	0.0016 J	ND	ND	0.0016 J	0.041
Heptachlor Epoxide	0.0035	**0.130 J**	**0.090 J**	0.014	**0.800**	**0.350 J**	ND	ND	ND	0.0019 J	ND	ND	ND	0.02
Endosulfan I	ND	0.063 J	ND	ND	ND	ND	**50.000 NJ**	**3.600 NJ**	0.870 NJ	0.0028 J	ND	ND	0.0026 J	0.9
Dieldrin	0.0036 JB	**0.930 B**	**0.310 B**	0.012 JB	ND	**0.190 JB**	ND	**4.600**	**0.240 J**	0.011 B	0.027 JB	0.00080 JB	0.0060 JB	0.044
4,4'-DDE	0.0047	0.680	0.980	0.016 J	1.300	1.300	ND	**2.500**	ND	0.034	ND	ND	0.014	2.1
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9
4,4'-DDD	0.0048	1.400	0.360	0.026	1.600	2.000	**570.000**	**15.000 J**	**5.400**	0.038	ND	0.0036	0.69	2.9
Endosulfan Sulfate	ND	0.100 J	0.047 J	ND	ND	0.092 J	ND	0.520 J	0.094 J	ND	0.018 J	ND	ND	1.0
4,4'-DDT	0.0057 B	1.300	1.900 B	0.033 B	1.600 B	**2.400 B**	ND	**17.000**	0.210 J	0.022	0.250	0.0034	0.012	2.1
Methoxychlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Endrinaldehyde	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	+
Endrin Ketone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	+
alpha-Chlordane	0.010 B	**1.400 B**	0.470 B	0.069 B	**5.400 B**	**2.800 B**	**120.000**	**5.800**	**1.900**	0.033 B	**0.790 B**	0.0037 B	0.012 B	0.54
gamma-Chlordane	0.0075 B	**1.300 B**	0.110 B	0.042 B	**3.200 B**	**1.800 B**	**140.000**	**5.500**	**1.900**	0.035 B	**0.620 B**	0.0028 B	0.031 B	0.54
Total Pesticides	0.0436	8.293	4.477	0.217	**14.7**	**10.97**	**891**	**53.82**	**10.7**	0.1883	1.716	0.01461	0.1682	10

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+ = No Soil Cleanup Objective is available.
N = Analyte is tentatively identified based on presumptive evidence.

The off-site surface soil samples at SS-8 through SS-10 exhibited slight exceedances of the NYSDEC Objectives for heptachlor, heptachlor epoxide, dieldrin, 4,4'-DDE, 4,4'-DDT, alpha- and gamma-chlordane and/or total pesticides as shown on Table 2.1.1. The concentrations at SS-9 and SS-10 were somewhat higher than at SS-8. Although several targeted compounds were detected in the deeper soil samples at SS-8 and SS-10, none of the concentrations in the deeper samples exceeded NYSDEC Objectives. Based on these data, the off-site soil pesticide concentrations decrease with depth.

Surface soil samples were collected at four locations (SS-28 through SS-31) approximately 15 feet laterally away from SS-9 and SS-10 to evaluate the lateral extent of the impacts detected at SS-9 and SS-10. The off-site surface soil samples at SS-28 and SS-29 exhibited slight exceedances for heptachlor epoxide, dieldrin, 4,4'-DDE, alpha-chlordane and/or gamma-chlordane. However, the detected concentrations are all less than those detected at nearby SS-9. Similar results were obtained at SS-30 and SS-31 and here, too, the detected concentrations were less than at nearby SS-10. Based on these data, surface soil pesticide concentrations decrease laterally away from the 50 by 50-foot area.

2.1.3 SS-4 Area

Near-surface soil chemical analytical data were collected during the SI and indicated that elevated levels of various pesticides are present in the near-surface soil at SS-4. Additional near-surface soil samples were collected during the RI and additional investigation at on-site locations SS-11, SS-12, SS-13, SS-32, and SS-33 and off-site location SS-14. A deeper soil sample was also collected at each of the SS-4 and SS-11 locations. These data are shown on Table 2.1.1.

The near-surface soil at SS-11, located on site to the south of SS-4, exhibited exceedances of the NYSDEC Objectives for heptachlor, dieldrin, endrin, 4,4'-DDE, 4,4'-DDT, alpha- and gamma-chlordane and total pesticides. Moderate exceedances of the NYSDEC Objectives were detected at SS-11 and SS-4 in the samples collected from 3 to 4 feet below grade; these concentrations were much lower than the surface soil concentrations at these locations. The other near-surface soil samples in this area showed slight (SS-14, SS-32, and SS-33) to moderate (SS-12) exceedances of the NYSDEC Objectives for several pesticides. The off-site sample collected at SS-14 was obtained through an opening in the asphalt-paved parking lot; the low concentrations of pesticides detected in this sample indicate that pesticides have not significantly affected the off-site soils in this area.

In summary, the most elevated concentrations of pesticides detected in the SS-4 area were noted in near-surface soil at SS-4 and SS-11. The results from the deeper samples collected at SS-4 and SS-11 indicate that pesticide concentrations decrease with depth. The results at SS-12, SS-13, SS-32, and SS-33

TABLE 2.1.2.1
SOIL BORING CHEMICAL ANALYTICAL DATA, 50 BY 50-FOOT AREA
HARDER TREE SERVICES SITE
HEMPSTEAD, NEW YORK

Location	GP-1					GP-2			GP-3					GP-4					NYSDEC
Depth (in feet) / Analyte	0-2	4-6	8-10	18-20	28-30	0-2	4-6	8-10	0-2	4-6	8-10	18-20	28-30	0-2	4-6	8-10	18-20	28-30	Recommended Soil Cleanup Objectives
TCL Pesticides in mg/kg																			
delta-BHC	ND	ND	ND	ND	ND	ND	0.0026 J	ND	ND	ND	ND	ND	ND	**65.000 J**	**44.000 J**	ND	ND	ND	0.3
gamma-BHC (Lindane)	**0.190 J**	ND	ND	ND	ND	**0.170 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06
Heptachlor	**1.100 J**	**0.24**	**0.580 J**	**0.140 J**	0.011 J	**4.4**	0.047	0.058	**23**	0.036	**0.160 J**	**0.790 J**	**1.200 J**	**1,100.00**	**740**	**740**	0.075	0.036	0.1
Aldrin	ND	ND	ND	ND	0.0054 J	**2.4**	0.0048 J	0.010 J	**14.000 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.041
Dieldrin	ND	ND	ND	ND	0.022 J	**5.7**	0.027	0.031 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.044
4,4'-DDE	ND	ND	ND	ND	ND	**4.5**	0.021	ND	**39**	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.300 J**	ND	ND	**110.000 J**	ND	ND	ND	0.9
4,4'-DDD	ND	ND	ND	ND	0.027 J	**10**	0.035	0.041	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9
4,4'-DDT	1.600 J	0.110 J	ND	ND	0.0067 J	**19**	0.074	0.039	**9.100 J**	ND	ND	ND	ND	**140.000 J**	ND	ND	ND	ND	2.1
Methoxychlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.750 J	ND	ND	ND	ND	ND	ND	10
alpha-Chlordane	**35**	**1.6**	**3.5**	0.48	0.12	**32**	0.14	0.17	**190**	0.21	**1.6**	**12**	**17**	**3,700.00**	**2,400.00**	**2,500.00**	0.400 NJ	0.180 J	0.54
gamma-Chlordane	**27**	**1.4**	**2.9**	0.44	0.096	**33**	0.12	0.18	**160**	0.18	**1.3**	**11**	**16**	**3,300.00**	**2,200.00**	**1,800.00**	0.320	0.150	0.54
Total Pesticides	**64.89**	3.35	6.98	1.06	0.2881	**110.17**	0.4714	0.529	**435.1**	0.426	3.06	**26.86**	**34.2**	**8,305**	**5,494**	**5,040**	0.795	0.366	10

Notes:
TCL = Target Compound List
mg/kg = Milligrams per kilogram.
ND = Not Detected.
J = Concentration is estimated.
- = No NYSDEC Recommended Soil Cleanup Objective established for this analyte.
Bold values exceed NYSDEC Recommended Soil Cleanup
N = Analyte is tentatively identified based on presumptive evidence.

indicate that pesticide concentrations decrease to the north, west, and south, respectively. Pesticide concentrations also decrease significantly to the east based on the off-site SS-14 sample.

2.1.4 SS-1/MW-8 Area

The soil chemical analytical data collected in the SS-1/MW-8 area are shown on Table 2.1.1 and Plate 2. Elevated concentrations of pesticides were detected in the shallow soil at SS-1 during the Site Assessment investigation. However the deeper sample at SS-1 (3 to 4 feet below grade) exhibited a slight exceedance of only one NYSDEC Objective (dieldrin). Shallow and deeper soil samples at SS-15 through SS-23, located to the north, west and east of SS-1, generally exhibited only slight to moderate exceedances of the NYSDEC Objectives for several pesticides. These data also generally indicate that pesticide concentrations decrease with increasing depth and many of the deeper samples do not exceed the NYSDEC Objective for total pesticides.

There are, however, several exceptions to these generalizations. At SS-17, elevated pesticide concentrations were detected in the deeper sample and pesticide concentrations were noted to increase with increasing depth. Somewhat elevated pesticide concentrations were also noted in the shallow sample at SS-18; however, the pesticide concentrations were noted to decrease with increasing depth. Finally, a somewhat elevated total pesticides concentration was also noted in the deeper sample at SS-22.

Shallow (0 to 0.25 feet) soil samples were collected at off-site locations SS-35, SS-36, and SS-37 during the additional sampling event. These locations are immediately north (within five feet) of the fence adjoining the on-site SS-17, SS-18, and SS-20 locations, respectively, and are beneath a turf area. Several pesticides were detected in these off-site samples; however, the detected concentrations only slightly exceeded the NYSDEC Objectives and the total pesticides concentration in each sample did not exceed the Objective. Based on these data, the pesticides detected in soils in the SS-1/MW-8 area do not extend significantly off site to the north. No additional surface soil sampling was conducted to the south of SS-1 since this off-site area was found to be paved with concrete and a car wash had been constructed over this area.

In summary, slight to moderately elevated concentrations of pesticides were generally detected in soil samples from the SS-1/MW-8 area. In general, pesticide concentrations were noted to decrease with increasing depth in this area, with the exception of the SS-17 and SS-22 locations which appear to be anomalous. The shallow soil sample at SS-1, the deeper soil sample at SS-17, and the shallow soil sample at SS-18 exhibited the most elevated pesticide concentrations. However, at the SS-1 and SS-18 locations, pesticide concentrations were noted to decrease with increasing depth. It should be noted that the majority of this on-site area is paved; the only area noted to be unpaved is located to the northwest of the one-story garage building in the vicinity of SS-19 and SS-20. Pesticide concentrations did not appear to be highly elevated at either of these two locations. Off-site shallow soils to the north beneath a turf area exhibited pesticide concentrations only slightly exceeding the Objectives.

2.1.5 SS-6 Area

The chemical analytical results from the soil samples collected in the SS-6 area are shown on Table 2.1.1. Slightly elevated pesticide concentrations were detected in the shallow soil sample at SS-6; however, the deeper soil sample collected at SS-6 did not exceed any of the NYSDEC Objectives for pesticides. Therefore, it appears that pesticide impact at SS-6 is limited to the shallow soil. The shallow soil samples from SS-24 and SS-25 exhibited slight exceedances of the NYSDEC Objectives for several pesticides. However, in both cases the total pesticides concentration did not exceed the NYSDEC Objective and the concentrations of the pesticides detected were below those previously detected in the shallow soil at SS-6.

Based on these data, the slight exceedances of NYSDEC Objectives for pesticides noted in the shallow soil at SS-6 do not extend to depth. These slightly elevated pesticide concentrations also do not appear to extend laterally.

2.1.6 SS-7 Area

A shallow soil sample collected at SS-7 exhibited slightly elevated concentrations of pesticides; however, the deeper sample collected at SS-7 did not exhibit exceedances of any of the NYSDEC Objectives, as shown on Table 2.1.1. Shallow soil samples collected at nearby locations SS-26 and SS-27 slightly exceeded the NYSDEC Objectives for several pesticides.

Based on these data, it appears that the concentrations of pesticides decrease with increasing depth in the SS-7 area, similar to other areas of this Site. The slightly elevated levels of pesticides detected in the shallow soil at SS-7 appear to extend laterally to SS-26 and SS-27. However, the concentrations detected at SS-26 and SS-27 are comparable to those detected at SS-7, suggesting that pesticides are relatively uniformly slightly elevated in this area.

2.1.7 D-2 Drywell Area Soil

A sediment sample collected from the D-2 drywell exhibited elevated concentrations of pesticides, as discussed in Section 2.2. This sample was collected from 1 to 2 feet below the top of sediments which were encountered at 11 feet below grade. Therefore, soil samples were collected at several depths in two borings performed through the concrete pavement adjacent to D-2 to evaluate the lateral extent of potential soil contamination outside of the drywell structure.

Boring D-2A was performed adjacent to the north wall of drywell D-2 and boring D-2B was performed adjacent to the south wall of drywell D-2. Soil samples were collected at two depths in each boring: 9 to 10 and 14 to 15 feet below grade and the chemical analytical data are shown in Table 2.1.1.

Although several pesticides were detected in each of the D-2A and D-2B soil samples, the only exceedances of the NYSDEC Objectives were very slight and were noted for alpha- and gamma-chlordane in the deeper sample from boring D-2A. No exceedances of the NYSDEC Objective for total pesticides were noted for any of these samples. These data indicate that the pesticide impact noted in the sediment in drywell D-2 does not appear to extend laterally to the surrounding soil.

2.1.8 TCLP Results

Four near-surface soil samples were collected from locations exhibiting elevated pesticide concentrations: SS-1, SS-11, GP-4, and D-2. These samples were tested for Resource Conservation and Recovery Act (RCRA) pesticides using the TCLP method. The results are summarized on Table 2.1.8.1.

The only sample exhibiting exceedances of the RCRA regulatory levels was the shallow sample at SS-11, which exhibited exceedances for heptachlor and chlordane. The SS-11 near-surface soil sample collected during the SI exhibited very high concentrations of these compounds and also exhibited the highest concentration of total pesticides detected at the Site during the SI or RI. Based on these data, it appears that the near-surface soil at SS-11 exhibits RCRA hazardous characteristics. However, soil from other portions of the Site is unlikely to exhibit RCRA hazardous characteristics.

2.2 Leaching Pool Contamination

Several leaching pools and drains are located on the Site, as shown on Plate 1, and pesticides have previously been detected in all of them. Table 2.2.1 summarizes the leaching pool and drain sampling results; the results are also summarized on Plate 2.

The leaching pool LP-1 was previously remediated by Marine Pollution Control (now known as Miller Environmental Group). Soil and sediment were excavated from LP-1, the pool was backfilled to grade and sealed with concrete, and a new leaching pool (LP-2) was constructed to the southwest. The soil beneath LP-1 was sampled and elevated pesticide concentrations were encountered in native soil at 15 to 17 feet below grade. Pesticide concentrations in a deeper sample at 24 to 25 feet below grade were lower, indicating that the impact decreases with depth.

TABLE 2.1.8.1
TCLP EXTRACTION CHEMICAL ANALYTICAL DATA
2001-2002 REMEDIAL INVESTIGATION
HARDER TREE SERVICE SITE
HEMPSTEAD, NEW YORK

Location	SS-11	SS-1	GP-4	D-2	RCRA Regulatory Level
Sample Depth (feet below grade)	0-0.25	0-2	0-2	0-2	
TCLP Pesticides in mg/l					
Heptachlor	**0.011 J**	ND	ND	0.0014	0.008
Chlordane	**0.17**	ND	ND	ND	0.03
Endrin	ND	ND	ND	0.00098 J	0.020

Notes:

ND = Not detected
mg/l = Milligrams per liter.
TCLP = Toxicity Characteristic Leaching Procedure
RCRA = Resource Conservation and Recovery Act
Bold values exceed RCRA regulatory level
J = Concentration is estimated.

TABLE 2.2.1
SUMMARY OF LEACHING POOL SEDIMENT/SOIL CHEMICAL ANALYTICAL DATA
HARDER TREE SERVICE SITE
HEMPSTEAD, NEW YORK

Location	D-1	D-2				D-3	LP-1		LP-2	LP-3	NYSDEC Recommended Soil Cleanup Objectives
Depth Below Top of Sediment (feet)	1-2	0.05-1	3-4	8-10	14-16	0-1	-	-	0-1	1-2	
Depth Below Grade (feet)	3-4	11.5-12	14-15	19-21	25-27	5-6	15-17	24-25	12-13	7-8	
TCL Pesticides in mg/kg											
beta-BHC	ND	**36.000 J**	ND	ND	ND	ND	ND	ND	ND	ND	0.2
delta-BHC	ND	**15.000 J**	ND	ND	ND	ND	ND	ND	ND	ND	0.3
Heptachlor	**0.580 J**	**15.000 J**	ND	**1.300 J**	0.087 NJ	**0.270 J**	**1,000.000**	**51.000**	ND	0.037 J	0.10
Aldrin	ND	**39.000 J**	**11.000 J**	ND	ND	**2.100 J**	**750.000**	ND	ND	ND	0.041
Endosulfan I	ND	**610.000**	**50.000 NJ**	**3.600 NJ**	0.870 NJ	ND	**570.000**	ND	ND	**2.800**	0.9
Dieldrin	**3.000**	ND	ND	**4.600**	**0.240 J**	ND	**490.000**	**23.000**	**0.280 J**	ND	0.044
4,4'-DDE	1.300 J	**69.000 J**	ND	**2.500**	ND	**13.000**	ND	ND	1.200	0.660 J	2.1
Endrin	ND	**260.000**	ND	ND	ND	ND	ND	ND	ND	ND	0.10
4,4'-DDD	**5.700**	**1,600.000**	**570.000**	**15.000 J**	**5.400**	**12.000**	**150.000 J**	**13.000 J**	0.680 J	2.400	2.9
Endosulfan Sulfate	ND	ND	ND	0.520 J	0.094 J	ND	ND	ND	ND	ND	1.0
4,4'-DDT	**2.800**	**1,200.000**	ND	**17.000**	0.210 J	ND	ND	**3.300 J**	0.190 J	ND	2.1
alpha-Chlordane	**17.000 B**	**520.000 B**	**120.000**	**5.800**	**1.900**	**28.000 B**	**490.000 B**	**61.000 B**	**1.500**	**2.800 B**	0.54
gamma-Chlordane	**13.000 B**	**420.000 B**	**140.000**	**5.500**	**1.900**	**23.000 B**	**1,200.000 B**	**66.000 B**	**1.400**	**2.100 B**	0.54
Total Pesticides	**43.38**	**4,784**	**891**	**53.82**	**10.7**	**78.37**	**4,650**	**217.3**	5.25	**10.797**	10

Notes:

TCL = Target Compound List
mg/kg = milligrams per kilogram
ND = Not Detected
B = Analyte was detected in blank sample(s).
J = Concentration is estimated.
Bold values exceed NYSDEC Recommended Soil Cleanup Objectives.
N = Analyte is tentatively identified based on presumptive evidence.

A sediment sample collected from leaching pool D-2 exhibited elevated levels of pesticides. Soil samples were, therefore, collected from several depths below the sediments to evaluate the vertical extent of impact. Pesticide concentrations were noted to decrease with increasing depth and the soil in the 25 to 27-foot interval exhibited only very low exceedances of the Objectives.

Leaching pool LP-2 contained sediments exhibiting only slight exceedances of the Objectives. Similarly, leaching pool LP-3 also contained sediments exhibiting only slight exceedances of the Objectives.

Sediment in drain D-1 exhibited moderate levels of pesticides. This drain is reported to discharge to the storm sewer. Sediment in drain D-3 also exhibited moderate levels of pesticides.

2.3 Groundwater Contamination

Groundwater samples were obtained and analyzed from all of the on-site and off-site wells during the RI and previous sampling events, as per the NYSDEC-approved work plans. Each of the samples was analyzed for TCL pesticides and/or TCL VOCs. The chemical analytical results are summarized in Table 2.3.1. The recent groundwater chemical analytical data are also summarized on Plate 3.

With respect to the most recent analytical results for each well, TCL pesticides and/or TCL VOCs were detected in all of the groundwater samples for which they were analyzed with the exception of well MW-10, which did not contain detectable concentrations of pesticides. Exceedances of the NYSDEC Class GA Ambient Water Quality Standards (Standards) were noted for pesticides in all the samples in which pesticides were detected. The pesticides detected most frequently were alpha- and gamma-chlordane. Only two VOCs, methylene chloride and tetrachloroethene (PCE), were detected at concentrations exceeding the NYSDEC Standards during the 2001 and 2002 sampling events. The recent and historic sampling results for each well are discussed below.

Well MW-7 is located approximately 260 feet upgradient of the Site and showed slight exceedances for alpha- and gamma-chlordane (0.10 and 0.061 ug/l, respectively), heptachlor, and heptachlor epoxide during the 2001 sampling event. This well was initially sampled in 1988 and chlordane was detected at a moderate concentration (0.31 ug/l). These data indicate that an off-site upgradient source of chlordane, heptachlor, and heptachlor epoxide groundwater contamination continues to exist in the Site vicinity.

Well MW-1, which is located in the 50 by 50-foot area, showed moderate exceedances of the NYSDEC Standards for alpha- and gamma-chlordane (0.56 and 0.66 ug/l, respectively) and PCE during the 2001 sampling event. Well MW-1 was previously sampled several times. Chlordane and 4,4'-DDT were detected at moderate concentrations in 1987 but were not detected in 1986 or 1988. Chlordane was again

TABLE 2.3.1
GROUNDWATER CHEMICAL ANALYTICAL DATA
HARDER TREE SERVICES SITE
1986, 1987, 1988, 1999, 2001, AND 2002 SAMPLING EVENTS

Well No.	MW-1				MW-2				MW-3				MW-4				NYSDEC Class GA Ambient Water Quality Standards
Date	1986	1987	1988	2001	1986	1987	1988	1999	1986	1987	1988	1999	1986	1987	1988	1999	
Pesticides in ug/l																	
Lindane (Hexachlorocyclohexane)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.51**	**0.21**	**0.25**	**0.35 J**	0.05
Dieldrin	ND	ND	ND	ND	**6**	**2.5**	**0.46**	**1.7 J**	**0.08**	**0.05 J**	**0.040**	**0.28**	ND	ND	ND	**1.9**	0.004
Heptachlor	ND	ND	ND	0.022 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.30**	ND	0.04
Heptachlor Epoxide	ND	NA	ND	0.023 J	ND	NA	ND	ND	**0.07**	NA	**0.085**	**0.11**	ND	NA	ND	ND	0.03
Endrin Ketone	ND	ND	ND	ND	0.2	1.8	ND	0.14 J	ND	ND	ND	ND	1.0	0.31	ND	1.3	5
alpha-BHC	NA	ND	ND	ND	NA	ND	**0.46**	**0.11 J**	NA	ND	ND	ND	NA	**0.03**	ND	**0.21 J**	0.01
Chlordane	NA	**0.19**	ND	-	NA	**9.0**	ND	-	NA	ND	ND	-	NA	ND	ND	ND	0.05
4,4'-DDD	NA	ND	ND	ND	NA	ND	ND	**0.86 J**	NA	ND	ND	ND	NA	ND	ND	ND	0.3
4,4'-DDT	NA	**0.24**	ND	ND	NA	ND	ND	ND	NA	**0.43**	ND	ND	NA	**0.48**	ND	ND	0.2
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	*
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*
alpha-Chlordane	NA	-	-	**0.56**	NA	-	-	**3.4 B**	NA	-	-	**0.58 B**	NA	-	-	**2.5 B**	0.05
gamma-Chlordane	NA	-	-	**0.66**	NA	-	-	**4.8 B**	NA	-	-	**0.53 B**	NA	-	-	ND	0.05
delta-BHC	ND	ND	ND	ND	ND	ND	**0.47**	**1**	ND	ND	ND	ND	ND	ND	ND	ND	0.04
beta-BHC	ND	ND	ND	ND	ND	ND	ND	**1.3**	ND	ND	ND	ND	ND	ND	ND	**0.35 J**	0.04
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	**0.42 J**	ND	ND	ND	ND	ND	ND	ND	ND	0.02
Volatile Organic Compounds in ug/l																	
1,1-Dichloroethane	ND	NA	ND	ND	1.1	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	5
Tetrachloroethene	ND	NA	**332**	**17**	3.1	NA	2.4	ND	ND	NA	**12**	ND	ND	NA	ND	ND	5
1,1,1-Trichloroethane	ND	NA	ND	ND	2.4	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	5
Trichloroethene	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	5
Benzene	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	**26.0**	NA	ND	ND	1
Xylene	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	4.4	NA	ND	**19**	5
Chloroform	ND	ND	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	1.9	7
Toluene	ND	ND	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	0.8	5
Ethylbenzene	ND	ND	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	4.8	5
Methylene Chloride	ND	ND	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	5
Acetone	ND	ND	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	50

Notes:

Only detected compounds are reported.
- = For chlordane, either total chlordane or alpha- and gamma-chlordane are reported.
ug/l = Micrograms per liter
ND = Not Detected.
NA = Not Analyzed.

J = Concentration is estimated
B = Analyte was detected in blank sample(s)
* = No NYSDEC Class GA Ambient Water Quality Standard established for this analyte.
Bold values exceed NYSDEC Class GA Ambient Water Quality Standard.

TABLE 2.3.1 (CONTINUED)
GROUNDWATER CHEMICAL ANALYTICAL DATA
HARDER TREE SERVICES SITE
1986, 1987, 1988, 1999, 2001, AND 2002 SAMPLING EVENTS

Well No.	MW-5					MW-6				MW-7		NYSDEC Class GA Ambient Water Quality Standards
Date	1986	1987	1988	1999	2001	1986	1987	1988	1999	1988	2001	
Pesticides in ug/l												
Lindane (Hexachlorocyclohexane)	ND	ND	ND	ND	0.0028 J	ND	ND	ND	ND	ND	ND	0.05
Dieldrin	ND	**0.05 J**	**0.047**	**1.4**	**0.67**	ND	**0.05 J**	ND	ND	ND	ND	0.004
Heptachlor	ND	ND	ND	0.022 J	ND	0.04 J	**0.19**	ND	**0.058**	ND	**0.11 J**	0.04
Heptachlor Epoxide	**0.05 J**	NA	**0.12**	ND	**0.10**	ND	NA	ND	ND	ND	**0.036 J**	0.03
Endrin Ketone	ND	ND	ND	0.065 J	ND	ND	ND	ND	ND	ND	ND	5
alpha-BHC	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	0.01
Chlordane	NA	**0.42**	ND	-	-	NA	**0.49**	**0.80**	-	**0.31**	-	0.05
4,4'-DDD	NA	ND	ND	ND	ND	NA	0.09 J	ND	0.17	ND	ND	0.3
4,4'-DDT	NA	**0.38**	ND	ND	0.11	NA	**0.48**	ND	**0.32**	ND	ND	0.2
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	ND	ND	ND	ND	0.021 J	ND	ND	ND	ND	ND	ND	*
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*
alpha-Chlordane	NA	-	-	**0.94 B**	**0.28**	NA	-	-	**0.20 B**	-	**0.10**	0.05
gamma-Chlordane	NA	-	-	**0.92 B**	**0.21**	NA	-	-	**0.20 B**	-	**0.061**	0.05
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	**0.089**	**0.11**	ND	ND	0.02
Volatile Organic Compounds in ug/l												
1,1-Dichloroethane	ND	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	5
Tetrachloroethene	ND	NA	**720**	4	2.8	ND	NA	**5.8**	ND	ND	ND	5
1,1,1-Trichloroethane	ND	NA	1.2	ND	ND	ND	NA	ND	ND	ND	ND	5
Trichloroethene	ND	NA	ND	ND	ND	4.4	NA	**10**	ND	ND	ND	5
Benzene	ND	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	1
Xylene	ND	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	5
Chloroform	ND	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	7
Toluene	ND	NA	ND	ND	4.4	ND	NA	ND	ND	ND	ND	5
Ethylbenzene	ND	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	5
Methylene Chloride	ND	NA	ND	ND	**7.6**	ND	NA	ND	ND	ND	4.1	5
Acetone	ND	NA	ND	ND	13	ND	NA	ND	ND	ND	16	50

Notes:

Only detected compounds are reported.
- = For chlordane, either total chlordane or alpha- and gamma-chlordane are reported.
ug/l = Micrograms per liter
ND = Not Detected.
NA = Not Analyzed.

J = Concentration is estimated
B = Analyte was detected in blank sample(s)
* = No NYSDEC Class GA Ambient Water Quality Standard established for this analyte.
Bold values exceed NYSDEC Class GA Ambient Water Quality Standard.

TABLE 2.3.1 (CONTINUED)
GROUNDWATER CHEMICAL ANALYTICAL DATA
HARDER TREE SERVICES SITE
1986, 1987, 1988, 1999, 2001, AND 2002 SAMPLING EVENTS

Well No.	MW-8			MW-9	MW-10	NYSDEC Class GA Ambient Water Quality Standards
Date	1988	1999	2002	2001	2002	
Pesticides in ug/l						
Lindane (Hexachlorocyclohexane)	ND	ND	ND	ND	ND	0.05
Dieldrin	ND	ND	ND	**5.7**	ND	0.004
Heptachlor	ND	ND	ND	ND	ND	0.04
Heptachlor Epoxide	ND	ND	ND	**2.1**	ND	0.03
Endrin Ketone	ND	ND	ND	0.085 J	ND	5
alpha-BHC	ND	ND	ND	ND	ND	0.01
Chlordane	**44**	-	ND	-	ND	0.05
4,4'-DDD	ND	ND	ND	**1.9 J**	ND	0.3
4,4'-DDT	ND	ND	ND	**0.70 J**	ND	0.2
Endrin	ND	ND	ND	**0.18 J**	ND	ND
Endosulfan Sulfate	ND	ND	ND	0.77 J	ND	*
Endosulfan II	ND	ND	1.8 J	0.77 J	ND	*
alpha-Chlordane	-	**28 B**	**30 NJ**	**2.8**	ND	0.05
gamma-Chlordane	-	**32 B**	**28 J**	**4.3**	ND	0.05
delta-BHC	ND	ND	ND	ND	ND	0.04
beta-BHC	ND	ND	ND	ND	ND	0.04
4,4'-DDE	ND	ND	ND	ND	ND	0.02
Volatile Organic Compounds in ug/l						
1,1-Dichloroethane	ND	ND	NA	ND	NA	5
Tetrachloroethene	ND	ND	NA	ND	NA	5
1,1,1-Trichloroethane	1.4	ND	NA	ND	NA	5
Trichloroethene	ND	ND	NA	ND	NA	5
Benzene	ND	ND	NA	ND	NA	1
Xylene	ND	ND	NA	ND	NA	5
Chloroform	ND	ND	NA	ND	NA	7
Toluene	ND	ND	NA	ND	NA	5
Ethylbenzene	ND	ND	NA	ND	NA	5
Methylene Chloride	ND	ND	NA	3.5	NA	5
Acetone	ND	ND	NA	8.2	NA	50

Notes:

Only detected compounds are reported.
- = For chlordane, either total chlordane or alpha- and gamma-chlordane are reported.
ug/l = Micrograms per liter
ND = Not Detected.
NA = Not Analyzed.
N = Analyte is tentatively identified based on presumptive evidence.
J = Concentration is estimated.
B = Analyte was detected in blank sample(s).

detected in 2001 at moderate concentrations. PCE was initially detected in this well in 1988 at 332 ug/l, which is much higher than the 2001 detection at 17 ug/l. PCE was also previously detected in 1988 in other Site wells at slight to elevated concentrations but was not detected during either of the most recent sampling events at other than low concentrations. Based on these data, a chlordane impact appears to be present at well MW-1 in the 50 by 50-foot area. This impact is greater, but of the same general order of magnitude as that at upgradient well MW-7, as discussed above. PCE appears to be decreasing in well MW-1; the concentrations recently detected in this well and the other Site wells do not suggest a PCE source in this area.

Wells MW-2 and MW-6 are located near the center of the Site, downgradient from well MW-1; neither of these wells was sampled during the RI or additional sampling event. Moderate to elevated levels of pesticides, primarily dieldrin and chlordane, have previously been detected in well MW-2. In general, the concentrations decreased between 1986 and 1988. However, slightly more elevated concentrations were detected in 1999 relative to 1988. At well MW-6, slight to moderate concentrations of pesticides, including chlordane, 4,4'-DDT and dieldrin, have been detected between 1987 and 1999. In general, the concentrations detected in well MW-6 are lower than those detected in well MW-2. Also, concentrations were generally noted to decrease between 1987 and 1999.

Wells MW-3 and MW-4 are located on the downgradient side of the Site; neither of these wells was sampled during the RI or additional sampling event. Both of these wells previously exhibited slight to moderate concentrations of several pesticides. No clear pattern of concentration changes were noted for these wells. However, the concentrations detected were generally lower than at on-site upgradient well MW-2.

Well MW-8, which is located on the west side of the Site, was sampled during the additional sampling event and also in 1988 and 1999. Chlordane was detected during all three sampling events at elevated concentrations. These data suggest that a chlordane source is likely present in the vicinity of well MW-8. Based on the similarity of the sampling results between 1988, 1999 and 2002, it also appears that the groundwater impact is not increasing.

Well MW-5, which is located downgradient approximately 200 feet south of the Site, exhibited slight to moderate exceedances of the NYSDEC Standards for dieldrin, heptachlor epoxide, alpha- and gamma-chlordane, and methylene chloride during the 2001 sampling event. Slight to moderate concentrations of pesticides, primarily chlordane and dieldrin, have previously been detected in this well and PCE was detected at a moderate concentration in 1988. Methylene chloride was not previously detected in this well and may be related to laboratory contamination. In general, pesticide concentrations increased somewhat between 1987 and 1999 but decreased in 2001. These data suggest that the impact to downgradient groundwater is decreasing over time. The pesticide concentrations detected at well MW-5 were also noted to be somewhat lower than at the closest on-site well, MW-4, and only slightly higher than those in the upgradient off-site well MW-7, suggesting that the magnitude of pesticide impact in groundwater at well MW-5 is only slightly greater than the ambient upgradient pesticide impact.

Well MW-9, which is located on the adjoining property to the west of the Site and approximately 220 feet downgradient of well MW-8, exhibited exceedances of the NYSDEC Standards for heptachlor epoxide, dieldrin, endrin, 4,4'-DDD, 4,4'-DDT, and alpha- and gamma-chlordane during the 2001 sampling event. The pesticide concentrations detected in this well were noted to be significantly less than those detected in the closest on-site upgradient well, MW-8.

Well MW-10 is located approximately 550 feet south of the Site and downgradient of wells MW-8 and MW-9. No pesticides were detected in this well.

Based on this evaluation, it appears that the majority of groundwater pesticide impact is limited to the Site and an area downgradient to the south of the Site. Some groundwater impact is observed at one location downgradient of the Site (well MW-5). However, the magnitude of this impact is comparable to the magnitude of the pesticide impact originating from an upgradient off-site source, as documented at well MW-7. No groundwater impact was observed at the well located furthest downgradient of the Site (MW-10). Therefore, the downgradient extent of groundwater impact exceeding the off-site upgradient groundwater impact is up to 200 feet in length. No impact is observed at 550 feet downgradient of the Site. Overall, most of the pesticide concentrations detected in the groundwater are very low, indicating that most of the pesticides detected at the Site remain adsorbed to the soil. No significant PCE source appears to be present in the Site vicinity.

2.4 Evaluation of Human Health Risk

A focussed qualitative risk assessment was performed for the on-site and off-site soils since there are several reasonably feasible exposure pathways for this medium. This qualitative risk assessment was presented in the Revised RI Report (FPM, August 2002). A risk assessment was not performed for groundwater since the receptor survey did not identify any groundwater receptors within one-half mile of the Site.

The current and reasonably anticipated Site uses are for commercial purposes and Site access is limited by a chain link fence with gates. A limited portion of the Site is occupied by a residence and is considered together with the off-site area since it is segregated from the commercial portion of the Site by a fence.

The majority of the Site is paved; unpaved areas include only the 50 by 50-foot area, a limited area behind the one-story garage building (the vicinity of locations SS-19 and SS-20), and an area immediately west of the residence where landscaping plants are stored (vicinity of locations SS-6, SS-7, and SS-24 through SS-27). A very limited unpaved area is also present in the vicinity of SS-11 where the Site pavement ends next to the Site perimeter fence.

Several potential exposure pathways have been identified for the on-site soils. For the soils beneath paved areas, it is unlikely that exposure will occur during investigation or remediation activities since a HASP will be utilized. These provisions could be extended to other subsurface construction or repair activities, thereby eliminating this potential exposure pathway for construction or repair workers. For the soils in the unpaved areas, exposure to surface or near-surface soil may occur for Site workers conducting activities in these areas.

Exposure pathways have also been identified for select off-site areas where unpaved/unvegetated soil exists. Residences adjoining to the north and east of the 50 by 50-foot area have undeveloped wooded areas with unpaved/unvegetated ground surfaces. Although no indications of ongoing residential activities were observed in these areas, there is the potential for exposure to near-surface soil in these areas. Other off-site areas consist of either multi-family residential or commercial properties either with paved surfaces or separated from the Site by Jerusalem Avenue or Henry Street, or covered with a well-developed turf. Therefore, the potential for exposure to near-surface soil at these off-site areas is considered to be low.

The soils in the areas where a reasonable exposure pathway is present were evaluated with respect to health-based criteria. The results of this evaluation indicate that for the on-site soils in the unpaved areas, the surface/near-surface soils exceed some of the health-based criteria in all three areas. The exceedances were generally noted to be greatest in the 50 by 50-foot area, although some of the more elevated pesticide exceedances were also noted for the SS-19/SS-20 area. The exceedances noted in the SS-6/SS-7/SS-24 through SS-27 area to the west of the on-site residence were minor.

For the subsurface on-site soils in the unpaved areas, exceedances of some of the health-based criteria were noted in all three areas. The exceedances were greatest in the 50 by 50-foot area. The exceedances were noted to be minor in the SS-19/SS-20 area. No exceedances of the health-based criteria were noted in the SS-6/SS-7/SS-24 through SS-27 area to the west of the on-site residence.

For the surface/near-surface off-site soils, exceedances of some of the health-based criteria were noted for all areas. The exceedances were noted to be greatest in the off-site area to the north and east of the 50 by 50-foot area. The exceedances in the SS-8/SS-35 through SS-37 area to the north and the SS-14 area were noted to be minor. The SS-8/SS-35 through SS-37 soils are located beneath well-developed turf and the SS-14 soil is located beneath asphalt pavement. No exceedances of the health-based criteria were noted for the off-site subsurface soils.

Exposure to on-site or off-site soils that exceed the health-based criteria could pose a dermal, inhalation and/or ingestion risk. These soils are further discussed in this report based on their potential health risk to humans.

2.5 Fish and Wildlife Impact Analysis

A Fish and Wildlife Analysis was performed as per the NYSDEC's Fish and Wildlife Analysis guidelines. It is concluded that no resources exist in the Site area and, therefore, no potential exists for migration of contaminants to these resources. The reasonable pathway for contaminants from the Site to potentially impact fish and wildlife would be limited to the discharge of groundwater to wetlands or other surface water bodies. However, no surface water bodies exist within at least one mile downgradient of the Site. In addition, the Site is completely enclosed by a chain-link fence through which access is permitted by two gates. These gates are closed and locked during non-working hours. Therefore, there is no reasonable potential for impacts to fish and wildlife.

2.6 Applicable or Relevant and Appropriate Requirements

Chemical-specific remediation goals have been developed to define the area and volume of the impacted media to be addressed to meet the Remedial Action Objectives (RAOs). These remediation goals are based on the evaluation of applicable or relevant and appropriate requirements (ARARs) and other criteria and guidelines and have been supplemented by the findings of risk evaluations. These evaluations are used to determine contaminant levels that will not endanger human health or the environment. The terms "ARARs" and "criteria and guidelines" encompass the terms "Standards, Criteria, and Guidance" (SCGs) as defined by the NYSDEC. The term "ARARs" refers to a promulgated and legally enforceable rule or regulation. "Criteria and guidelines" refer to policy documents that are not promulgated and not legally enforceable. However, "criteria and guidelines" become enforceable if they are incorporated into an accepted Record of Decision (ROD). To distinguish between enforceable and non-enforceable values, the terms "ARARs" and "guidelines" will be used rather than the NYSDEC term "SCGs".

There are three types of ARARs that remedial actions may have to comply with:

- Chemical-specific ARARs set concentrations for the chemicals of concern (e.g., drinking water standards);
- Location-specific ARARs may restrict remedial actions based on the characteristics of the site or its environs (remedial activities proposed for wetlands may be restricted by regulations protecting these areas); and
- Action-specific ARARs may affect remediation activities based on the type of technology selected (alternatives involving groundwater extraction at greater than 45 gallons per minute may be impacted by the Long Island Well Permit Program).

The following chemical-specific ARAR and guidelines have been identified for impacted sediments and soil at the Site:

- Federal Resource Conservation and Recovery Act (RCRA) regulations establish regulatory levels for various contaminants to be utilized in the evaluation of whether a solid waste is a hazardous waste (ARAR); and
- The NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046 "Determination of Soil Cleanup Objectives and Cleanup Levels", revised April, 1995, provides guidance concerning health-based criteria and remediation levels for various contaminants present at the Site (guidelines).

The following chemical-specific ARARs have been identified for impacted groundwater at the Site (no guidelines were identified):

- Federal Maximum Contaminant Levels (MCLs) established for groundwater protection (equivalent to the MCLs established pursuant to the Safe Drinking Water Act) (ARAR);
- NYSDEC Water Quality Regulations for Surface Waters and Groundwaters (6NYCRR Parts 700-705, revised March 8, 1998), established water quality standards for groundwater and effluent discharge standards (ARAR);
- NYSDEC State Pollutant Discharge Elimination System (SPDES, 6NYCRR Parts 750-758) establishes requirements for effluent limits for discharge permits (ARAR); and

- NYSDOH State Sanitary Code, Drinking Water Supplies establishes water quality standards for potable water (ARAR).

No location-specific or action-specific ARARs or guidelines have been identified.

2.7 Selection of Preliminary Remediation Goals

Preliminary remediation goals (PRGs) were developed to address the protection of both human health and the environment. The anticipated performance of each remedial action will be evaluated relative to the PRGs to estimate the acceptability of public health and environmental impacts. Final remediation goals may differ from PRGs and will be established in the ROD.

For Site sediment and soil, the Recommended Soil Cleanup Objectives identified in the NYSDEC TAGM HWR-94-4046 "Determination of Soil Cleanup Objectives and Cleanup Levels", revised April 1995, have been established as the PRGs. These guidelines are widely utilized for the evaluation of contaminants found in sediment and soil and provide guidance concerning health-based criteria for protection of human health and the environment.

For groundwater, the Class GA Ambient Water Quality Standards established in the NYSDEC Water Quality Regulations for Surface Waters and Groundwaters (6NYCRR Parts 700-705, revised June 1998) have been selected as the PRGs. These standards are well-established water quality standards for fresh groundwater that has the potential to be utilized for water supply.

It should be recognized that although these PRGs have been identified, it may be economically and technically impractical to actively remediate the media of concern to the levels dictated by these PRGs. Because of the Site location in an industrialized area, the presence of much of the impacted material at depths where no human health impact is anticipated, the lack of use of the groundwater in the impacted area for water supply purposes, and the immobility of contaminants in the Site soils, remediation to levels proscribed by the PRGs may not be justifiable. Therefore, as part of the FS, an evaluation of remediation to several different remediation goals will be evaluated.

2.8 Summary of Site Contamination to be Addressed by Remedial Alternatives

Based on the evaluation of the soil, leaching pool, and groundwater chemical analytical data with respect to the PRGs, several areas have been targeted for remediation at the Site, including on-site and off-site soils, leaching pool sediments, and groundwater. These areas are described as follows:

- For drain and leaching pool sediments, constituents exceeding PRGs are present in leaching pools D-1, D-2, D-3, LP-2, and LP-3 and in the soil beneath former leaching pool LP-1. The sediments in leaching pool D-2 and the soil beneath former leaching pool LP-1 may be characterized as having one or more analytes exceeding their respective PRGs by more than two orders of magnitude. The remaining leaching pools and drains, LP-2, LP-3, D-1, and D-3, did not exhibit exceedances of their PRGs by more than two orders of magnitude. In general, pesticide concentrations in the sediments in D-2 and in the soil beneath former LP-1 were detected at elevated concentrations in the shallow samples and decreased with increasing depth. Since the concentrations decrease with increasing depth, it appears that the pesticides in the materials in the leaching pools are relatively immobile in the subsurface environment. Several remediation options are evaluated for leaching pool sediments;

- For the soils, both on-site and off-site soils exhibit exceedances of the PRGs. However, the magnitude of the impact is variable, as is the potential for human exposure. Several remediation options are evaluated for the on-site and off-site soils; and

- For the groundwater, constituents exceeding the PRGs include pesticides present in wells MW-1 through MW-9. No exceedances of the PRGs were noted in well MW-10, which is located 550 feet downgradient of the Site. Several remediation options are evaluated for pesticides in groundwater.

SECTION 3.0
IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 Identification of General Response Actions

Based on the information presented in Section 2, general response actions (GRAs) are identified to address leaching pool sediment and groundwater contamination at the Site. GRAs describe classes of technologies that can be used to meet the remediation objectives for each medium of concern.

3.1.1 Leaching Pool Sediments

Sediments in leaching pools LP-2, LP-3, and D-2, and drains D-1 and D-3 are impacted with pesticides exceeding their respective PRGs (soil beneath the former leaching pool LP-1 is considered in Section 3.1.3). Sediments characterized as having one or more pesticides exceeding their respective PRGs by more than two orders of magnitude are only found in leaching pool D-2. These sediments do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, impacted sediments have the potential to cause groundwater contamination since stormwater is routinely directed to the leaching pools and drains for discharge. Therefore, GRAs that reduce the potential for groundwater contamination are considered in this FS. These GRAs include no action, excavation, replacement of the leaching pool structures, and in-situ stabilization.

3.1.2 Groundwater

Groundwater constituents exceeding the PRGs include concentrations of several pesticides in monitoring wells MW-1 through MW-9. Several types of GRAs may be utilized to reduce human and environmental exposure to pesticide-impacted groundwater. However, because there is no human exposure to on-site or off-site impacted groundwater, contaminant concentrations are confirmed to attenuate rapidly off site, and the contaminant source areas are proposed to be remediated, there does not appear to be a need for aggressive remediation to reduce pesticide concentrations to below the PRGs. Therefore, the GRAs to be considered for the Site groundwater include no action, long-term monitoring, and pump-and-treat.

3.1.3 On-Site and Off-Site Soils

For the Site soils, both on-site and off-site soils exhibit exceedances of the PRGs and select on-site soils exhibit exceedances of their PRGs by more than two orders of magnitude. On-site soils exhibiting this level of exceedances include portions of the 50 by 50-foot area, portions of the SS-4 area, portions of the

SS-1 area, and the area beneath former leaching pool LP-1. Off-site impacted soils include select soils adjoining 50 by 50-foot area, adjoining the on-site SS-4 area, and adjoining the on-site SS-17 through SS-20 locations. Several types of GRAs may be utilized to reduce human and environmental exposure to these impacted soils, including no action, excavation and disposal, and ex-situ and in-situ technologies. Since, the potential exists for humans to come into contact with shallow surface soils and some of the deeper soils have the potential to impact groundwater, the GRAs to be considered for the on-site and off-site soils are no action, excavation and disposal, and in-situ stabilization.

3.2 Identification and Screening of Leaching Pool Sediment Remedial Technologies

This section identifies and screens potential remedial action technologies that may be applicable to remediation of impacted leaching pool sediments at the Site. Each technology was evaluated in terms of effectiveness and implementability as shown in Table 3.2.1. After the preliminary screening, retained technologies are presented as remedial action alternatives, which are discussed in Section 3.5.

3.3 Identification and Screening of Groundwater Remedial Technologies

This section identifies and screens potential remedial action technologies that may be applicable to remediation of impacted groundwater at the Site. Each technology was evaluated in terms of effectiveness and implementability as shown in Table 3.3.1. After the preliminary screening, retained technologies are presented as remedial action alternatives, which are discussed in Section 3.5.

3.4 Identification and Screening of On-Site and Off-Site Soils Remedial Technologies

This section identifies and screens potential remedial action technologies that may be applicable to remediation of impacted on-site and off-site soil. Each technology was evaluated in terms of effectiveness and implementability as shown in Table 3.4.1. After the preliminary screening, retained technologies are presented as remedial action alternatives, which are discussed in Section 3.5.

3.5 Development and Screening of Alternatives

Remedial alternatives appropriate for addressing leaching pool sediments, on-site and off-site soils, and groundwater contamination are formulated by combining retained technologies screened in Sections 3.2 through 3.4 to develop comprehensive remedial actions. The retained remedial technologies for the leaching pool sediments, on-site and off-site soils, and/or groundwater at the Harder facility include:

- No Action;
- Leaching Pool Sediment Removal and Disposal;

TABLE 3.2.1
SCREENING OF LEACHING POOL SEDIMENT REMEDIAL TECHNOLOGIES
HARDER TREE SERVICE
HEMPSTEAD, NEW YORK

Technology	Effectiveness	Implementability	Recommended Action
No Action	No active reduction in contaminant concentrations, possible slow degradation.	No action required. No associated cost.	Retain for further consideration due to easy implementability and low cost.
Sediment Removal and Off-Site Disposal	Effectively removes contaminants.	Commonly-utilized technology, limited by engineering constraints. Initial cost moderate to high, but reduced long-term costs.	Retain for further consideration due to effectiveness.
In-Situ Remediation-Stabilization	Reduces mobility of contaminants by decreasing soil permeability. No reduction in contaminant concentrations	This method is less common and the initial cost is moderate to high. Will make leaching pools unusable for their intended purpose.	Reject due to impact on leaching pool function.
Replacement of Leaching Pool Structures	Reduces mobility of contaminants by reducing infiltration through the soil. No reduction in contaminant concentrations	Common technology, already utilized once at the Site. Cost is moderate.	Retain for further consideration due to easy implementability.

TABLE 3.3.1
SCREENING OF GROUNDWATER REMEDIAL TECHNOLOGIES
HARDER TREE SERVICE
HEMPSTEAD, NEW YORK

Technology	Effectiveness	Implementability	Recommended Action
No Action	No active reduction in contaminant concentrations. Possible degradation.	No action required. No associated cost.	Retain for further consideration due to easy implementability and low cost.
Long-Term Monitoring	No active reduction in contaminant concentrations. Possible degradation, may be assessed with monitoring data.	Monitoring required. Moderate long-term monitoring cost.	Retain for further consideration due to relatively easy implementability and moderate cost.
Ex-Situ Groundwater Remediation – Pump-and-Treat	Groundwater plume could be controlled and dissolved concentrations could be reduced. However, treatment is inefficient due to high partitioning coefficients of many of the contaminants. Treatment would be lengthy and would entail many hundreds of water flushings to remove a substantial mass of contaminants.	Readily available technology. High initial and long-term costs due to expense of treatment, equipment maintenance, and anticipated lengthy duration of treatment.	Reject due to high costs and low efficiency.

TABLE 3.4.1
SCREENING OF ON-SITE/OFF-SITE SOIL REMEDIAL TECHNOLOGIES
HARDER TREE SERVICE
HEMPSTEAD, NEW YORK

Technology	Effectiveness	Implementability	Recommended Action
No Action	No active reduction in contaminant concentrations, possible slow degradation.	No action required. No associated cost.	Retain for further consideration due to easy implementability and low cost.
Soil Removal and Off-Site Disposal (select soil)	Effectively removes highest contaminant concentrations.	Commonly-utilized technology, limited by engineering constraints. Initial cost moderate to high, but reduced long-term costs.	Retain for further consideration due to effectiveness.
Soil Removal and Off-Site Disposal (all impacted soil)	Effectively removes all contaminants.	Commonly utilized technology, limited by engineering constraints. Initial cost will be very high, but reduced long-term costs.	Retain for further consideration due to effectiveness.
Capping	Reduces mobility of contaminants by decreasing water infiltration. No reduction in contaminant concentrations.	Commonly utilized technology. Initial cost is low to moderate, low long-term costs.	Retain for further consideration due to effectiveness and low to moderate cost.
In-Situ Remediation-Stabilization	Reduces mobility of contaminants by decreasing soil permeability. No reduction in contaminant concentrations.	This method is less common and the initial cost is moderate to high.	Retain for further consideration due to effectiveness.

- On-Site/Off-Site Soil Removal and Disposal
- In-Situ Soil Remediation-Stabilization;
- Long-term Groundwater Monitoring; and
- Capping.

Since many remediation technologies were screened out in Sections 3.2 through 3.4 because of concerns about effectiveness, implementability, and cost, a relatively small number of alternatives are developed for each of the media of concern. The individual remedial alternatives for each medium of concern are combined into Site-wide remedial alternatives which are further evaluated in Section 4. This section presents detailed descriptions of each of the individual remedial alternatives.

3.5.1 No Action Alternative

The No Action alternative is presented as a baseline for comparison to the other alternatives. This alternative would leave the leaching pool sediments, on-site/off-site soils, and groundwater as they currently exist at the Site. Concentrations of the contaminants of concern may decrease slowly as the result of natural processes such as physical dispersion, chemical reaction, and/or biologic activity. However, no monitoring of the contaminant concentrations would be performed to evaluate subsurface conditions over time.

3.5.2 Leaching Pool Sediment Removal and Disposal

Impacted sediment may be remediated by removal and off-site disposal. Although sediment removal and off-site disposal may not meet chemical-specific ARARs, it will likely reduce constituent concentrations significantly and is a widely utilized remedial technology on Long Island. In general, removal and off-site disposal of sediments includes accessing the leaching pool interiors, removal and off-site disposal of any accumulated liquids, removal of the impacted sediments, pressure-washing to remove sediments adhering to the interior of the leaching pools, transfer of the sediments to appropriate containers for transportation, and transportation of the containerized sediments for disposal. Completion of remediation is evaluated by collecting and analyzing an end-point sample from the materials remaining in the leaching pools following remediation. Following the completion of remediation, the leaching pools may be restored to their previous service or may be abandoned by backfilling, if necessary. Sediment removal may be accomplished by several mechanisms including utilizing a vactor to vacuum the impacted sediments from the interior of the leaching pools, utilizing a crane-mounted clam-shell device (commonly referred to as an orange peel device) to remove the impacted sediments, or utilizing a backhoe with an extendable arm to remove the impacted sediments.

Under this alternative, leaching pool sediments would be removed from all leaching pools at the Site, although the amount of sediment to be removed from each pool or drain structure would vary.

Based on the previous sampling results, as shown in Table 2.2.1, the top four feet of sediments in leaching pool D-2 exhibited the most elevated levels of pesticides. Sediments in drains D-1 and D-3 exhibited moderate levels of pesticides, and sediments in leaching pools LP-2 and LP-3 exhibited only slight exceedances of the Objectives for pesticides. Therefore, if this remedial alternative were selected, it is anticipated that the greatest amount of sediments would be removed from D-2, with lesser amounts removed from LP-2, LP-3, D-1, and D-3. Depth of sediment removal would also be limited by the depth of the leaching pool structure; generally, sediments are not removed from below the base of the structure due to the potential for the structure to collapse.

3.5.3 On-Site/Off-Site Soil Removal and Disposal

Impacted soils may be remediated by removal and off-site disposal. Soil removal and off-site disposal will likely reduce constituent concentrations significantly and is a widely utilized remedial technology on Long Island. In general, removal and off-site disposal of Site soils includes removal of pavement (if necessary), excavating the soils, transfer of the soil to appropriate containers for transportation, and transportation of the containerized soil for disposal. Completion of remediation is evaluated by collecting and analyzing an end-point sample from the soils remaining in each area following remediation. Following the completion of remediation, the areas may be backfilled with clean soils to grade, if necessary. Soil removal may be accomplished by several mechanisms including utilizing an excavator, a bulldozer, or a backhoe with an extendable arm to remove the impacted soil.

Under this alternative, soils would be removed from either select on-site/off-site locations or from all on-site/off-site locations where exceedances were noted (as limited by engineering constraints). If select areas are to be remediated, those on-site areas which are accessible and exhibited the greatest exceedances of the NYSDEC Objectives and those off-site areas where the total pesticides concentration exceeded its Objective would be targeted. These include select on-site soils in the 50 by 50-foot area, the SS-4/SS-11 area, and select portions of the SS-1 area (including SS-17, SS-18, SS-20, SS-21, and SS-22. Off-site soils include select locations adjoining 50 by 50-foot area (including SS-9, SS-10, SS-28, SS-30, and SS-31), adjoining the SS-4 area (including SS-14), and adjoining the SS-17 through SS-20 area (including SS-35 through SS-37).

3.5.4 In-Situ Soil Remediation: Stabilization

Impacted soils may be remediated by stabilization. In this case, stabilization would include injection of cement, cement/bentonite or bentonite grout throughout the targeted soil to significantly reduce the soil permeability. By reducing soil permeability, the potential for the soil to leach contaminants is reduced since infiltrating water would no longer contact the impacted soil. Soil stabilization by injection would involve using a drill rig or direct-push rig to advance a borehole to the base of the targeted interval to be injected. Grout would then be injected under pressure from the base to the top of the targeted interval as the rods or augers are withdrawn. The injected grout will flow out into the surrounding soils to a distance controlled by the rate and pressure of injection, the rod/auger withdrawal rate, the consistency of the grout, and the porosity and permeability of the soil. Based on contractor-provided information, the radius of grout injection at the Site is anticipated to range from 10 to 20 feet from the injection point.

In-situ soil stabilization by grout injection is more feasible for deep soils rather than shallow soils due to the tendency for pressurized grout to blow out to the ground surface when injected at shallow depths. Therefore, grout injection is most applicable to the deeper impacted soils at GP-4, LP-1 and D-2.

The effectiveness of soil stabilization for this site would need to be verified by bench-scale pilot testing to confirm the anticipated reduction of leaching of pesticides from the targeted soil. In the event that the bench-scale pilot test did not confirm the reduction in leaching, then an alternative technology, such as installation of an impermeable membrane with an asphalt cap, would be proposed, as discussed below.

3.5.5 Capping

Impacted soils may be remediated by capping the affected areas with a low-permeability material. Although this method does not reduce contaminant concentrations, it isolates the affected soils from human exposure and it reduces the potential for soil to leach contaminants to groundwater since the infiltration of water is significantly reduced.

Capping would include grading the affected areas to a uniform grade (this may involve removal and disposal of some near-surface soil, as discussed in Section 3.5.3), placement of clean backfill, as necessary to prepare a base for the capping material, and placement of a permanent low-permeability cap (asphalt or concrete) capable of withstanding anticipated traffic loads at the Site.

Since most of the affected areas of the Site are already effectively capped with concrete or asphalt pavement, capping is considered for unpaved impacted areas of Site, including the 50 by 50-foot area, the edge of the SS-4/SS-11 area, the unpaved area behind the garage and those portions of the SS-1/MW-8 area where the pavement is deteriorated or absent. Capping is also contemplated for any on-site area where soil removal is performed.

In the event that bench-scale pilot testing does not confirm the effectiveness of soil stabilization, as discussed above, then installation of an impermeable cap would be considered for the areas formerly targeted for soil stabilization. In this case, the cap would be constructed as discussed above with the addition of an impermeable membrane beneath the asphalt or concrete to further reduce the potential for infiltration.

3.5.6 Long-Term Groundwater Monitoring

The long-term monitoring alternative would employ groundwater monitoring to evaluate groundwater contaminant concentrations at select Site wells to document the anticipated reduction in groundwater pesticides concentrations following source-area remediation and to continue to confirm the location of the downgradient edge of the plume. This alternative would be utilized in conjunction with other remedial alternatives to provide data to evaluate subsurface conditions over time.

SECTION 4.0
DETAILED ANALYSIS OF ALTERNATIVES

This section presents a detailed discussion and evaluation of each of the remedial alternatives described in Section 3 for leaching pool sediments, soil, and groundwater. The alternatives are evaluated against seven criteria:

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume;
- Short-term effectiveness;
- Implementability; and
- Cost.

A description of each of these criteria is presented in the following subsection.

4.1 Descriptions of Evaluation Criteria

4.1.1 Overall Protection of Human Health and the Environment

This criterion provides a final check to assess whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and ability to attain cleanup goals.

Evaluation of the overall protectiveness of an alternative focuses on whether a specific alternative achieves adequate protection and how Site risks posed through each pathway being addressed by this FS are eliminated, reduced, or controlled through treatment, engineering, or institutional controls. This evaluation considers whether an alternative poses unacceptable short-term or cross-media impacts.

4.1.2 Compliance with ARARs

This criterion measures the ability of each alternative to achieve ARARs, including chemical-specific ARARs as identified in Section 2 and action-specific and location-specific ARARs that may apply to components of the remedial alternatives. Also evaluated under this criterion is the alternative's ability to meet applicable chemical-specific guidelines as identified in Section 2.

4.1.3 Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion addresses the results of the remedial action in terms of the risk remaining at the facility after the response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by the treatment residuals and/or untreated wastes.

4.1.4 Reduction of Toxicity, Mobility, or Volume

This evaluation criterion addresses the regulatory preference for selecting remedial actions that employ treatment technologies which permanently and significantly reduce the toxicity, mobility, or volume of the contaminants. This preference is satisfied when treatment is used to reduce the principal risks at the Site through destruction of contaminants for a reduction of total mass of contaminants, to attain irreversible reduction in mobility of contaminants, or to achieve reduction of the total volume of contaminated media.

4.1.5 Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternative on human health and the environment during the construction and implementation of the remedial action.

4.1.6 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including off-site disposal capability.

4.1.7 Cost

Detailed cost analysis of remedial alternatives includes the estimation of capital and operations and maintenance (O&M) costs. The cost analysis includes estimation of the net present worth of each method utilizing an interest rate of five percent and an inflation rate of three percent. It should be noted that, in some cases, the alternative would be applied only to select portions of the Site. In these cases, the costs are evaluated for the areas selected.

It should be noted that the costs for disposal of impacted soil and sediment are segregated into two categories: low-concentration material and high-concentration material. Both types of material would be disposed as hazardous waste. However, the high-concentration material exceeds Land Disposal Restrictions (LDRs) and would require additional treatment and/or a more costly disposal option.

Each of the alternatives for each of the media of concern is described in the following sections, followed by analyses with respect to the evaluation criteria. Following the individual analyses, the alternatives for each of the media of concern are combined into Site-wide alternatives which are presented in Section 4.11.

4.2 Site Leaching Pool Sediment Alternative 1: No Action

4.2.1 Alternative Description

The No Action alternative would not involve any remediation or monitoring at the Site. Leaching pool sediments would remain in their existing state. Concentrations of the contaminants of concern within the sediments will likely slowly decrease as a result of natural processes, including physical dispersion, chemical reactions and/or biologic activity.

4.2.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Sediments in all of the sampled leaching pools are impacted with pesticides. These sediments do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, impacted sediments have the potential to cause groundwater contamination since stormwater is routinely directed to the leaching pools for discharge.

Compliance with ARARs

Sediments in all of the leaching pools sampled are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under the No Action alternative, the contaminant levels would likely continue to exceed the NYSDEC Objectives for an extended period of time.

Long-Term Effectiveness and Permanence

The No Action alternative would not actively reduce contaminant concentrations currently present at the Site.

Reduction of Toxicity, Mobility, or Volume

There would not likely be a significant reduction in the contaminant concentration levels with the No Action alternative and, therefore, there would be no significant volume reduction or change in toxicity. Most of these constituents have low mobility. However, the continuing action of stormwater discharge through the leaching pools would likely result in some downward migration of contaminants into the soil beneath the leaching pools and possibly into the groundwater.

Short-Term Effectiveness

No additional risks would be encountered by human or environmental receptors with this alternative because no construction or implementation actions would occur.

Implementability

No remedial action would be implemented under this alternative.

Cost

The estimated capital and O&M costs for this alternative are zero because no remedial action would be conducted.

4.3 Site Leaching Pool Sediment Alternative 2: Sediment Removal and Disposal

4.3.1 Alternative Description

The sediment removal and disposal alternative would involve excavation of impacted leaching pool sediments, transportation and disposal of the excavated materials at an off-site approved facility, and restoration of the leaching pool structures. The structures to be remediated would include the leaching pools and drains with sediments characterized as having one or more analytes exceeding their respective PRGs including: LP-2, LP-3, D-1, D-2, and D-3.

Removal of liquids from the leaching pools would be necessary prior to the removal of the sediments and scheduling of the remedial work during the summer months would likely reduce the amount of liquids removal required. The removed liquids would be characterized and disposed off site at an approved waste disposal facility. Sediments would be excavated from the select leaching pools and drains utilizing a vactor, an orange peel device, or a backhoe with an extendable arm. The selection of the excavation method will depend on the depth to the sediments, configuration of the pool manway, anticipated depth of excavation, and other factors. It is estimated that the amount of impacted sediments that would be removed from each leaching pool would vary and would depend on the level of impact, the configuration of the structure, and other factors. An end-point sample would be collected from each leaching pool following the completion of excavation and analyzed for the constituents of concern. These data will be evaluated together with other engineering factors (excavation depth, leaching pool structure stability, proximity to buildings, cost, and other factors) to confirm the completion of remediation. If necessary, clean sand and gravel will be placed in the bottom of each leaching pool for structural stabilization following remediation. In general, each leaching pool structure will be restored and returned to its former function, although, in the case of leaching pool D-2, it may be necessary to abandon the structure and replace it with a catch basin to divert stormwater to an alternate discharge point, as discussed in Section 4.4.

4.3.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Sediments in all of the sampled leaching pools are impacted with pesticides. These sediments do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, impacted sediments have the potential to cause groundwater contamination since stormwater is routinely directed to the leaching pools for discharge. The remediation goals for the leaching pool sediments are based primarily on protection of groundwater. The risk of groundwater contamination at the Site will be significantly reduced after removal of the most impacted sediments. This alternative would reduce the contaminant concentrations and would reduce the potential for groundwater contamination. Therefore, it is considered to be a protective action.

Compliance with ARARs

Sediments in all of the leaching pools sampled are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under this alternative, the contaminant levels will be significantly reduced, although it is likely that they will continue to exceed the NYSDEC Objectives somewhat. End-point sampling would be performed to confirm the contaminant concentrations that remain following remediation.

Long-Term Effectiveness and Permanence

Sediment removal and off-site disposal would be an effective alternative over the long term because the majority of the most contaminated sediments would be physically removed from the Site. Additional monitoring may be necessary upon the completion of the remediation because some impacted sediments would remain in Site leaching pools.

Reduction of Toxicity, Mobility, or Volume

This alternative would effectively remove the most contaminated sediments from the Site. The actual volume of contaminated sediments would not be reduced, only removed from the Site to the disposal facilities. However, the toxicity and volume of the impacted sediments remaining at the Site would be significantly reduced. If necessary, the mobility could also be reduced by redirecting stormwater discharges that would otherwise continue to pass through the most impacted of the remaining sediments, as discussed in Section 4.4.

Short-Term Effectiveness

Few hazards would be expected during the remedial activities for this alternative. The remedial period would be short and the risk to workers would be minimal. An approved HASP would be required prior to initiation of work at the site. Personal protective equipment would be utilized to protect workers from potential exposures. Equipment would be decontaminated regularly to avoid spreading the contamination. The surrounding community and the facility workers would be at little or no risk from remedial activities since access to the work areas would be restricted. The work on stormwater leaching pools and drains would be scheduled for a period of no rainfall and the affected leaching pool structures would be restored immediately following remediation so as to minimize the impact to facility drainage.

Implementability

This alternative is readily implementable and each aspect of remediation would involve standard local remediation practices. Qualified contractors are readily available to perform this work. Work is anticipated to be performed so as to coordinate with facility operations and financial constraints. Therefore, no significant shortage of contractors or disposal facilities is foreseen. Disposal facilities would need to be identified prior to implementation and waste profiles would be required for disposal of contaminated sediments. Remediation would need to be coordinated with facility operations and areas for staging of equipment, supplies, and temporary waste storage would need to be identified.

Cost

The estimated capital cost for this alternative is $66,000 (see Table 4.3.2.1). There are no O&M costs since no operating remediation system is planned and monitoring is not applicable. For cost estimation purposes, it was assumed that the excavation would be performed utilizing a vactor and/or a backhoe. Two waste characterization samples would be required and three end-point samples would be collected from the remediated leaching pools. It is assumed that drains D-1 and D-3 are solid-bottom structures and, therefore, no end-point samples would be required. The endpoint samples would be analyzed for TCL Pesticides. Disposal would occur at a non-hazardous landfill or thermal desorption facility for the non-hazardous soils and at a Canadian facility for the hazardous soils. Backfill to restore the

TABLE 4.3.2.1
COSTS FOR LEACHING POOL SEDIMENT ALTERNATIVE 2
SEDIMENT REMOVAL AND DISPOSAL

Description	Quantity	Units	Unit Cost	Cost (Rounded)
Capital Costs				
Engineering Costs	1	LS	$10,000	$10,000
Waste Characterization	2	EA	$1,000	$2,000
Sediment Sample Analyses	3	EA	$470*	$1,400
Data Validation	3	EA	$85*	$300
Remediation Labor and Equipment	3	day	$5,500	$16,500
Replace Leaching Pool Parts	3	EA	$1,800	$5,400
Liquids Trans. and Disposal	8,000	gals	$0.1	$800
Low-Concentration Soil Trans. and Disposal	15	tons	$425	$6,400
High-Concentration Soil Trans. and Disposal	35	tons	$450	$15,800
Clean Backfill	40	cu yd	$27	$1,100
Capital Cost Subtotal				**$59,700**
Contingency (10%)				$5,970
Capital Cost Total (rounded)				**$66,000**
Annual Operation and Maintenance Costs				**$0**
Annual O&M Cost				**$0**
Net O&M Present Worth				**$0**
TOTAL COST				**$66,000**

Notes:

- * = includes QA/QC samples.
- Amounts of sediment removed will depend on initial level of impact, leaching pool structural configuration, and other factors.

leaching pools would be clean bank-run sand brought from an off-site location. The pavement in the vicinity of the pools remediated using a backhoe would require restoration following remediation.

4.4 Site Leaching Pool Sediment Alternative 3: Sediment Removal and Disposal/Pool Replacement

4.4.1 Alternative Description

The sediment removal and disposal alternative would involve excavation of impacted leaching pool sediments, transportation and disposal of the excavated materials at an off-site approved facility, and replacement of the leaching pool structures where the remaining sediments continued to exceed the NYSDEC Objectives. The structures to be remediated would include the leaching pools and drains with sediments characterized as having one or more analytes exceeding their respective PRGs including: LP-2, LP-3, D-1, D-2, and D-3.

Removal and management of liquids and sediments from the leaching pools would be performed in a similar manner as described for Alternative 2. An end-point sample would be collected from each leaching pool following the completion of excavation and analyzed for the constituents of concern. These data will be evaluated together with other engineering factors (excavation depth, leaching pool structure stability, proximity to buildings, cost, and other factors) to confirm the completion of remediation. If necessary, clean sand and gravel will be placed in the bottom of each leaching pool for structural stabilization following remediation. For this alternative, each leaching pool structure will be restored and returned to its former function if the end-point sample results do not significantly exceed the NYSDEC Objectives. However, for leaching pool D-2, it is likely that the end-point sample results will exceed the NYSDEC Objectives. In this case, it will be planned to abandon the structure and replace it with another on-site leaching pool.

4.4.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Sediments in all of the sampled leaching pools are impacted with pesticides. These sediments do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, impacted sediments have the potential to cause groundwater contamination since stormwater is routinely directed to the leaching pools for discharge. The remediation goals for the leaching pool sediments are based primarily on protection of groundwater. The risk of groundwater contamination at the Site will be significantly reduced after removal of the impacted sediments. This alternative would reduce the contaminant concentrations significantly and would reduce the potential for groundwater contamination. Therefore, it is considered to be a protective action.

Compliance with ARARs

Sediments in all of the leaching pools sampled are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under this alternative, the contaminant levels will be significantly reduced to below or slightly above the NYSDEC Objectives. End-point sampling would be performed to confirm the contaminant concentrations that remain following remediation. For any leaching pools where the end-point sample results significantly exceeded the NYSDEC Objectives, the structure would be taken out of service and replaced with a new leaching pool structure. Therefore, infiltrating water will no longer pass through these sediments.

Long-Term Effectiveness and Permanence

Sediment removal and off-site disposal would be an effective alternative over the long term because the majority of the most contaminated sediments would be physically removed from the Site. Impacted sediments remaining in Site leaching pools would be isolated from infiltrating water since these pools would be replaced.

Reduction of Toxicity, Mobility, or Volume

This alternative would effectively remove the most contaminated sediments from the Site. The actual volume of contaminated sediments would not be reduced, only removed from the Site to the disposal facilities. However, the toxicity and volume of the impacted sediments remaining at the Site would be significantly reduced. The mobility would also be reduced by redirecting stormwater discharges that would otherwise continue to pass through the remaining sediments into new structures.

Short-Term Effectiveness

Few hazards would be expected during the remedial activities for this alternative. The remedial period would be short and the risk to workers would be minimal. An approved HASP would be required prior to initiation of work at the site. Personal protective equipment would be utilized to protect workers from potential exposures. Equipment would be decontaminated regularly to avoid spreading the contamination. The surrounding community and the facility workers would be at little or no risk from remedial activities since access to the work areas would be restricted. The work on stormwater leaching pools and drains would be scheduled for a period of no rainfall and the affected leaching pool structures would be restored or replaced immediately following remediation so as to minimize the impact to facility drainage.

Implementability

This alternative is readily implementable and each aspect of remediation would involve standard local remediation and construction practices. Qualified contractors are readily available to perform this work. Work is anticipated to be performed so as to coordinate with facility operations and financial constraints. Therefore, no significant shortage of contractors or disposal facilities is foreseen. Disposal facilities would need to be identified prior to implementation and waste profiles would be required for disposal of contaminated sediments. Remediation would need to be coordinated with facility operations and areas for staging of equipment, supplies, temporary waste storage, and potential new leaching pool locations would need to be identified.

Cost

The estimated capital cost for this alternative is $95,200 (see Table 4.4.2.1). There are no O&M costs since no operating remediation system is planned and monitoring is not applicable. For cost estimation purposes, it was assumed that the excavation would be performed utilizing a vactor and/or a backhoe. Two waste characterization samples would be required and three end-point samples would be collected from the remediated leaching pools. It is assumed that drains D-1 and D-3 are solid-bottom structures and, therefore, no end-point samples would be required. The endpoint samples would be analyzed for TCL Pesticides. Disposal would occur at a non-hazardous landfill or thermal desorption facility for the non-hazardous soils and at a Canadian facility for the hazardous soils. Backfill to restore the leaching pools would be clean bank-run sand brought from an off-site location. It is also assumed that leaching pool D-2 would require replacement. The pavement in the vicinity of the pools remediated using a backhoe would require restoration following remediation.

4.5 On-Site/Off-Site Soil Alternative 1: No Action

4.5.1 Alternative Description

The No Action alternative would not involve any remediation or monitoring at the Site. On-Site/off-site soils would remain in their existing state. Concentrations of the contaminants of concern within the soils will likely slowly decrease as a result of natural processes, including physical dispersion, chemical reactions and/or biologic activity.

TABLE 4.4.2.1
COSTS FOR LEACHING POOL SEDIMENT ALTERNATIVE 3
SEDIMENT REMOVAL AND DISPOSAL/POOL REPLACEMENT

Description	Quantity	Units	Unit Cost	Cost (Rounded)
Capital Costs				
Engineering Costs	1	LS	$15,000	$15,000
Waste Characterization	2	EA	$1,000	$2,000
Sediment Sample Analyses	3	EA	$470*	$1,400
Data Validation	3	EA	$85*	$300
Remediation Labor and Equipment	5	day	$5,500	$27,500
Replace Leaching Pool Parts	3	EA	$1,800	$5,400
Replace D-2 with New Pool	1	EA	$10,000	$10,000
Liquids Trans. and Disposal	8,000	gals	$0.1	$800
Low-Concentration Soil Trans. and Disposal	15	tons	$425	$6,400
High-Concentration Soil Trans. and Disposal	35	tons	$450	$15,800
Clean Backfill	70	cu yd	$27	$1,900
Capital Cost Subtotal				**$86,500**
Contingency (10%)				$8,650
Capital Cost Total (rounded)				**$95,200**
Annual Operation and Maintenance Costs				**$0**
Annual O&M Cost				**$0**
Net O&M Present Worth				**$0**
TOTAL COST				**$95,200**

Notes:

- * = includes QA/QC samples.
- Amounts of sediment removed will depend on initial level of impact, leaching pool structural configuration, and other factors.

4.5.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Soils in on-site and off-site areas are impacted with pesticides. Most of these soils do not directly present a hazard to human health since access to the Site is limited, as discussed in Section 2.4. However, some of these soils are located in unpaved areas or are in off-Site areas where there is the potential for human contact. Most of the impacted soils have a low potential to cause groundwater contamination since the majority of the Site is paved. However, areas of exposed soil or cracked/broken pavement will allow stormwater to percolate through the soil and may have the potential to cause groundwater contamination.

Compliance with ARARs

On-Site and off-site soils are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under the No Action alternative, the contaminant levels would likely continue to exceed the NYSDEC Objectives.

Long-Term Effectiveness and Permanence

The No Action alternative would not actively reduce contaminant concentrations currently present at the Site.

Reduction of Toxicity, Mobility, or Volume

There would not likely be a significant reduction in the contaminant concentration levels with the No Action alternative and, therefore, there would be no significant volume reduction or change in toxicity. Most of these constituents have low mobility. However, the continuing action of stormwater discharge through exposed surface soils or cracked/broken pavement would likely result in some downward migration of contaminants into the soil beneath the Site and possibly into the groundwater.

Short-Term Effectiveness

No additional risks would be encountered by human or environmental receptors with this alternative because no construction or implementation actions would occur.

Implementability

No remedial action would be implemented under this alternative.

Cost

The estimated capital and O&M costs for this alternative are zero because no remedial action would be conducted.

4.6 On-Site/Off-Site Soil Alternative 2: Soil Removal and Disposal (Select Locations)

4.6.1 Alternative Description

The soil removal and disposal (select locations) alternative would involve excavation of impacted soils, transportation and disposal of the excavated materials at an off-site disposal facility, and backfilling and regrading of the excavation areas with clean fill soil. Following regrading, the excavated on-site areas would be capped with low-permeability pavement. The soils to be remediated would consist of the areas characterized as having one or more analytes exceeding their respective PRGs by more than two orders of magnitude, including: on-site soils in portions of the 50 by 50-foot area (GP-3 and GP-4 to three feet below grade), portions of the SS-4 area (including SS-11 and SS-12), and portions of the SS-1/MW-8 area (including SS-17, SS-18, and SS-20), and select (shallow) off-site soils, including those adjoining the 50 by 50-foot area (including SS-9, SS-10, SS-28, SS-30, and SS-31), those adjoining the SS-4 area (including SS-14), and those adjoining the SS-17 through SS-20 area (including SS-35 through SS-37).

4.6.2 Detailed Analysis

Overall Protection of Human Health and the Environment

On-Site and off-site soils are impacted with pesticides. Most of these soils do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, select shallow soils in unpaved areas on site and off site have the potential to impact human health and, therefore, are addressed in this alternative. These impacted soils also have the potential to cause groundwater contamination since stormwater has the potential to percolate through exposed soils or cracked/broken pavement. The remediation goals for the soils are based both on protection of human health and protection of groundwater. The risk of groundwater contamination at the Site will be significantly reduced after removal of the most impacted soils and the risk of human health impact would also be significantly reduced. This alternative would reduce the contaminant concentrations and would reduce the potential for human health impacts and groundwater contamination. Therefore, it is considered to be a protective action.

Compliance with ARARs

On-site and off-site soils are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under this alternative, the contaminant levels in the most impacted on-site shallow soils in the unpaved areas and in the off-site areas will be significantly reduced, since the impacted soil would be removed and replaced with clean backfill. However, some soil with pesticide concentrations somewhat exceeding the ARARs will remain on site. End-point sampling would be performed to confirm the contaminant concentrations that remain following remediation. The remaining on-site impacted soils would be further isolated by capping.

Long-Term Effectiveness and Permanence

Soil removal and off-site disposal would be an effective alternative over the long term because the majority of the most accessible and contaminated soils would be physically removed from the Site and the remaining on-site soils would be capped. Additional groundwater monitoring may be necessary upon the completion of the remediation because some impacted soils may remain on site below the excavated areas or in other (paved) areas.

Reduction of Toxicity, Mobility, or Volume

This alternative would effectively remove the most accessible and contaminated soils from the Site. The actual volume of contaminated soils would not be reduced, only removed from the Site to the disposal facilities. However, the toxicity and volume of the impacted soils remaining at the Site would be significantly reduced.

Short-Term Effectiveness

Few hazards would be expected during the remedial activities for this alternative. The remedial period would be short and the risk to workers would be minimal. An approved HASP would be required prior to initiation of work at the site. Personal protective equipment would be utilized to protect workers from potential exposures and a Community Health and Safety Plan would be utilized during the off-site soil removal activities. Equipment would be decontaminated regularly to avoid spreading the contamination. The surrounding community and the facility workers would be at little or no risk from remedial activities since access to the work areas would be restricted.

Implementability

This alternative is readily implementable and each aspect of remediation would involve standard local remediation and construction practices. Qualified contractors are readily available to perform this work. Disposal facilities would need to be identified prior to implementation and waste profiles would be required for disposal of contaminated soils. Remediation would need to be coordinated with neighboring residents (off-site work only) and facility operations and areas for staging of equipment, supplies, and temporary waste storage would need to be identified.

Cost

The estimated capital cost for this alternative is $353,000 (see Table 4.6.2.1). There are no O&M costs since no operating remediation system is planned and monitoring is not applicable. For cost estimation purposes, it was assumed that the off-site excavation would be performed utilizing hand methods and on-site excavation would be performed using an excavator, bulldozer, and/or a backhoe. Two waste characterization samples would be required and an estimated 25 end-point samples would be collected from the excavated areas. The endpoint samples would be analyzed for TCL Pesticides. Disposal of soil containing lower concentrations of pesticides would occur at a US hazardous waste disposal facility and disposal of soil containing higher concentrations of pesticides would be at a Canadian facility. Backfill to restore excavated areas would be brought from an off-site location. The pavement in the vicinity of the excavated areas would be replaced following remediation.

4.7 On-Site/Off-Site Soil Alternative 3: Soil Removal and Disposal (All Feasible Impacted Soil)

4.7.1 Alternative Description

The soil removal and disposal (all feasible impacted soil) alternative would involve excavation of reasonably accessible impacted soils, transportation and disposal of the excavated materials at off-site disposal facilities, and capping of the on-site/off-site areas affected.

Soils would be excavated from all of the reasonably accessible on-site and off-site areas exhibiting exceedances of the NYSDEC Objectives utilizing an excavator, a backhoe with an extendable arm and/or a bulldozer. "Reasonably-accessible" soils include soils that are not overlain by buildings, subsurface utilities, permanent surface or subsurface structures, and where excavation would not present a safety hazard or structural concern. The selection of the excavation method will depend on the location of the soils, anticipated depth of excavation, need to remove pavement, and other factors. It is estimated that soil would be removed to an approximate depth of three to five feet below grade in most of the impacted on-site

TABLE 4.6.2.1
COSTS FOR ON-SITE/OFF-SITE SOIL ALTERNATIVE 2
SOIL REMOVAL AND DISPOSAL (SELECT LOCATIONS)

Description	Quantity	Units	Unit Cost	Cost (Rounded)
Capital Costs				
Engineering Costs	1	LS	$10,000	$10,000
Waste Characterization	2	EA	$1,000	$2,000
End-Point Sample Analyses	25	EA	$260*	$6,500
Data Validation	25	EA	$45*	$1,125
Remediation Labor and Equipment	4	day	$6,000	$24,000
Low-Concentration Soil Trans. and Disposal	130	tons	$425	$55,300
High-Concentration Soil Trans. and Disposal	390	tons	$450	$175,500
Pavement Restoration	4,500	sq. ft.	$8	$36,000
Clean Backfill	400	cu yd	$27	$10,800
Capital Cost Subtotal				**$321,255**
Contingency (10%)				$32,126
Capital Cost Total (rounded)				**$353,000**
Annual Operation and Maintenance Costs				**$0**
Annual O&M Cost				**$0**
Net O&M Present Worth				**$0**
TOTAL COST				**$353,000**

Note:

- * = includes QA/QC samples.

and off-site areas. Additional soil removal may be necessary in select areas where the impact is deeper. Shoring may be required in the vicinity of deeper excavations near property lines, subsurface structures, or buildings. Clean fill material will be utilized to backfill the excavated on-site and off-site areas following remediation and all of the excavated on-site areas would be capped with a low-permeability pavement. Off-site excavated areas would be backfilled, graded and capped with turf.

4.7.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Soils in many of the on-site and off-site areas are impacted with pesticides. Many of these soils do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, impacted soils in unpaved areas may impact human health and also have the potential to cause groundwater contamination since stormwater has the potential to percolate through exposed soils or cracked/broken pavement. In addition, if subsurface work is performed in paved areas, there is the potential for worker contact with soils that are now beneath pavement. The remediation goals for the soils are based primarily on human health impacts and protection of groundwater. The risk of human health impacts and groundwater contamination at the Site will be significantly reduced after removal of the reasonably accessible impacted soils. This alternative would reduce the contaminant concentrations and would reduce the potential for human health impacts and groundwater contamination. Therefore, it is considered to be a protective action.

Compliance with ARARs

Soil in many of the on-site and off-site areas sampled are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under this alternative, the contaminant levels will be significantly reduced in all of the reasonably accessible areas, generally to below the NYSDEC Objectives. End-point sampling would be performed to confirm the contaminant concentrations that may remain in limited areas following remediation.

Long-Term Effectiveness and Permanence

Soil removal and off-site disposal would be an effective alternative over the long term because the contaminated sediments would be physically removed from the Site and all of the on-site excavated areas would be capped. Groundwater monitoring will still be required following the completion of the remediation to confirm reductions in groundwater constituent concentrations. However, it is anticipated that monitoring would be terminated more quickly if more impacted soil is removed.

Reduction of Toxicity, Mobility, or Volume

This alternative would effectively remove the contaminated soils from the reasonably accessible impacted on-site and off site areas. The actual volume of contaminated soils would not be reduced, only removed from the Site to the disposal facilities. However, the toxicity and volume of the impacted soils remaining at the Site would be significantly reduced.

Short-Term Effectiveness

Few hazards would be expected during the remedial activities for this alternative, although the risk to remediation workers would be greater than for Alternative 2 since the duration of remediation would be greater and the remediation techniques may present more risk to workers. An approved HASP would be required prior to initiation of work at the site. Personal protective equipment would protect workers from potential exposures and a Community Health and Safety Plan would be used to protect residents during off-site work. Equipment would be decontaminated regularly to avoid spreading the contamination. The surrounding community and the facility workers would be at little or no risk from remedial activities since access to the work areas would be restricted.

Implementability

The majority of this alternative is readily implementable as it involves standard local remediation and construction practices. Qualified contractors are readily available to perform the majority of this work. Work is anticipated to be performed in stages so as to coordinate with facility operations and financial constraints. Disposal facilities would need to be identified prior to implementation and waste profiles would be required for disposal of contaminated soils. Each remediation stage would need to be coordinated with nearby residents (for off-site work only) and facility operations and areas for staging of equipment, supplies, and temporary waste storage would need to be identified. It is anticipated that the duration of this remediation alternative would be greater than for Alternative 2 since significantly more soil would require remediation and the backfilling, regrading, and capping (paving) operations are anticipated to require more time for completion.

Cost

The estimated capital cost for this alternative is $1,495,000 (see Table 4.7.2.1). There are no O&M costs since no operating remediation system is planned and monitoring is not applicable. For cost estimation purposes, it was assumed that the excavation would be performed utilizing hand methods for off-site work and a backhoe and excavator for all of the on-site soil excavation. Shoring would be installed in

TABLE 4.7.2.1
COSTS FOR ON-SITE/OFF-SITE SOIL ALTERNATIVE 3
SOIL REMOVAL AND DISPOSAL (ALL FEASIBLE IMPACTED SOIL)

Description	Quantity	Units	Unit Cost	Cost (Rounded)
Capital Costs				
Engineering Costs	1	LS	$15,000	$15,000
Waste Characterization	7	EA	$1,000	$7,000
End-Point Sample Analyses	26	EA	$280*	$7,200
Data Validation	26	EA	$45*	$1,200
Remediation Labor and Equipment	8	day	$6,000	$48,000
Shoring	1,500	ft^2	$15.10	$22,650
Low-Concentration Soil Trans. and Disposal	2,145	tons	$425	$911,625
High-Concentration Soil Trans. and Disposal	520	tons	$450	$234,000
Pavement Restoration (Asphalt/Turf)	400	sq. ft.	$2	$800
Pavement Restoration (Concrete)	7,000	sq. ft.	$8	$56,000
Clean Backfill	2,050	cu yd	$27	$55,350
Capital Cost Subtotal				**$1,358,825**
Contingency (10%)				$135,883
Capital Cost Total (rounded)				**$1,495,000**
Annual Operation and Maintenance Costs				**$0**
Annual O&M Cost				**$0**
Net O&M Present Worth				**$0**
TOTAL COST				**$1,495,000**

Note:

- * = includes QA/QC samples.

two areas of deeper excavations. Approximately seven waste characterization samples would be required and 26 end-point samples would be collected from the excavated areas. The endpoint samples would be analyzed for TCL pesticides. Disposal of soil containing lower concentrations of pesticides would occur at a US hazardous waste disposal facility and disposal of soil containing higher concentrations of pesticides would be at a Canadian facility. Backfill would be brought from an off-site location. The excavated on-site area would be capped with a low-permeability pavement following remediation and the excavated off-site area would be capped with turf.

4.8 On-Site/Off-Site Soil Alternative 4: In-Situ Stabilization

4.8.1 Alternative Description

The in-situ stabilization alternative would involve injection of low-permeability grout (bentonite, cement-bentonite, or equivalent) into the impacted soils to be treated. The grout would reduce the permeability of the treated soils such that contact by infiltrating water would be significantly reduced, thereby reducing the potential for these soils to impact groundwater. This alternative would be applicable to deeper impacted on-site soils, including beneath LP-1 and D-2 from 15 feet to the water table at 30 feet, and beneath GP-4 from approximately 4 to 18 feet below grade. Since this alternative will decrease the permeability of the deeper soils, provisions must be made for alternate means of stormwater management beneath D-2. If this alternate is selected, the leaching pool at D-2 would have to be replaced with a catch basin to direct accumulated stormwater to the sewer or to another on-site leaching pool.

The effectiveness of soil stabilization would require verification with bench-scale pilot testing to evaluate the reduction in leaching of pesticides from the soil after stabilization. If the pilot test results do not demonstrate an acceptable reduction in pesticide leaching from the soil, then an alternative technology, such as capping the affected soil with an impermeable membrane, would be utilized. In this case, the targeted areas would be capped with asphalt or concrete underlain by an impermeable membrane to further reduce infiltration.

4.8.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Deep on-Site soils are impacted at select locations with pesticides. These soils do not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, these soils have the potential to cause groundwater contamination since they extend to near the water table and/or stormwater has the potential to percolate through exposed soils. Under this remedy, the remediation goals for the soils are based on protection of groundwater. The risk of groundwater contamination at the Site will be reduced after lowering the permeability of these impacted soils. This alternative would reduce the potential for groundwater contamination. Therefore, it is considered to be a protective action.

Compliance with ARARs

Deep on-site soils at select locations are impacted with pesticides at concentrations exceeding the NYSDEC Objectives. Under this alternative, the contaminant levels would not be significantly reduced. However, a reduction will occur since the soil void spaces will be filled with low-permeability materials that do not contain pesticides.

Long-Term Effectiveness and Permanence

In-situ stabilization would be an effective alternative for the deeper impacted soils over the long term because the potential for further groundwater contamination would be reduced. Additional groundwater monitoring may be necessary upon the completion of the remediation because the deep impacted soils will remain in place and groundwater contaminant reductions may not occur immediately.

Reduction of Toxicity, Mobility, or Volume

This alternative would effectively reduce the permeability of the deeper contaminated soils at the Site. The actual volume of contaminated soils would not be reduced. However, the mobility of the contaminants remaining in the deeper soils at the Site would be significantly reduced.

Short-Term Effectiveness

Few hazards would be expected during the remedial activities for this alternative. The remedial period would be short and the risk to workers would be minimal. An approved HASP would be required prior to initiation of work at the site. Personal protective equipment would be utilized to protect workers from potential exposures. Equipment would be decontaminated regularly to avoid spreading the contamination. The surrounding community and the facility workers would be at little or no risk from remedial activities since access to the work areas would be restricted.

Implementability

This alternative is readily implementable and each aspect of remediation would involve standard grout injection practices commonly used in the construction industry. Qualified contractors are readily available to perform this work. Bench-scale pilot testing would be performed to confirm the anticipated

TABLE 4.8.2.1
COSTS FOR ON-SITE/OFF-SITE SOIL ALTERNATIVE 4
IN-SITU STABILIZATION

Description	Quantity	Units	Unit Cost	Cost (Rounded)
Capital Costs				
Pilot Test	1	LS	$8,000	$8,000
Engineering Costs	1	LS	$15,000	$15,000
Remediation Labor and Equipment	3	day	$6,000	$18,000
Geophysical Markout	1	day	$2,500	$2,500
Capital Cost Subtotal				**$43,500**
Contingency (15%)				$6,725
Capital Cost Total (rounded)				**$50,000**
Annual Operation and Maintenance Costs				**$0**
Annual O&M Cost				**$0**
Net O&M Present Worth				**$0**
TOTAL COST				**$50,000**

reduction in pesticide leaching. Remediation would need to be coordinated with facility operations and areas for staging of equipment and supplies, and temporary waste storage would need to be identified.

Cost

The estimated capital cost for this alternative is $39,000 (see Table 4.8.2.1). There are no O&M costs since no operating remediation system is planned and monitoring is not applicable. For cost estimation purposes, it was assumed that the grout injection would be performed utilizing a direct-push or hollow-stem auger rig with a slotted lead rod. Based on injection radii reported for local sandy soils, it is anticipated that an injection radius of between 10 and 15 feet would be achieved. More closely-spaced injection points are planned so as to achieve overlap. Based on the estimated areas of deeper impacted soils at LP-1, D-2 and GP-4, 16 injection points are planned. A bench-scale pilot test is also included.

4.9 Site Groundwater Alternative 1: No Action

4.9.1 Alternative Description

The No Action alternative would not involve any remediation or monitoring at the Site. Groundwater would remain in its existing state. Concentrations of the contaminants of concern in the groundwater will likely decrease as a result of natural processes, including physical dispersion, chemical reactions, and/or biologic activity.

4.9.2 Detailed Analysis

Overall Protection of Human Health and the Environment

On-site and limited amounts of off-site groundwater are impacted with pesticides. There is no human exposure to the on-site or limited off-site groundwater, contaminant concentrations attenuate rapidly off site, and the contaminant source areas are proposed to be remediated. Therefore, there does not appear to be a concern for human health risk from groundwater and the impact to the environment is minimal.

Compliance with ARARs

Groundwater on site and at limited off-site locations is impacted with pesticides at concentrations exceeding the NYSDEC standards. The source material for this contamination is proposed to be remediated. Therefore, under the No Action alternative, the contaminant levels are anticipated to naturally attenuate due to dispersion, chemical fixation, and/or biologic activity. However, the contaminant concentrations would likely continue to exceed the NYSDEC standards for several years.

Long-Term Effectiveness and Permanence

The No Action alternative would not actively reduce contaminant concentrations currently present at the Site. However, contaminant concentrations are anticipated to slowly decrease as described above.

Reduction of Toxicity, Mobility, or Volume

There would not likely be a significant immediate reduction in the contaminant concentration levels with the No Action alternative; however, there would likely be a gradual reduction over time, resulting in a volume reduction and change in toxicity.

Short-Term Effectiveness

No additional risks would be encountered by human or environmental receptors with this alternative because no construction or implementation actions would occur.

Implementability

No remedial action would be implemented under this alternative.

Cost

The estimated capital and O&M costs for this alternative are zero because no remedial action would be conducted.

4.10 Site Groundwater Alternative 2: Long-Term Monitoring

4.10.1 Alternative Description

The long-term monitoring alternative would employ monitoring to document contaminant concentrations on site and downgradient of the Site and to document anticipated contaminant reductions following source-area remediation. Although this alternative does not involve any active remediation, the constituent concentrations would be monitored.

For the groundwater, implementation of the long-term monitoring alternative would require the collection of representative groundwater samples on a semi-annual basis from Site monitoring wells and analysis of the samples for the constituents of concern. Based on the contaminant types and the observed concentrations, it is estimated that groundwater samples would be collected semi-annually for 10 years. A report would be prepared at the end of the monitoring period to document observed contaminant concentration changes.

4.10.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Groundwater at select locations on the Site and off site is impacted with pesticides. This groundwater does not directly present a hazard to human health since there is no exposure pathway, as discussed in Section 2.4. However, impacted groundwater has the potential to continue to migrate off site. In comparison to the No Action alternative, the long-term monitoring alternative would provide analytical data to be utilized in the evaluation of groundwater impacts.

Compliance with ARARs

Under the long-term monitoring alternative, the contaminant levels would likely continue to exceed the NYSDEC standards for a time. However, groundwater monitoring data would be available to evaluate the contaminant concentrations with respect to the ARARs.

Long-Term Effectiveness and Permanence

The long-term monitoring alternative would not actively reduce pesticides concentrations on or off the Site. However, monitoring data would be utilized to evaluate anticipated contaminant concentration reduction following remediation of impacted soil and sediment.

Reduction of Toxicity, Mobility, or Volume

There would not likely be a rapid reduction in constituent concentrations with the long-term monitoring alternative. Therefore, there is not anticipated to be a rapid volume reduction or change in toxicity.

Short-Term Effectiveness

Implementation of this alternative would not result in any significant short-term impacts to human health or the environment because no construction or implementation actions would occur.

Implementability

There are no technical limitations to implementing this alternative. This alternative utilizes readily available monitoring methodologies which may be scheduled without difficulty.

Cost

Costs would be incurred for this alternative to perform the testing required and are presented in Table 4.10.2.1. Groundwater at 10 monitoring wells would be sampled semi-annually for 10 years for TCL Pesticides. These data would be evaluated annually and a brief report documenting the results would be prepared. At the end of the monitoring period, all of the data would be incorporated into a summary report. The estimated costs for this alternative are $19,400 in annual monitoring costs. The net present value of monitoring costs over a 10-year period is estimated to be $178,000.

4.11 Evaluation of Site-Wide Alternatives

The remediation alternatives for each medium of concern are combined into Site-wide remedial alternatives and are evaluated in this section. Three Site-wide alternatives are considered:

- Site-Wide Alternative 1: No Action for soil, leaching pool sediments, or groundwater;
- Site-Wide Alternative 2: Removal and disposal of leaching pool sediments and select on-site/off-site soil, paving (capping) excavated areas, soil stabilization for the deeper on-site impacted soil, and long-term monitoring for groundwater; and
- Site-Wide Alternative 3: Removal and disposal of all reasonably accessible impacted on-site and off-site soils, paving (capping) excavated areas, removal and disposal of leaching pool sediment, replacement of the D-2 leaching pool, soil stabilization for the deeper impacted soil, and long-term monitoring for groundwater.

4.11.1 Site-Wide Alternative 1

This Site-wide alternative would consist of No Action to address the soil, sediment, or groundwater contamination at the Site. The No Action alternative would not involve any remediation or monitoring at the Site. Soil, leaching pool sediments, and groundwater would remain in their existing states. Concentrations of the contaminants of concern will likely decrease as a result of natural processes, including chemical reactions and/or biologic activity; however, the rate of contaminant reduction would likely be slow, particularly for on-site/off-site soils which contain elevated contaminant concentrations.

Because most of the impacted soil, leaching pool sediments, and groundwater are located below grade and are beneath pavement and there are no groundwater receptors, there does not appear to be the potential for human exposure other than to soil in the unpaved impacted areas. The impacted groundwater

TABLE 4.10.2.1
COSTS FOR GROUNDWATER ALTERNATIVE 2
GROUNDWATER MONITORING

Description	Quantity	Units	Unit Cost	Cost (Rounded)
Capital Costs				
- None -				$0
Annual Monitoring Costs				
Groundwater Sample Analyses	20	EA	$280*	$5,600
Labor	2	LS	$2,400	$4,800
Expense	2	LS	$600	$1,200
Report Preparation	1	LS	$5,000	$5,000
Data Validation	20	EA	$45*	$1,000
Annual Subtotal				**$17,600**
Contingency (10%)				$1,760
Annual Monitoring Costs (rounded)				**$19,400**
Monitoring Net Present Worth (10 years, rounded)				**$178,000**
TOTAL COST				**$178,000**

Notes:

- Assumed interest rate is 5% and assumed inflation rate is 3%.
- * = includes QA/QC samples.

is limited to an area less than 550 feet downgradient of the Site boundary. Therefore, the risk to human health from allowing most of these materials to remain at the Site appears to be minimal. However, impacted unpaved soils may impact human health and impacted leaching pool sediments have the potential to cause groundwater contamination since stormwater is routinely directed to the leaching pools for discharge. Therefore, there is the potential for impact to the human health and environment if this alternative is selected.

Under the No Action alternative, the concentrations of the constituents of concern would likely continue to exceed their respective PRGs. However, over time constituent concentrations are expected to be slowly reduced by natural processes of dispersion, chemical degradation, and biologic activity.

The estimated capital and O&M costs for this alternative are zero because no remedial action would be conducted. However, no evaluation of contaminant concentration changes would be performed since no monitoring data would be obtained.

4.11.2 Site-Wide Alternative 2

This Site-wide alternative would consist of on-site soil removal from the most impacted areas (soils exceeding the PRG by more than two orders of magnitude), followed by capping with pavement. All impacted off-site soils exceeding the PRGs would be removed. In-situ soil stabilization would also be performed for the deeper on-site soils, sediment removal and disposal would be used to address impacted leaching pools, and long-term monitoring of groundwater would be performed. Due to the reduction in soil permeability following soil stabilization, leaching pool D-2 would be replaced with a catch basin to divert stormwater to an alternate discharge point. This alternative would actively address the most impacted soils both on-site and off site and capping and soil stabilization will reduce the potential for the remaining impacted soils to affect the groundwater. The anticipated amounts of soil and sediment to be removed are shown in Table 4.11.2.1. In the event that pilot testing showed soil stabilization to be ineffective, the capping of the deeper impacted soils with asphalt or concrete underlain by a impermeable membrane would be performed. The most impacted leaching pool sediments would also be removed from the Site. Concentrations of the contaminants of concern in the less impacted media (soil and groundwater) will likely continue to slowly decrease as a result of natural processes, including chemical reactions and/or biologic activity. The reduction in groundwater contaminant concentrations anticipated following remediation would be confirmed by monitoring.

Because much of the impacted soil, leaching pool sediments, and groundwater are located below grade and are capped by pavement and there are no groundwater receptors, there does not appear to be a

TABLE 4.11.2.1
ANTICIPATED SOIL REMOVAL AMOUNTS
SITE-WIDE ALTERNATIVE 2

Location	Area to be Excavated (square feet)	Excavation Depth (feet)	Volume (cubic yards)
Off-Site Soil			
Adjoining 50 by 50-foot area	1,400	1	52
Adjoining SS-17 through SS-20	400	1	15
Adjoining SS-4 area	300	1	11
SS-1/MW-8 Area	1,800	1 to 5	130
SS-4 Area	800	1 to 4	70
50 by 50-Foot Area	800	3	90
Leaching Pools			
D-1	9	3	1
D-2	80	5	15
D-3	9	3	1
LP-2	50	3	6
LP-3	50	3	6
Anticipated Total Volume to be Removed			**397**

significant potential for human exposure except in unpaved areas. This alternative would address the soils in the unpaved areas and all off-site impacted soil. The risk to human health from allowing the materials in the paved areas to remain at the Site appears to be minimal. The impacted leaching pool sediments and the deeper impacted on-site soil which have the most potential to cause groundwater contamination will be addressed and, therefore, this alternative will also reduce the potential for further groundwater contamination.

These remedial actions are readily implementable and are anticipated to pose little risk to remediation workers, Site occupants, or neighboring residents.

Under this alternative, the concentrations of the constituents of concern in the soil, sediments, and groundwater would likely continue to exceed their respective PRGs, although the soil and sediment with the highest concentrations (more than two orders of magnitude above the PRGs) will generally be removed. Over time constituent concentrations are expected to be reduced by natural processes of dispersion, chemical degradation, and biologic activity.

Since soil and groundwater exceeding their PRGs would remain on site following remediation, a deed restriction would be necessary to reduce the potential for human contact with the remaining contaminants. In addition, a soil management plan would be developed to address procedures for handling impacted soil should this become necessary.

The estimated capital costs and O&M net present value costs for this alternative are $647,000 over the estimated 10-year remediation and monitoring period as shown on Table 4.11.2.2.

4.11.3 Site-Wide Alternative 3

This Site-wide alternative would consist of removal of all reasonably-accessible on-site soils exceeding the PRGs and all off-site impacted soils exceeding the PRGs, capping of the excavated areas, removal of sediment from impacted leaching pools, replacement of the D-2 leaching pool structure, stabilization of the deeper on-site impacted soils, and long-term monitoring of groundwater. It is anticipated that the depth of the on-site soil excavations might extend from three to five feet below grade. The anticipated amounts of soil and sediment to be removed are shown in Table 4.11.3.1. "Reasonably-accessible" soils includes soils that are not overlain by buildings, subsurface utilities, permanent surface or subsurface structures, or where the removal of these soils would not present a safety hazard or structural concern.

TABLE 4.11.2.2
COSTS FOR SITE-WIDE ALTERNATIVE 2

Description	Cost (Rounded)
Capital Costs	
Leaching Pool Sediment Alternative 2: Sediment Removal and Disposal	$66,000
On-Site/Off-Site Soil Alternative 2: Soil Removal and Disposal (Select Locations)	$353,000
On-Site/Off-Site Soil Alternative 4: In-Situ Stabilization	$50,000
Capital Cost Subtotal	**$469,000**
Annual O&M Cost (Groundwater Monitoring)	**$19,400**
Net O&M Present Worth	**$178,000**
TOTAL COST	**$647,000**

Notes:

- Assumed interest rate is 5% and assumed inflation rate is 3%.
- Amounts of sediment removed will depend on initial level of impact, leaching pool structural configuration, and other factors.

TABLE 4.11.3.1
ANTICIPATED SOIL REMOVAL AMOUNTS
SITE-WIDE ALTERNATIVE 3

Location	Area to be Excavated (square feet)	Excavation Depth (feet)	Volume (cubic yards)
Off-Site Soil			
Adjoining 50 by 50-foot area	1,400	1	52
Adjoining SS-17 through SS-20	400	1	15
Adjoining SS-4 area	300	1	11
SS-1/MW-8 Area	4,800	3 to 6	800
SS-4 Area	1,800	2 to 6	265
50 by 50-Foot Area	2,500	3 to 15	830
SS-6 Area	400	1	15
SS-7 Area	400	1	15
Leaching Pools			
D-1	9	3	1
D-2	80	5	15
D-3	9	3	1
LP-2	50	3	6
LP-3	50	3	6
Anticipated Total Volume to be Removed			**2,032**

This alternative would actively address the large majority of the impacted media at the Site and provide for monitoring of the impacted groundwater. Concentrations of the contaminants of concern in the less impacted media (remaining soil and groundwater) will likely continue to decrease as a result of natural processes, including chemical reactions and/or biologic activity. The reduction in groundwater contaminant concentrations would be confirmed by monitoring.

Most of these remedial actions are readily implementable; however, the removal of all of the readily-accessible impacted soils and repaving of these areas is anticipated to be extensive and costly with little incremental benefit in comparison to Alternative 2. There is some additional risk to remediation workers due to the additional duration of remediation.

Under this alternative, the concentrations of the constituents of concern in the soil, leaching pool sediments, and groundwater would likely continue to exceed their respective PRGs, although to a lesser extent than for Alternative 2. Over time, the remaining constituent concentrations are expected to be reduced by natural processes of dispersion, chemical degradation, and biologic activity. The concentrations of contaminants in the groundwater will be monitored.

Since soil and groundwater exceeding their PRGs would remain on site following remediation, a deed restriction would be necessary to reduce the potential for human contact with the remaining contaminants. In addition, a soil management plan would be developed to address procedures for handling impacted soil should this become necessary.

The estimated capital and O&M net present value costs for this alternative are $1,818,000 over the estimated 10-year remediation and monitoring period, as shown in Table 4.11.3.2.

TABLE 4.11.3.2
COSTS FOR SITE-WIDE ALTERNATIVE 3

Description	Cost (Rounded)
Capital Costs	
Site Leaching Pool Alternative 3: Sediment Removal and Disposal/Pool Replacement	$95,200
On-Site/Off-Site Soil Alternative 3: Soil Removal and Disposal (All Feasible Impacted Soil)	$1,495,000
On-Site/Off-Site Soil Alternative 4: In-Situ Stabilization	$50,000
Capital Cost Subtotal (Rounded)	**$1,640,000**
Annual O&M Cost (Groundwater Monitoring)	**$19,400**
Net O&M Present Worth	**$178,000**
TOTAL COST	**$1,818,000**

Notes:

- Assumed interest rate is 5% and assumed inflation rate is 3%.
- Amounts of sediment removed will depend on initial level of impact, leaching pool structural configuration, and other factors.

SECTION 5.0
RECOMMENDATIONS

The recommended remedial alternative for the Site, based on a comparison of the evaluation criteria, is Site-wide Alternative 2: select on-site and off-site soil removal followed by capping, in-situ soil stabilization for the deeper on-site soils, sediment removal and disposal to address impacted leaching pools, and long-term monitoring of groundwater. This alternative provides for protection of human health and the environment at a reasonable cost without posing additional risks during remediation activities. The proposed remediation activities are targeted to provide significant reductions in contaminant concentrations and mobility. The proposed remediation methods are commonly utilized locally and may be readily implemented. A deed restriction would be implemented and a soil management plan would be developed to address potential for exposure to the remaining contaminants.

Site-wide Alternative 1, No Action for the Site soil, leaching pool sediments, or groundwater, would not provide for remediation of impacted soil or leaching pool sediments and, therefore, the source of groundwater contamination would remain on-site. The potential for human health impact from impacted soil in unpaved areas would also remain. This altemative would not significantly reduce contaminant concentrations or environmental risks and would not provide monitoring data for the evaluation of contaminant concentrations.

Site-wide Alternative 3, removal of all reasonably-accessible on-site and off-site impacted soils, removal of impacted leaching pool sediments, stabilization of deeper impacted on-site soils, and long-term monitoring of groundwater would provide for remediation of the majority of the impacted media at the Site. However, this alternative includes the removal and disposal of significant quantities of minimally-impacted soil in paved areas which is costly and provides little environmental or human health benefit. The removal of all of the reasonably-accessible impacted soils does not appear to be necessary and would not significantly reduce current or future risks.

The incremental cost for Site-wide Alternative 3 is excessive relative to the potential incremental benefit; Alternative 3 is estimated to cost approximately $1,171,000 more than Alternative 2 with little increase in benefit to human health or the environment. The short-term risk during remediation activities is also greater for Alternative 3 than for Altemative 2.

SECTION 6.0
REFERENCES

Energy & Environmental Analysts, Inc., March 1987. *Engineering Investigation at Inactive Hazardous Site, Phase II Investigation.*

FPM Group, August 2002. *Revised Remedial Investigation Report for Harder Tree Services, 63 Jerusalem Avenue, Hempstead, New York, NYSDEC Registry # 130035.*

FPM Group, January 30, 2002. *Letter Work Plan for Additional Investigation.*

FPM Group, September 2001. *Remedial Investigation Report for Harder Tree Service Site, 63 Jerusalem Avenue, Hempstead, New York, NYSDEC Registry # 1-30-035.*

FPM Group, August 2000. *Remedial Investigation/Feasibility Study Work Plan for Harder Tree Services, 63 Jerusalem Avenue, Hempstead, New York, NYSDEC Registry # 130035.*

Fanning, Phillips and Molnar, May, 1999. *Site Assessment Update Report for Harder Tree Services, 63 Jerusalem Avenue, Hempstead, New York, NYSDEC Registry # 130035.*

Fanning, Phillips and Molnar, September, 1998. *Site Assessment Update Work Plan for Harder Tree Services, NYSDEC Site # 130035.*

Nassau County Department of Public Works, 1997. *March, 1997 Nassau County Water Table Elevation.*

New York State Department of Environmental Conservation. *April 9, 2002 letter approving revised Work Plan for Additional Investigation.*

New York State Department of Environmental Conservation. *February 15, 2002 letter commenting on Work Plan for Additional Investigation.*

New York State Department of Environmental Conservation. *August 3, 2000* letter *approving the Remedial Investigation/Feasibility Study Work Plan.*

New York State Department of Environmental Conservation. *July 16, 1999 letter commenting on Site Assessment Update Report.*

New York State Department of Environmental Conservation, March 8, 1998. *Water Quality Regulations for Surface Waters and Groundwaters.*

New York State Department of Environmental Conservation, April, 1995. *Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels, TAGM HWR-94-4046.*

U.S. Geological Survey, 1979. *Freeport, New York Quadrangle.*

U.S. Geological Survey, 1972. *Water Transmitting Properties of Aquifers on Long Island, New York.*

U.S. Geological Survey, 1963. *Water-Supply Paper 1613-A, "Geology and Ground-Water Conditions in Southern Nassau and Southeastern Queens Counties, Long Island, NY".*

U.S. Soil Conservation Service, 1987. *Soil Survey for Nassau County, New York.*

SECTION 7.0
DISCLAIMER

Conclusions from this data are limited to those areas focused on in the study and represent our best judgement using analytical techniques and our past experience. Even though our investigation has been scientific and thorough, it is possible that certain areas of this property may pose environmental concerns that yet are undiscovered. In addition, environmental regulations may change in the future and could have an effect on our conclusions.

APPENDIX A

COST ESTIMATE CALCULATIONS

FPM

Site Leaching Pool Sediment Alternative 2: Sediment Removal and Disposal

Assume:

- 1 staff
- Two waste characterization samples (solid & liquid)
- Three end-point samples with full QA/QC analyzed for TCL Pesticides
- Off-site disposal
- Clean backfill

Remediation Labor and Equipment Costs:

- Excavator, loader, crew + equipment = $5,500 /day x 3 days = **$16,500**

Engineering Costs:

- Preparation: $3,000
- Oversight: $2,000
- Reporting: $5,000

Sediment Sampling Lab Costs:

- 3 primary samples + MS/MSD + duplicate + equipment blanks
- Waste char. 2 x $1,000 = $2,000
- End-point 3 + 4 QA/QC x $200 = $1,400
- Data Validation – 7 @ $35/sample = $245

Sediment and Liquid Transportation and Disposal Costs:

- Moderately impacted sediment = 10 cubic yards or 15 tons @ $425/ton = $6,375
- Highly impacted sediment = 23 cubic yards or 35 tons @ $450/ton = $15,750
- Liquids = 8,000 gallons @ $0.10/gallon = $800

Backfill and Pool Reconstruction Costs:

- Backfill - $27/cubic yard x 40 cubic yards = $1,100
- Replacement parts- $1,800 ea. x 3 = $5,400

Site Leaching Pool Sediment Alternative 3: Sediment Removal and Disposal/Pool Replacement

Assume:

- 1 staff
- Two waste characterization samples (solid & liquid)
- Three end-point samples with full QA/QC analyzed for TCL Pesticides
- Off-site disposal
- Clean backfill
- Pool replacement and capping

Remediation Labor and Equipment Costs:

- Excavator, loader, crew + equipment = $5,500/day x 5 days = **$27,500**

Engineering Costs:

- Preparation: $4,000
- Oversight: $6,000
- Reporting: $5,000

Sediment Sampling Lab Costs:

- 3 primary samples + MS/MSD + duplicate + equipment blanks
- Waste char. 2 x $1,000 = $2,000
- End-point 3 + 4 QA/QC x $200 = $1,400
- Data Validation – 7 @ $35 each = $245

Sediment and Liquid Transportation and Disposal Costs:

- Moderately impacted sediment = 10 cubic yards or 15 tons @ $425/ton = $6,375
- Highly impacted sediment = 23 cubic yards or 35 tons @ $450/ton = $15,750
- Liquids = 8,000 gallons @ $0.10/gallon = $800

Backfill and Pool Reconstruction Costs:

- Backfill - $27/cubic yard x 70 cubic yards = $1,900
- Replacement parts - $1,800 ea. x 3 = $5,400
- Install D-2 replacement - 1 @ $10,000 ea = $10,000

On-Site/Off-Site Soil Alternative 2: Soil Removal and Disposal (Select Locations)

Assume:

- 1 staff
- One waste characterization sample
- 20 end-point samples analyzed for TCL Pesticides
- Off-site disposal
- Clean backfill
- Pavement restoration (capping)

Remediation Labor and Equipment Costs:

- Excavator, loader, crew + equipment = $6,000/day x 3 days = **$18,000**

Engineering Costs:

- Preparation: $3,000
- Oversight: $4,000
- Reporting: $5,000

Soil Sampling Lab Costs:

- 25 primary samples + MS/MSD + equipment blanks + duplicate
- Waste char. 2 x $1,000 = $2,000
- End-point 25 + 6 QA/QC x $200 = $6,500
- Data Validation – 25 + QA/QC @ $35 each = $1,125

Soil Transportation and Disposal Costs:

- Moderately impacted soils = 100 cubic yards or 130 tons @ $425/ton = $55,300
- Highly impacted soils = 300 cubic yards or 390 tons @ $450/ton = $175,500

Backfill and Paving (Capping) Costs:

- Backfill - $27/cubic yard x 400 cubic yards = $10,800
- Concrete - $8/square foot x 4,000 sq. feet = $32,000

On-Site/Off-Site Soil Alternative 3: Soil Removal and Disposal (All Feasible Impacted Soils)

Assume:

- 1 staff
- One waste characterization sample
- 20 end-point samples with full QA/QC analyzed for TCL Pesticides
- Off-site disposal and clean backfill
- Replacement of pool parts and installation of a new catch basin

Remediation Labor and Equipment Costs:

- Excavator, loader, crew + equipment = $6,000/day x 8 days = **$48,000**

Engineering Costs:

- Preparation: $4,000
- Oversight: $6,000
- Reporting: $5,000

Soil Sampling Lab Costs:

- 26 primary samples + MS/MSD + equipment blanks + duplicate
- Waste char. 7 x $1,000 = $7,000
- End-point 26 + 10 QA/QC x $200 = $7,200
- Data Validation – 36 @ $35/sample = $1,224

Soil Transportation and Disposal Costs:

- Moderately impacted soils = 1,650 cubic yards or 2,145 tons @ $425/ton = $911,625
- Highly impacted soils = 400 cubic yards or 520 tons @ $450/ton = $234,000

Backfill and Paving (Capping) Costs:

- Backfill - $27/cubic yard x 2,050 cubic yards = $55,350
- Asphalt/turf - $2/square foot x 400 sq. feet = $800
- Concrete - $8/square foot x 7,000 sq. feet = $56,000

Shoring Costs:

- Assume 100' length, 15' deep excavation @ $15.10/ft^2 = $22,650

On-Site/Off-Site Soil Alternative 4: In-Situ Stabilization

Assume:

- 1 staff
- Geophysical markout
- Grout injection

Remediation Labor and Equipment Costs:

- Injection rig and grout plant = $6,000/day x 3 days = **$18,000**
- Geophysical Markout - $2,500/day x 1 day = $2,500

Engineering Costs:

- Preparation: $9,000
- Oversight: $3,000
- Reporting: $3,000

Pilot Test:

- Soil Collection: $1,000
- Leaching Tests: 2 @ $1,000 ea. = $2,000
- Bench-Scale Grouting: $2,000
- Reporting: $3,000

Site Groundwater Alternative 2: Long Term Monitoring

Assume:

- Sample 10 wells, twice per year
- Purge 3-5 volumes, monitoring parameters, and sample with 2 field staff
- Analyze for TCL Pesticides, CLP method, Category B ASP-95 deliverables
- Full QA/QC
- Prepare report once per year

Sampling Labor:

- 2 staff = **$2,400/event**

Equipment Expenses:

- Water level indicator (1 day)
- PH/conductivity/turbidity meters (1day)
- Pump rental
- Mileage
- Sample charges
- Ice
- Shipping
- Total = **$600/event**

Lab Costs:

- 10 primary samples + duplicate + equipment blank + MS/MSD = 14 samples/event
- Lab - TCL Pesticides with Category B deliverables = $200/sample
- Total = **$2,800/event**

Data Validation:

- 14 Samples @ $35/sample = **$490/event**

Report Preparation:

- Annual report = **$5,000**