REMEDIATION SYSTEM EVALUATION

SMS INSTRUMENTS
DEER PARK, NEW YORK

Report of the Remediation System Evaluation,
Site Visit Conducted at the SMS Instruments Superfund Site
July 16, 2003

Final Report
December 9, 2003

NOTICE

Work described herein was performed by GeoTrans, Inc. (GeoTrans) for the U.S. Environmental Protection Agency (U.S. EPA). Work conducted by GeoTrans, including preparation of this report, was performed under Dynamac Corporation Prime Contract No. 68-C-02-092, Work Service Request Nos. ST-1-20 and ST-1-15. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

EXECUTIVE SUMMARY

A Remediation System Evaluation (RSE) involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for up to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, may be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team.

The SMS Instruments Superfund Site is located at 120 Marcus Boulevard in Deer Park, Suffolk County, New York. The site consists of a 34,000 square foot building located on a 1.5-acre lot that is surrounded by other light industrial facilities. A recharge basin is located adjacent to the property to the east. Facility operations occurred between 1967 and 1990 and primarily involved overhauling of military aircraft components. These activities consisted of cleaning, painting, degreasing, refurbishing, metal machining, and testing components. The current uses, under different ownership, include the manufacturing of wooden kitchen utensils. Site contamination was first discovered in 1980 when the Suffolk County Department of Health Services sampled a leaching pool on the south side of the facility. Investigative and remedial activities have included pumping out the leaching pond and backfilling it, removal of an underground storage tank, and operation of a soil vapor extraction system. A P&T system was constructed and began operation in 1994. This RSE report pertains to that P&T system and other site conditions that directly affect the performance of this system.

The RSE team observed a site where the soil remedy had effectively removed soil contamination, which had been providing a continuing source of dissolved ground water contamination. Ground water concentrations have decreased substantially, indicating the initial success of the remedies. The ground water remedy has continued to extract and treat contaminated ground water in an attempt to achieve its remediation objectives, but the system has failed to meet its discharge criteria on multiple occasions and the annual costs of operation are significantly more than the RSE team would expect for this site. The observations and recommendations contained in this report are not intended to imply a deficiency in the work of either the system designers or operators but are offered as constructive suggestions in the best interest of the EPA, the public, and the facility. These recommendations have the obvious benefit of being formulated based upon operational data unavailable to the original designers.

The RSE team suggests the following recommendation to improve system effectiveness:

- The data analysis and reporting should be improved. Current reports include little or no data analysis, no figures, no water level data, and no information about the treatment system. In addition, the reports reviewed by the RSE team were submitted seven months to one year after the associated sampling event. The reports should be improved to include these items and should be submitted in a timely manner. These improvements are particularly important given that plume capture has not been evaluated since a new extraction well became operational in 1998 and given that the treatment system has had two recent exceedances of the discharge standards.

The RSE team suggests the following recommendations for cost reduction:

- Over 80% of the O&M costs are devoted to labor. Approximately $130,000 per year is used to fund a full time plant operator, and approximately $150,000 per year is used to fund project management, technical support, and reporting. The amount of labor (and therefore the labor cost) can and should be reduced without sacrificing the system effectiveness. The system is automated and does not require a full time operator, and the project management, technical support, and reporting should not exceed $110,000 for this site. The RSE team suggests that approximately $113,000 per year can be saved by reducing labor without sacrificing system effectiveness.

- The monitoring program can be optimized by both reducing the sampling frequency at a number of wells and discontinuing the analysis for SVOCs and metals from the ground water samples. Reductions in laboratory analysis will not result in cost savings because the analyses are conducted through the Contract Laboratory Program, but approximately $9,000 can be saved from the reductions in sampling labor.

- Because the influent concentrations are orders of magnitude lower than the design influent concentrations, it may be possible to reduce the frequency of vapor phase GAC replacements. The RSE team encourages the site team to evaluate the influent and effluent to the GAC units and determine if the replacement frequency can be reduced without sacrificing effectiveness. A cost savings of $3,000 to $5,000 might result if the frequency can be reduced.

No recommendations are provided in the technical improvement category. Rather, the RSE team suggests that emphasis be placed on the effectiveness and cost reduction recommendations. One recommendation is provided with regard to site closeout. The RSE team recommends developing an exit strategy and provides three potential approaches. The risks that the ROD highlighted as the reason for active remediation are no longer present at the site. Therefore, two of the approaches provided include discontinuing the P&T system and monitoring for potential plume migration. In addition to the above recommendations, the RSE team provides options for the site team to consider if the system is expected to continue for a number of years and maintenance becomes a problem.

A table summarizing the recommendations, including estimated costs and/or savings associated with those recommendations, is presented in Section 7.0 of this report.

PREFACE

This report was prepared as part of a project conducted by the United States Environmental Protection Agency (USEPA) Office of Superfund Remediation and Technology Innovation (OSRTI). The objective of this project is to conduct Remediation System Evaluations (RSEs) at selected pump and treat (P&T) systems that are jointly funded by EPA and the associated State agency. The project contacts are as follows:

Organization	Key Contact	Contact Information
USEPA Office of Superfund Remediation and Technology Innovation (OSRTI)	Jennifer Griesert	1200 Pennsylvania Avenue, NW Mail Code 5201G Washington, DC 20460 phone: 703-603-8888 griesert.jennifer@epa.gov
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1.0 INTRODUCTION

1.1 PURPOSE

During fiscal years 2000, 2001, and 2002 Remediation System Evaluations (RSEs) were conducted at 24 Fund-lead pump and treat (P&T) sites (i.e., those sites with pump and treat systems funded and managed by Superfund and the States). Due to the opportunities for system optimization that arose from those RSEs, EPA OSRTI has incorporated RSEs into a larger post-construction complete strategy for Fund-lead remedies. During fiscal year 2003, RSEs at up to 6 Fund-lead sites are planned in an effort to improve or optimize the sites. GeoTrans, Inc., an EPA contractor, is conducting these evaluations, and representatives from EPA OSRTI are attending the RSEs as observers.

The Remediation System Evaluation (RSE) process was developed by the US Army Corps of Engineers (USACE) and is documented on the following website:

http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html

An RSE involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for 1 to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, might be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team.

The SMS Instruments site was selected by EPA OSRTI based on a recommendation from EPA Region 2 and the annual costs of operating the remedy. This report provides a brief background on the site and current operations, a summary of the observations made during a site visit, and recommendations for changes and additional studies. The cost impacts of the recommendations are also discussed.

1.2 TEAM COMPOSITION

The team conducting the RSE consisted of the following individuals:

- Rob Greenwald, Hydrogeologist, GeoTrans, Inc.
- Peter Rich, Civil and Environmental Engineer, GeoTrans, Inc.
- Doug Sutton, Water Resources Engineer, GeoTrans, Inc.

The RSE team was also accompanied by the following observers:

- Jennifer Griesert from EPA OSRTI
- Matthew Charsky from EPA OSRTI

1.3 DOCUMENTS REVIEWED

Author	Date	Title
US EPA	9/29/1989	Record of Decision, OU1
CDM	7/7/1993	Various figures from the Remedial Investigation/Feasibility Study
US EPA	3/1995	Cost and Performance Report, Soil Vapor Extraction at the SMS Instruments Superfund Site (Excerpt from Remediation Case Studies: Soil Vapor Extraction)
Advanced Environmental	12/1995	Operation and Maintenance Groundwater Treatment Facility, Volume I, Main Text
US EPA	5/31/2001	Superfund Five-Year Review Report, SMS Instruments
CDM	3/25/2003	Data Summary Report, Quarterly Sampling, December 2001 and April 2002, SMS Instruments Remedial Action
CDM	10/23/2003	Data Summary Report, Quarterly Sampling, December 2002 and March 2003, SMS Instruments Remedial Action
CDM	7/2003	Excel Spreadsheet of Sampling Data (updated through April 2002)

1.4 PERSONS CONTACTED

The following individuals associated with the site were present for the visit:

Mark Dannenberg, RPM, EPA Region 2
Rob Alvey, Hydrogeologist, EPA Region 2
John Malleck, EPA Region 2

Gerald J. Rider, Jr., New York State Department of Environmental Conservation
Carl R. Hoffman, New York State Department of Environmental Conservation

Paul Hagerman, Project Manager, CDM
Kenneth F. Roberts, Plant Operator, CDM
Demetrios Klerides, Principal Engineer, CDM

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 LOCATION

The SMS Instruments Superfund Site is located at 120 Marcus Boulevard in Deer Park, Suffolk County, New York. The site consists of a 34,000 square foot building located on a 1.5-acre lot that is surrounded by other light industrial facilities, and a recharge basin is located adjacent to the property to the east. Facility operations occurred between 1967 and 1990 and primarily involved overhauling of military aircraft components. These activities consisted of cleaning, painting, degreasing, refurbishing, metal machining, and testing components. The current uses, under different ownership, include the manufacturing of wooden kitchen utensils. The location of the facility and the surrounding area are depicted in Figure 1-1. The site plan, including monitoring well locations and source areas, is depicted in Figure 1-2.

Site contamination was first discovered in 1980 when the Suffolk County Department of Health Services sampled a leaching pool on the south side of the facility. This leaching pool was pumped out and backfilled with sand in 1983. Other investigative and remedial activities conducted at the site include the following:

1986	-	The EPA included the site on the National Priorities List.
1987-89	-	The EPA performed a Remedial Investigation/Feasibility Study (RI/FS) at the site and detected organic and inorganic contamination of soils and ground water.
1988	-	An underground storage (UST) tank located to the east of the facility building was removed from the site.
1989	-	A Record of Decision (ROD) was issued for the site. The ROD identified soil vapor extraction (SVE) and P&T as remedies for site-related soil and ground water contamination. It also indicated that a second operable unit (OU-2) would be established to address potential upgradient sources.
1992-94	-	An SVE system was operated near the former leaching pond and UST tank areas to remediate soils. Cleanup criteria were met and demobilization occurred in March 1994.
1993	-	No upgradient sources were identified, and the ROD for OU-2 specified “no-action”.
1994	-	Construction of the P&T system was completed, and the system began operating.
1995	-	The Removal Action Branch of EPA completed the removal of approximately 50 drums from a drum storage shed located on the north-east portion of the site.

This RSE report pertains to the operating P&T system and other site conditions that directly affect the performance of this system.

1.5.2 POTENTIAL SOURCES

The site had three main contaminant source areas:

- the leaching pool that was closed in 1983
- the UST tank that was excavated in 1988
- the drum storage area where the drums were removed in 1995

Approximately 1,250 cubic yards of soil in the former locations of the leaching pond and UST were treated with SVE from April 1992 to November 1993. Of 14 confirmation samples collected in November 1993, only two exceeded the standards and in each of these two samples, the exceedance pertained to only one constituent. Therefore, it was determined that the remedy achieved its goal and treatment with the SVE system could be discontinued. No soil remediation was conducted near the drum storage area.

Given that soil has been effectively cleaned to standards and that non-aqueous phase liquid (NAPL) has not been identified at the site, it is likely that there are no continuing sources of dissolved ground water contamination. Ground water sampling data (discussed in the following sections) further confirm that continuing sources are likely not present.

1.5.3 HYDROGEOLOGIC SETTING

The site overlies a recharge zone for the Magothy aquifer, a sole-source aquifer for Long Island. The depth to water is approximately 16 to 24 feet, and the hydraulic conductivity (as determined by a slug test conducted during the Remedial Investigation) was estimated at approximately 268 feet per day. Water levels suggest a hydraulic gradient for the site of approximately 0.001 feet per foot directing ground water flow to the south east. This gradient, the hydraulic conductivity provided above, and an assumed porosity of approximately 0.3 suggests a ground water velocity of approximately foot per day to the southeast. More updated information was not available for review. The majority of the site and the surrounding area are covered by asphalt, concrete, or buildings. Therefore, recharge to the aquifer within the property boundary is fairly limited.

1.5.4 RECEPTORS

The primary potential receptors are water supply wells. The closest downgradient supply well is located approximately 1 mile south of the site along Brook Avenue and is over 300 feet deep. As of the time of the RSE site visit, the site team was unaware of any impacts to that well from site-related contamination. The closest downgradient surface water body is Guggenheim Lake, which is located approximately 1.5 miles south of the site.

1.5.5 DESCRIPTION OF GROUND WATER PLUME

In April 2002, the following wells had contamination that exceeded the cleanup criteria. More recent data were not available at the time of the RSE.

Well	Contaminant Exceeding Standard	April 2002 Concentration (ug/L)	Cleanup Standard (ug/L)
MW-6S	1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Chlorobenzene Ethylbenzene n-Propylbenzene Xylenes sec-Butylbenzene	90 13 8.4 13 28 12 6.2	5 5 5 5 5 5 5
MW-15	1,1-Dichloroethane	20	5
EW-1	1,2-Dichlorobenzene Chlorobenzene	4.9 39	4.7 5
EW-3	Chlorobenzene	39	5

Figure 1-2 presents the locations of these wells and shows that MW-6S and EW-3 are located adjacent to each other in the area of the former leaching pond. No monitoring points are located between this area and EW-1, but given the continued contamination at EW-1, it is likely that this intermediate area has contamination above cleanup standards.

Contamination is generally limited to less than 70 feet below ground surface. MW-6D is installed to a depth of 102 feet, is screened from 87 to 97 feet below ground surface, and has no contamination above cleanup standards. Similarly, site-related contamination has not been found at MW-16D or MW-13D.

2.0 SYSTEM DESCRIPTION

2.1 SYSTEM OVERVIEW

The original system design included extraction from two downgradient wells (EW-1 and EW-2) at a combined rate of 500 gpm. Ground water was to be treated and then reinjected through reinjection wells upgradient of the site. The actual system, however, was constructed to extract ground water from one well (EW-1) at 90 gpm. Due to repeated fouling, the reinjection wells were taken offline in 1996, and treated ground water was discharged to the adjacent recharge basin. The current system includes extraction of 90 gpm evenly divided between EW-1 and EW-3, a new well installed in the 1998 near the source area at a depth of 40 feet.

The following table summarizes the contaminant concentrations in the plant influent for 2001. For all compounds detected above cleanup standards in the influent, the maximum 2001 concentration and effluent standards are provided.

Parameter	Maximum 2001 Influent Concentration (ug/L)	Effluent Standard (ug/L)
1,2-Dichlorobenzene 1,4-Dichlorobenzene	24.0 15.0	4.7*
Chlorobenzene	110	5.0
P-xylene and m-xylene	130	5.0
O-xylene	12	5.0
1,2,4-Trimethylbenzene	24	5.0
1,3,5-Trimethylbenzene	7.7	5.0
Ethylbenzene	27	5.0
Total	349.7	NA

** the standard of 4.7 ug/l is for the sum of these compounds*

Given this influent concentration and an extraction rate of 90 gpm, the mass loading to the treatment system is under 0.40 pounds of VOCs per day. The average concentration is much lower and a mass loading is likely closer to 0.2 pounds of VOCs per day.

2.2 EXTRACTION SYSTEM AND INJECTION SYSTEM

The current extraction system includes EW-1 downgradient of the site and EW-3 in the area of the former leaching pond. EW-2 was drilled, but never converted to an extraction well. EW-1 is approximately 70 feet deep, and EW-3 is approximately 40 feet deep. Each well is outfitted with a 5 HP pump that reportedly extracts approximately 45 gpm for an estimated total of 90 gpm between the two wells. EW-1 has heat tracing and conductivity high and low probes to control extraction, but the well operates continuously. To minimize the capital costs of installation, EW-3 was installed without heat tracing or conductivity probes. EW-3 was piped to the original line extending from EW-1 to the treatment plant. All piping is 4-inch HDPE.

2.3 TREATMENT SYSTEM

The treatment system consists of the following components:

- 7,300 gallon influent tank with a 7.5HP effluent pump (plus a parallel redundant pump)
- chemical metering pump
- flow meter (currently bypassed to eliminate frequent cleaning)
- 50-foot tall packed tower with a 5 HP blower designed to provide 665 cfm of air (plus a redundant blower that is currently out of service)
- 1,000 gallon effluent tank (currently out of service)
- 12.3 kW glycol heat exchanger, 1.5 HP glycol pump, and dehumidifier
- four 2,000 pound vapor GAC units arranged in two parallel trains each with two units in series
- a 55 gallon GAC vessel to treat the vapors in the head space above the influent tank

All units except for the chemical metering and heat exchanger are located outside, insulated, and heat traced. Extracted water flows into the influent tank, and pumping from the influent tank to the air stripper is regulated by a recycle valve. The tank is sealed and emissions are vented through the 55-gallon GAC vessel. About one drum of sludge is drained from the tank each year. Approximately 2.5 gallons per day of a polyphosphate sequestering agent (AquaMag) is dosed into the water prior to the air stripper. Process water then enters the air stripper to remove VOCs and is then discharged by gravity to the adjacent recharge basin. Off gas from the air stripper is dehumidified and then routed through the GAC vessels to remove the VOCs.

2.4 MONITORING PROGRAM

All 20 site monitoring wells, the two extraction wells, and system influent and effluent are sampled quarterly (about 100 samples per year total excluding QA/QC samples) and analyzed for VOCs, SVOCs and metals. The resulting data are presented in a quarterly monitoring report, but little analysis and no figures are provided. Depths to water are measured during the sampling events, but the measurements are not converted to water levels, used to develop potentiometric surface maps, or presented in the quarterly reports.

Ground water samples are collected by purging the well of three volumes and collecting a sample with a peristaltic pump. The purge water is emptied into the treatment plant influent tank and is treated by the system. EW-1 can be sampled with a sampling port. EW-3 is sampled by shutting down EW-1 and collecting a sample at the treatment plant. All laboratory analyses are conducted through the Contract Laboratory Program at no direct cost to the site.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

The 1989 ROD specifies two operable units (OUs) of the remedy:

OU1 - the remediation of on site soils through SVE and ground water through P&T
OU2 - the identification and remediation of upgradient sources

Further investigation found no upgradient sources and a "no-action" ROD was issued for OU2 in 1993. The soils portion of the OU1 remedy was also completed in the 1993. The OU1 ROD specifies the following objective for the ground water portion of the OU1 remedy:

> The ground water will be remediated by extraction, treatment, and reinjection to meet either Federal or State drinking water levels except in those cases where the upgradient concentrations are above such standards. In such a case, the contamination will be reduced to upgradient levels so as to eliminate any significant contribution from the SMS site.

The 1989 ROD further stated that remediation would be expected within four years of operation. Although this decision document specifically addresses aquifer cleanup, the 1992 monitoring plan indicates that the P&T system was designed to provide a hydraulic barrier across the width of the SMS property (approximately 300 feet).

The cleanup standards for the primary contaminants of concern that remain at the site as of the RSE are summarized in the following table.

Contaminant Exceeding Standard	Cleanup Standard (ug/L)
sec-Butylbenzene	5
Chlorobenzene	5
1,2-Dichlorobenzene	4.7*
1,1-Dichloroethane**	5
Ethylbenzene	5
n-Propylbenzene	5
1,2,4-Trimethylbenzene	5
1,3,5-Trimethylbenzene	5
Xylenes	5

** this standard applies to the combined concentration of 1,2-Dichlorobenzene and 1,4-Dichlorobenzene*
*** as discussed in Section 4.2.3 of this report, 1,1-Dichloroethane is likely associated with upgradient sources and should not be considered a contaminant of concern at the SMS site*

3.2 TREATMENT PLANT OPERATION STANDARDS

Although the treatment plant was originally designed to reinject the treated water through injection wells upgradient of the SMS property, fouling of those injection wells resulted in the site team discharging the water to a recharge basin located to the east (sidegradient) of the site. The effluent standards for the primary constituents of concern that remain in the treatment plant influent are provided in the following table. These standards are based on the water quality standards of the receiving ground water and are documented in the O&M manual.

Parameter	Effluent Standard (ug/L)
1,2-Dichlorobenzene 1,4-Dichlorobenzene	4.7*
Chlorobenzene	5.0
P-xylene and m-xylene	5.0
O-xylene	5.0
1,2,4-Trimethylbenzene	5.0
1,3,5-Trimethylbenzene	5.0
Ethylbenzene	5.0

** the standard of 4.7 ug/l is for the sum of these compounds*

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The RSE team observed a site where the soil remedy had effectively removed soil contamination, which had been providing a continuing source of dissolved ground water contamination. Ground water concentrations have decreased substantially, indicating the initial success of the remedies. The ground water remedy has continued to extract and treat contaminated ground water in an attempt to achieve its remediation objectives, but the system has failed to meet its discharge criteria on multiple occasions and the annual costs of operation are significantly more than the RSE team would expect for this site. The observations provided below are not intended to imply a deficiency in the work of the system designers, system operators, or site managers but are offered as constructive suggestions in the best interest of the EPA and the public. These observations obviously have the benefit of being formulated based upon operational data unavailable to the original designers. Furthermore, it is likely that site conditions and general knowledge of ground water remediation have changed over time.

4.2 SUBSURFACE PERFORMANCE AND RESPONSE

4.2.1 WATER LEVELS

Although depth to water measurements are collected quarterly and converted to water elevations these measurements are not presented in the quarterly reports or used to generate potentiometric surface maps. Water levels from March 2003 confirm suggest a hydraulic gradient of approximately 0.001 feet per foot. The water elevation is approximately 55.7 feet a MW-8 and MW-9 and decreases to approximately 54.7 feet per foot at MW-11, MW-12, and MW-13. The influence of pumping is not discernible from plotted water levels, but this is expected given the relatively flat hydraulic gradient, a productive aquifer, and limited points to measure water elevation.

The site team maintains that discharging the treated water to the recharge basin has little or no effect on the capture provided by the extraction system because there was a limited or undetectable change in the water elevation at site after discharge to the basin began. This finding is not documented in site reports and was not confirmed by the RSE team, but the productive nature of the aquifer supports the finding.

4.2.2 CAPTURE ZONES

An analysis of capture has not been recently conducted or documented. However, a preliminary capture zone analysis can be conducted by performing a water budget analysis and by reviewing water quality data from sentinel wells.

A water budget analysis calculates the amount of ground water entering the site from upgradient and compares this value to the amount extracted. In general, the amount extracted should exceed the amount entering from up gradient by a factor of 1.5 or 2.0. As stated in Section 1.5.3 of this report, the hydraulic gradient is approximately 0.001 feet per foot and the hydraulic conductivity estimated at approximately 268 feet per day. This translates to a Darcy velocity of 0.27 feet per day. The saturated thickness from the water table to the bottom of EW-1 is approximately 50 feet assuming a water table depth of 20 feet below ground surface and a total depth for EW-1 of 70 feet. The contaminated portion of the site is approximately 100 feet in width, which suggests a total cross-sectional area of approximately 5,000 square feet (50 feet deep by 100 feet across). Therefore, approximately 1,350cubic feet per day (0.27 feet per day times 5,000 square feet) enter the site from upgradient during non-pumping conditions. This is equivalent to approximately 10,000 gallons per day. The pumping rate from EW-1 is approximately 45 gpm (64,800 gallons per day), and the combined pumping rate from EW-1 and EW-3 is approximately 90 gpm (129,600 gallons per day). Therefore, the amount extracted is approximately a factor of 10 greater than the amount entering the site based on the hydraulic data from the Remedial Investigation. A water budget analysis, therefore, strongly supports that capture is provided.

An evaluation of water quality data from downgradient wells MW-12, MW-13, MW-14, MW-15, and MW-16S,M,D reveals a number of exceedances for 1,1-dichloroethane and 1,1,1-trichloroethane. As discussed in Section 4.2.3 of this report, the 1,1-dichlorothane and the 1,1,1-trichloroethane likely result from upgradient sources and therefore, in the opinion of the RSE team, should not be considered contaminants of concern for this site. Their presence in sentinel wells for the SMS site therefore do not indicate failed capture of site-related contamination.

In addition, to the exceedances of 1,1-dichloroethane and 1,1,1-trichloroethane, there was a series of exceedances between October 2001 and April 2002 for chlorobenzene in MW-13 and a single exceendance of bis (2-ethylhexyl) phthalate in MW-16S in April 2002. The RSE team might attribute this series of exceedances, that are indicative of a contaminant spike, to a potential extended shutdown in the treatment system that might have resulted in a temporary failure to provide capture. This should be verified by the site team. As calculated in Section 1.5.3 of this report, the estimated contaminant transport velocity for ground water at this site is approximately 1 foot per day. Therefore, an extended shutdown of the treatment system one year earlier may have resulted in contamination migrating toward MW-13, which is approximately 300 feet downgradient of EW-1.

4.2.3 CONTAMINANT LEVELS

Ground water contamination at the site has decreased substantially since the Remedial Investigation. The RSE team attributes this decrease to removal of the contaminated soil by the SVE system and the productive aquifer (augmented by injection of treated water between 1994 and 1998) that has flushed contaminated ground water toward EW-1 or even beyond EW-1 before it became operational. The following tables provide representative ground water concentrations from the Remedial Investigation and the maximum concentrations from the April 2002 sampling event.

Contaminant Exceeding Standard	"Representative" Remedial Investigation Concentration (ug/L)	Maximum April 2002 Concentration (ug/L)
SVOCs		
1,3-Dichlorobenzene	22.5	<5
1,2- and 1,4-Dichlorobenzene	119.5	4.9
Napthalene	34.5	<5

Contaminant Exceeding Standard	"Representative" Remedial Investigation Concentration (ug/L)	Maximum April 2002 Concentration (ug/L)
	VOCs	
Chlorobenzene	568	39
1,2-Dichloroethane	530	<5
1,1-Dichloroethane	7	20
Ethylbenzene	215	13
Tetrachloroethene	20.8	<5
Trichloroethene	4,396	<5
Total xylenes	1,750	12

As is evident from the tables, most contaminant concentrations have decreased by over an order of magnitude from the time of the Remedial Investigation. For many of the chlorinated compounds, such as tetrachloroethene and trichloroethene, the decrease in concentration may also be due to dechlorination caused by microbial activity using the other organics as nutrients and the chlorinated compounds as electron acceptors. Figure 4-1 shows that total VOC concentrations at MW-6S were decreasing between 1994 and 1998 and that the decrease was substantially accelerated by the addition of EW-3. Figure 4-2 also shows that concentrations have been low since 1998. They are, however, not low enough to meet the cleanup standards and conditions have been nearly stable (with fluctuations) for approximately four years.

If capture of the source area is complete with EW-3, the RSE team would expect concentrations in EW-1 to decrease over time and fall below cleanup standards. During the first year of operation, concentrations in EW-1 appeared to decline substantially, but asymptotic behavior and fluctuations in the concentrations have prevented cleanup standards from being met at this downgradient location. The RSE team expects that this same behavior will continue for a number of years and perhaps decades before the cleanup standards are consistently met over a number of sampling events. Although the extraction at EW-3 helps remove mass near the source area, it also likely creates a zone of stagnation immediately downgradient, which will delay the flushing of contamination that is between EW-3 and EW-1 toward EW-1 for extraction.

The RSE team also believes that ground water contamination from upgradient will continue to flow through the site and will affect the ability of the site team to close the site if it does not distinguish between the contamination that is site-related and the contamination that is not site-related. In particular, the RSE team sees 1,1-dichlorothane and 1,1,1-trichloroethane as contaminants from upgradient. As shown in Figure 4-2, these constituents are found throughout the site, including the upgradient wells. Contrastingly, the site-related contaminants, including a variety of benzene-related compounds, are limited to the former source area and the immediate area downgradient (EW-1, EW-3, and for a brief period, MW-13). In addition, 1,1-dichloroethane and 1,1,1-trichloroethane were not detectable in the surface or subsurface soils during the Remedial Investigation indicating that they were not part of the original site-related source material.

4.3 COMPONENT PERFORMANCE

4.3.1 EXTRACTION SYSTEM WELLS, PUMPS, AND HEADER

The extraction wells continue to operate as expected, pumping approximately 45 gpm each. The lack of controls and heat tracing has not adversely affected the performance of EW-3 for over four years. The lines between EW-1 and the treatment system were cleaned once since the system became operational to remove iron fouling.

4.3.2 EQUALIZATION/INFLUENT TANK

Approximately 55 gallons of sludge accumulates in the bottom of the 7,300-gallon influent tank per year. This sludge is removed and disposed of as non-hazardous waste.

4.3.3 AIR STRIPPER

The 50-foot tall air stripper is acid washed once per month. The pH in the influent tank is lowered to approximately 3.5 or 4.5 and water is recirculated through the air stripper. In addition, polyphosphate is added prior to the air stripper in an attempt to prevent it from precipitating onto the packing material. In 1998, chemicals from the cleaning of EW-1 inadvertently passed through the air stripper, perhaps resulting in further cleaning. The system failed to meet discharge standards on based on the 10/17/01 and 12/11/01 sampling results. Troubleshooting identified a failed blower motor as a cause of the decreased efficiency and failure to meet discharge standards. Sampling in April 2002, December 2002, and March 2003 indicate that the system is meeting discharge requirements and that the failed blower motor was the primary cause of the previous exceedances.

4.3.4 GAC

The GAC in the four 2,000-pound vapor phase GAC vessels is replaced every 18 months. This replacement frequency is based primarily on the historical frequency but OVA readings are taken regularly. Given that treatment plant removes less than 0.4 pounds of VOCs per day (216 pounds every 18 months), this translates to approximately 37 pounds of vapor GAC per pound of contaminants.

4.3.5 GYLCOL HEATING UNIT

This system functions as expected to dehumidify the air stripper off gas before treatment via vapor phase GAC.

4.3.6 SYSTEM CONTROLS

The system has a series of alarms that can indicate problems to the plant operator, and these alarms are connected to an autodialier that can contact the operator during off hours.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF O&M COSTS

According to the RPM, the annual costs for system O&M are approximately $378,000 per year. A breakdown of those costs is provided in the following table and subsections based on information provided by the contractor project manager during the RSE site visit. It should be noted that this annual cost exceeds the ROD estimate of $123,000 by more than 200%. Both the RSE team and the representatives from NYSDEC expected that such a system should likely cost approximately $200,000 per year. Furthermore, as discussed below, the current costs do not include any analytical costs because the laboratory analysis is provided at no cost to the site by the Contract Laboratory Project, which further inflates the actual O&M costs relative to the expectations of the ROD, NYSDEC, and the RSE team.

At the RSE site visit, the site team reported that during one recent year, the annual costs were reduced to approximately $260,000 for the year in order to accommodate reduced funding. The cost cutting measures included reduced operator hours (perhaps by 50%), reduced maintenance measures, and omitting replacement of the vapor phase GAC. As is evident from reviewing the following table, other measures were also likely taken to reduce costs by $118,000 (i.e., from approximately $378,000 for the year to approximately $260,000 for the year).

Item Description	Estimated Cost	Percentage of Total Cost
Labor: Project management, technical support, reporting	$150,000 per year	39.7%
Labor: Plant operator (hours)	$130,000 per year	34.4%
Labor: Groundwater monitoring (events, durations, number of teams)	$36,000 per year*	9.5%
Utilities: Electricity	$30,000 per year	7.9%
Non-utility consumables: GAC	$11,000 per year	2.9%
Non-utility consumables: chemicals and supplies for non-routine maintenance	$20,000 per year	5.3%
Waste disposal	$1,000 per year	<1%
Chemical analysis under Contract Laboratory Program	No cost to project	0%
Total Estimated Cost	**$378,000**	**100%**

** This cost is estimated relatively conservatively by the RSE team based on professional experience with labor and equipment costs for ground water sampling*

4.4.1 UTILITIES

At any given time, the treatment system has approximately 23 HP of pumps and blowers operating plus the 12.3 kW glycol heating unit. Heat tracing that is used during the winter would also add to the electrical usage when used. The contractor project manager indicated that utilities cost approximately $30,000 per year, which is consistent with an unit electrical cost of approximately $0.10 per kWh.

4.4.2 NON-UTILITY CONSUMABLES AND DISPOSAL COSTS

GAC is the single largest non-utility consumable cost at approximately $11,000 per year as reported by the contractor project manager. This cost covers replacement of the GAC in the four 2,000 pound vapor phase GAC vessels every 18 months, which translates to a unit cost of approximately $2 per pound of GAC. Other non-utility consumable costs include approximately $20,000 per year for 16 drums of polyphosphate per year, hydrochloric acid for the air stripper acid washes, and other materials and supplies. These other materials and supplies likely include insulation, which is reportedly replaced each winter, and replacement pumps or parts for the system.

4.4.3 LABOR

Labor is the largest component of annual costs, contributing over 80% of those costs. The plant operator consistently works a 40 hour week (including responding to alarm calls) at a reported cost of $130,000 per year. This translates to an hourly rate, including overhead, of approximately $60 to $65 per hour. With respect to project management, technical support, and reporting, a reported cost of $150,000 per year and an estimated hourly rate of $100 per hour, including overhead, should translate to approximately 1,500 hours per year, or approximately 28 hours in a 40-hour week. The cost for sampling labor is estimated by the RSE team based on information provided by the contractor. The contractor reports that there are four sampling events per year and that each sampling event requires three people working approximately three days. At an relatively conservative estimated cost of $3,000 per day for labor and equipment, this translates to an annual cost of approximately $36,000 per year.

In addition to contributing over 80% of the annual O&M costs, the actual labor costs also vary widely compared with the original ROD estimates. All actual costs were relatively equivalent with the ROD cost estimate except for operating labor and project management/technical support/reporting labor. The ROD estimated 312 hours per year of operating labor for $15,600 per year compared to the actual 2,080 hours per year for $130,000 per year. Therefore, the actual labor cost is over 8 times higher than expected. The project management/technical support/reporting labor was estimated in the ROD at an unusually low figure of $1,200 per year. The actual expense is $150,000 per year, which is unusually high, especially considering the lack of figures and analysis provided in reports and the lack of changes to the system since EW-3 was added.

4.4.4 CHEMICAL ANALYSIS

The site does not incur any costs for chemical analysis because the Contract Laboratory Program provides the laboratory analysis. The turnaround time between the collection of the sample and the report from the laboratory is approximately 6 to 8 weeks. Given the current process monitoring program, approximately 12 samples (including QA/QC samples) are analyzed per year for VOCs, SVOCs, and metals. Given the current ground water monitoring program, approximately 100 samples (including QA/QC samples) are analyzed for VOCs, SVOCs, and metals. Typical costs for these analyses on one sample would be approximately $400 per sample at a private laboratory, which would translate to a total analytical cost of approximately $45,000 per year.

4.5 RECURRING PROBLEMS OR ISSUES

The contractor reports the following recurring problems.

- annual insulation repairs
- electrical storms during the summer, which are the most common causes for system shut downs and alarm calls
- snow accumulation during the winter

4.6 REGULATORY COMPLIANCE

The treatment plant exceeded the discharge criteria for four VOCs in October 2001 and for one VOC in December 2001. The criteria, however, were met in April 2002, December 2002, and March 2002..

4.7 TREATMENT PROCESS EXCURSIONS AND UPSETS, ACCIDENTAL CONTAMINANT/REAGENT RELEASES

No reagent releases or accidents were reported to the RSE team.

4.8 SAFETY RECORD

No reagent releases or accidents were reported to the RSE team.

5.0 EFFECTIVENESS OF THE SYSTEM TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT

5.1 GROUND WATER

The ROD indicates that the carcinogenic risk and the noncarcinogenic hazard at the time of the Remedial Investigation were well below the criteria for active remediation when considering casual ingestion, dermal adsorption, and vegetable consumption. The carcinogenic risks for these three exposure routes were less than 5×10^{-7} and the noncarcinogenic hazard indices were less than 1×10^{-2}. The potential use of ground water downgradient from the site was evaluated as a hypothetical scenario because it was assumed that all downgradient residences were connected to public water. Under this hypothetical scenario, the carcinogenic risk (calculated with measured data) was 2.27×10^{-5} and the noncarcinogenic hazard index was 6.86×10^{-1}. These values were calculated using trans-1,2-dichloroethene, tetrachloroethene, and trichloroethene because they were among the most toxic components found at the site and had elevated concentrations in ground water based on the Remedial Investigation data. These compounds are no longer present at the site above background concentrations. They were likely removed during the soil remedy and through natural degradation. As early as 1994 (i.e., when the P&T system began operating), few, if any, samples had concentrations of these compounds over ground water cleanup standards and the measured concentrations were comparable to the background concentrations from MW-8 and MW-9.

It appears that the remedy has largely been protective with respect to site related contamination. Based on the limited hydraulic information available, it appears that the capture zone is likely sufficient to prevent further migration of site-related contamination. In one or two instances, site-related contamination (primarily chlorobenzene) was able to migrate off site, perhaps due to a temporary lack of capture when the system was shut down for extended maintenance or repairs. This migration is smaller in extent and magnitude than the downgradient migration of 1,1-dichloroethane and 1,1,1-trichloroethane that likely result from upgradient sources and the SMS remedy, in its current form, is incapable of providing complete capture of this contamination coming from upgradient.

It is beyond the scope of the RSE to evaluate the current risks associated with the site, but given the relatively low risks/hazards that were present at the time of the Remedial Investigation and the fact that the most toxic contaminants have been removed, it is likely that the incremental carcinogenic risk to the public is less than $1x10^{-6}$ and that the noncarcinogenic hazard index is less than $1x10^{-2}$

5.2 SURFACE WATER

The closest downgradient surface water is Guggenheim Lake, located approximately 1.5 miles from the site. The potential risks to this and other surface water bodies were not discussed as part of the RSE. The current degree of plume capture should provide adequate protection to surface water.

5.3 AIR

The primary route for impacts to the air is from the air stripper off gas. Given that the current mass loading is orders of magnitude lower than expected and that the vapor phase GAC is still replaced, the measures taken at the site are likely protective.

Site wells do not indicate elevated levels of ground water contamination, and soil contamination has been remediated to the soil cleanup standards. Therefore, vapor intrusion in this light industrial area is not likely an issue requiring attention.

5.4 SOILS

The soil contamination was remediated to cleanup standards via SVE between 1992 and 1994. No further protectiveness issues related to soil are expected.

5.5 WETLANDS AND SEDIMENTS

The RSE team is not aware of wetlands or sediments that may be impacted by site-related contamination.

6.0 RECOMMENDATIONS

Cost estimates provided herein have levels of certainty comparable to those done for CERCLA Feasibility Studies (-30/+50%), and these cost estimates have been prepared in a manner consistent with EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000.

6.1 RECOMMENDATIONS TO IMPROVE EFFECTIVENESS

6.1.1 IMPROVE REPORTING AND DATA ANALYSIS (INCLUDING EVALUATING PLUME CAPTURE)

The contractor provides quarterly sampling data summary reports to the EPA. The summary report reviewed by the RSE team was prepared in March 2003 and summarized the data from December 2001 and April 2002. It had no figures, no water level data, and limited data analysis. Although monthly reports are prepared by the operator and provided to the prime contractor, EPA does not receive reports that have system operating information, including flow rates, mass removal, discharge quality, and major maintenance.

Discharge sampling is not required by permit but is conducted on a quarterly schedule. The results are included in the quarterly report but are not discussed in the report text. In reviewing the quarterly report dated March 2003, the RSE team found that in the October 2001 and December 2001 sampling events several VOCs in the system effluent were above discharge criteria. During the RSE, EPA indicated that they were not aware of this problem. This indicates a failure of the report to adequately inform the project manager of important site-related issues and may also be a function of the unacceptably long delay (over one year) between sampling events and the submission of the associated report.

The quarterly reports should be improved and should be submitted in a timely manner. Improvement might include the following:

- a site map detailing the ground water sampling results
- a potentiometric surface map indicating the pumping rate and the interpreted or estimated capture zone
- a method of highlighting exceedances of the discharge criteria or ground water cleanup criteria in the data tables
- descriptions of maintenance to the P&T system
- P&T system parameters, including flow rates, mass loading, discharge quality, etc.
- a written evaluation (perhaps 1 to 2 pages) of the system performance with respect to capture of the contaminant plume, progress toward cleanup, and compliance with air and water discharge standards

Normally, the RSE team would expect the reports to be submitted within 1 to 2 months of the sampling event, but given the unusually long turnaround time associated with the Contract Laboratory Program (6 to 8 weeks), submitting the reports within 3 months of the sampling event is reasonable. For this particular site, the RSE team estimates that each report (as described above) should cost $10,000 to generate. This $10,000 is the total cost of each report and not additional to the existing costs. Therefore, the total annual reporting cost for this site should be approximately $40,000 if reports including the above-mentioned items are prepared. The first report might cost an additional $5,000 to generate base maps and templates, but given the history of an exceptionally high project management/technical support/report expense, these items should have already been completed.

The current budget for reporting was not provided to the RSE team; therefore, the change in annual O&M costs for implementing this recommendation cannot be reliably calculated. Section 6.2.1 discusses cost reductions for project management, technical support, and reporting. That discussion assumes this recommended level of reporting and the above-mentioned estimated cost of $40,000 per year when stating the RSE team's opinion of appropriate labor costs for this site. Therefore, the costs associated with implementing this recommendation are included in the estimated cost savings discussed in Section 6.2.1.

6.2 RECOMMENDATIONS TO REDUCE COSTS

6.2.1 REDUCE OPERATOR AND PROJECT MANAGEMENT/TECHNICAL SUPPORT/REPORTING LABOR

After discussion during the RSE site visit, it is not clear to the RSE team why a full-time operator is necessary at the site. The contractor stated significant time was necessary for maintenance of the insulation and other weather related issues, including alarms during electrical storms and snow removal. Other items may include acid washing the air stripper once a month and maintaining the polyphospate addition approximately once every three to four weeks. Basic O&M activities, such as checking the system, responding to alarms, maintaining chemical addition should, and acid washing the tower should be accomplished for approximately 16 hours per week or less. Additional time might be required on a semi-annual basis, but this should be no more than two additional 40-hour weeks per year. This labor estimate translates to approximately 912 hours per year compared to the current 2,080 hours per year and an annual cost of approximately $57,000 per year or more compared to the current $130,000 per year.

Reductions should also be made in the project management/technical support/reporting costs. As stated in Section 6.1.1, the recommended level of reporting will likely cost approximately $40,000. Reviewing invoices, coordinating site activities, and overall project management should likely cost approximately $36,000 per year (approximately $3,000 per month) for this relatively simple system. The RSE team acknowledges that technical support is necessary during O&M, and for the SMS site, approximately $30,000 per year (approximately 200 to 300 hours per year of senior time) is likely sufficient. The sum of these three cost estimates equals approximately $106,000 per year. Therefore, rounding up, this category of labor should cost approximately $110,000 per year. Instead, however, it costs an additional $40,000 even though a number of basic items are not provided.

- The quarterly reports require significant improvements including data analysis, basic figures, and information on the treatment system.

- The quarterly reports are delayed by more than a year from the time of the sampling event (i.e., the report summarizing the December 2001 and April 2002 data was submitted in March 2003).

- The treatment system had two exceedances of the discharge criteria in 2001, EPA (the client) was unaware of these exceedances, more exceedances may have occurred since that time, and influent/effluent sampling data since April 2002 is not yet available as of July 2003.

- Ground water sampling still continues quarterly for VOCs, SVOCs, and metals even though VOCs are the only remaining contaminants of concern.

The RSE team recommends reducing labor as stated above. A total savings of approximately $113,000 per year could be expected. Subtracting these costs from the current annual O&M costs of approximately $378,000 would yield approximately $255,000, which is similar to the reduced annual O&M costs ($260,000 for the year) that were achieved during one year to accommodate reduced funding.

6.2.2 OPTIMIZE MONITORING PROGRAM

All 20 site monitoring wells, the two extraction wells, and system influent and effluent are sampled quarterly (about 100 samples per year total, excluding QA/QC samples) and analyzed for VOCs, SVOCs and metals. Analysis for SVOCs and metals is not necessary at any wells because they are not being treated by the groundwater treatment system and SVOC and metals plumes do not exist. SVOC and metals analysis should continue only in the treatment system effluent to verify the discharge water quality. Eliminating the unnecessary analyses will not result in direct cost savings to the site because analyses are provided by the Contract Laboratory Program, but it should be done because it will reduce the amount of data to manage, the number of bottles in the field to manage, and the sample load on the laboratory.

Sampling at many monitoring wells could be reduced from a quarterly to annual frequency or eliminated altogether. For example, MW-01, MW-02, MW-03, MW-04, MW-05, MW-6D, and MW-07 repeatedly have concentrations that are either consistent with background concentrations or are undetectable. Eliminating these wells from the sampling program would not compromise the ability of the sampling program to evaluate the performance of the remedy. At the very least, the sampling frequency in these wells should be reduced to annual.

Monitoring should continue on a quarterly basis at the extraction wells and the monitoring wells in and downgradient of the source area (MW-6S, MW-6D, MW-15, MW-16S,M,D, MW-11, MW-12, MW-13S,D, and MW-14) because they are valuable for either documenting progress to cleanup (MW-6S) or verifying plume capture. MW-08 and MW-09 should also continue to be monitored because they provide background samples for the site and there is a history of background contamination. The above recommended revisions to the sampling program would reduce the number of monitoring well samples per year from approximately 80 to 59. Therefore implementing this recommendation should reduce sampling costs by approximately 25% from an estimated $36,000 per year to $27,000 per year.

6.2.3 CONSIDER DECREASING THE FREQUENCY OF VAPOR PHASE GAC REPLACEMENTS

The O&M manual provides the potential impact from air stripper off-gas and the New York State Ambient Guideline Concentrations (AGCs). The system was designed to comfortably meet the AGCs with the highly elevated concentrations measured during the Remedial Investigation. Now that influent concentrations and mass loading are substantially lower, it is likely that with the reduced influent concentrations, the AGCs can be met with less frequent GAC changeouts. This was demonstrated during the year with reduced funding when the site team opted to not replace the vapor phase GAC. The RSE team recommends screening both the influent and effluent to the vapor phase GAC to determine if the replacement frequency can be reduced to once every two years or once every three years. If this reduction is possible, a savings of approximately $3,000 to $5,000 per year may result without sacrificing protectiveness.

6.3 MODIFICATIONS INTENDED FOR TECHNICAL IMPROVEMENT

No specific recommendations are provided in this category. Rather, the site team is encouraged to focus on the recommendations in the other categories.

6.4 CONSIDERATIONS FOR GAINING SITE CLOSE OUT

6.4.1 DEVELOP AND EXIT STRATEGY

Although the remedy has not yet achieved its specific objectives (i.e., restoration to applicable standards), the risks that the ROD stated were the reason for active remediation are no longer present. It may therefore be appropriate to discontinue the P&T system now or in the near future and rely on other mechanisms to reach the cleanup goals. The RSE team sees the following potential approaches that could be adopted as the basis for the remedy exit strategy.

Continue operating the P&T system until all contaminants of concern are at or below background concentrations

Given that concentrations have not substantially decreased over the past four to five years with the current P&T system, this approach will likely take a number of years. This approach would provide the best measure of capture relative to the other approaches, but it would also likely cost more than the other approaches. With an optimized system, the annual costs will likely be on the order of $250,000 per year.

Discontinue the P&T system to determine if contamination will migrate offsite above specified concentration criteria

Under this approach, the site managers would discontinue the P&T system but would continue monitoring to verify that the remaining, relatively low level contamination, does not migrate off site at concentrations that would be of concern. To proceed with this approach, the site team should develop a set of criteria that, if exceeded when the system is shut down, would cause the P&T system to be restarted. The criteria should include sampling locations, concentrations for each contaminant of concern at those locations, and the number of samples with elevated concentrations that would be needed to justify restarting the P&T system.   The RSE team suggests that the monitoring program discussed in Section 6.2.2 provides the necessary monitoring locations. The concentration criteria for each contaminant might be the MCL, background, or some risk-based concentration. The site team may determine that at least two quarterly samples over the course of a year with concentrations above the criteria might be required to justify restarting the P&T system.

The site team would continue with its monitoring program to 1) monitor for attainment of the cleanup criteria and 2) monitor for contaminant migration, and this monitoring would continue until cleanup is reached, whether or not the P&T system is restarted. Developing this exit strategy should cost approximately $20,000 but annual O&M would likely consist only of monitoring, data analysis, and reporting. The annual O&M cost could likely be under $100,000 per year. Discontinuing the P&T system before cleanup goals are met in favor of monitoring only would likely require a ROD Amendment.

Pilot an alternative technology and determine if either that technology or another approach should replace the P&T system

Various alternative technologies are available for reducing mass of VOCs, including air sparging, bioaugmentation, and chemical oxidation. Any of these three approaches (and many others) rely on effective delivery of reagents and a method to monitor effectiveness. Unfortunately, many of the reagents that can be added may damage the wells and prohibit them from being effectively used in the future, if necessary. Providing oxygen in the form of air or oxygen releasing compound might enhance iron fouling of the wells, and chemical oxidation will generate substantial heat that could damage the well casing. In addition, air sparging would release contaminant vapors into the unsaturated zone. Although ground water monitoring suggests low VOC concentrations in the subsurface, it is possible that vapors that are released to the unsaturated zone could migrate into nearby facilities. If this approach is taken, the RSE team suggests the use of oxygen releasing compound (ORC) or the use of air sparging, provided that steps are taken to monitor the release of vapors into nearby facilities.

Following this approach could be similar to the above approach for discontinuing the P&T system. The site team could discontinue pumping for the duration of the pilot test, use select existing wells or newly installed direct-push injection points for delivery, and use the monitoring program discussed in Section 6.2.2 to monitor effectiveness. The test would occur in much the same way as the approach above, with the exception that active remediation is occurring. Because the active remediation should reduce contamination, there should be a reduced potential for contamination to migrate offsite. Because this is a pilot test, the costs for planning and executing should be relatively low beyond the cost of the reagents or air sparging equipment. The monitoring for effectiveness would likely continue well beyond the period of active remediation, and the pilot test would end with either 1) restarting the P&T system due to unacceptable plume migration or 2) monitoring demonstrating that cleanup levels have been reached at some point in the future without having to restart the P&T system. The RSE team envisions limiting the total cost for the planning and remediation to under $125,000 and the cost for developing the exit strategy to approximately $20,000. On an annual basis, this option would require additional level of effort beyond the option of monitoring only. The cost for this option would likely be under $150,000 per year. Because this is a pilot test, a ROD Amendment or ESD is not likely required unless the alternative technology is fully accepted and it is known that the P&T system will be permanently shut down.

6.4.2 CONSIDERATIONS IF P&T IS REQUIRED FOR A NUMBER YEARS AND MAINTENANCE IS AN INCREASING CONCERN

It is possible that P&T may need to continue at this site for a number of years (e.g., greater than 5 years), depending on the exit strategy chosen by the site time and/or the outcome of an active remediation pilot test. If this is the case, and the treatment system requires an increasing amount of maintenance (perhaps due to fouling or damage from weather), modifications or replacement may necessary.

If a future problem with the air stripper is determined to be fouling of the air stripper packing, replacing the packing should restore the air stripper to near its original efficiency. The air stripper would likely need to be dismantled to accomplish this, especially if fouling is significant. The RSE team estimates that a capital cost of $10,000 up to $60,000 would be required to either remove and replace the packing or replace the air stripping tower entirely (depending on the degree of fouling). The RSE team notes that replacement of the packing is likely not necessary at this point. Since the blower was replaced, the air stripper has met its discharge standards and VOCs in the effluent have largely been undetectable. The packing, however, should be inspected to evaluate the degree of fouling and the effectiveness of the current acid washing and polyphosphate addition.

If future problems require replacement of the air stripper, the RSE team provides the following options for consideration.

Replace the air stripper with Liquid Phase GAC

This option would involve replacing the current air stripper with two 5,000-pound liquid phase GAC units. The units themselves would cost approximately $30,000, and installation might require an additional $100,000. An additional $70,000 is estimated to remove existing unnecessary equipment and provide for contingencies. The units could be insulated and placed outside with the other equipment. The vapor GAC and associated glycol heater would no longer be necessary. Utility costs would decrease by about $15,000 per year based on the removal of the glycol heating unit and the air stripper blower. The polyphospate and hydrochloric acid would also no longer be needed, and much of the current maintenance would be reduced yielding potential savings of $10,000 per year in chemicals and maintenance parts. Due to improved reliability and automation, operator labor costs would be similar to or less than those discussed in Section 6.2.1.

Based on the influent data from October 2001 (a sampling event with relatively high concentrations compared to other recent events) and documented carbon isotherms, the RSE team estimates that approximately 150 to 200 pounds of GAC would be required to remove each pound of VOCs. Assuming an average mass loading to the treatment system of 0.2 pounds per day, this would translate to approximately replacing the lead GAC vessel two to three times per year based on chemical loading. This would likely translate to an estimated cost of approximately $25,000 per year, which is similar in magnitude to the decreased costs in utilities and chemicals described in the above paragraph.

With liquid phase GAC, fouling may be an issue. Including bag filters in the treatment train prior to the GAC units would help reduce the fouling, and the replacement frequency of two to three times per year for chemical loading may also be an appropriate replacement frequency for addressing fouling. The influent and effluent tanks should likely remain in place to allow for backwashing. Before proceeding, the RSE team would recommend further discussions with vendors and a pilot test to better estimate the replacement frequency based on chemical loading and fouling. This pilot test should be conducted for under $25,000 by diverting some of the influent through a test vessel of approximately 500 pounds of GAC. In sum, this approach may require $225,000 in capital costs, and the annual costs for chemicals, materials, and utilities would likely remain the same relative to operating the current system under the reduced labor as described in Section 6.2.1.

Replace the air stripper with a low-profile tray aerator

The existing packed tower air stripper could also be replaced with a low-profile tray stripper that can reliably provide 99% or greater removal efficiency for the contaminants of concern. A low-profile model, such as the North East Environmental Products (NEEP) models, can be easily serviced and cleaned to address iron fouling that may occur. There would be an increase in electrical costs for operating a larger blower, but these would likely be offset by reduced maintenance and discontinuing the acid washing and polyphospate addition. Due to improved reliability and automation, operator labor costs would be similar to or less than those discussed in Section 6.2.1. The stripper should be enclosed in a small, heated enclosure to avoid some of the weather problems reported by the current operator. A pilot test, however, would not be necessary because air stripping has already been proven effective at the site. With equipment, installation, electrical, and plumbing, and the enclosure, the RSE team estimates that the necessary modifications can be made for approximately $300,000.

6.5 SUGGESTED APPROACH TO IMPLEMENTATION

The RSE team suggests implementing recommendations 6.1.1, 6.2.1, 6.2.2, and 6.2.3 immediately and reducing annual O&M costs to approximately $250,000. The site team should then focus on the exit strategy as described in Section 6.4.1.

With respect to recommendation 6.4.1, the RSE team suggests proceeding with the second or third option, both of which involve discontinuing the P&T system, monitoring the potential for plume migration, and restarting the system if migration occurs at unacceptable levels. The RSE team further suggests adopting the selected exit strategy and approach by the end of calendar year 2003, while the site is still in the Long-Term Remedial Action phase. This would allow nearly a year and a half to determine if the P&T system will need to be restarted before the site is transferred to the state. If it does need to be restarted, EPA should evaluate the condition of the air stripper packing to determine if replacement of the packing is required.

7.0 SUMMARY

The RSE team observed a site where the soil remedy had effectively removed soil contamination, which had been providing a continuing source of dissolved ground water contamination. Ground water concentrations have decreased substantially, indicating the initial success of the remedies. The ground water remedy has continued to extract and treat contaminated ground water in an attempt to achieve its remediation objectives, but the system has failed to meet its discharge criteria on multiple occasions and the annual costs of operation are significantly more than the RSE team would expect for this site. The observations provided not intended to imply a deficiency in the work of the system designers, system operators, or site managers but are offered as constructive suggestions in the best interest of the EPA and the public. These observations obviously have the benefit of being formulated based upon operational data unavailable to the original designers. Furthermore, it is likely that site conditions and general knowledge of ground water remediation have changed over time.

The one recommendation to improve effectiveness in protecting human health and the environment is to improve the data analysis and reporting. Recommendations to reduce costs include reducing operator labor and project management/technical support/reporting labor. These components of labor comprise approximately 80% of the total O&M costs, and labor at this level is not necessary to operate and maintain this system. No recommendations are provided for technical improvement. Instead, emphasis should be placed on implementing the other recommendations. For site closeout, the RSE team recommends developing an exit strategy and provides three potential approaches for consideration. The risks that the ROD indicates as the reason for active remediation are no longer present. Therefore, two of the three approaches include discontinuing the P&T system and monitoring for potential plume migration. In addition, the RSE team provides considerations if the P&T system requires significant modifications or replacement in the future.

Table 7-1 summarizes the costs and cost savings associated with each recommendation. Both capital and annual costs are presented. Also presented is the expected change in life-cycle costs over a 30-year period for each recommendation both with discounting (i.e., net present value) and without it.

Table 7-1. Cost Summary Table

Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change In Life-cycle Costs ($) [1]	Estimated Change In Life-cycle Costs ($) [2]
6.1.1 Improve Reporting and Data analysis (Including Evaluating Plume Capture)	Effectiveness	$0	Included in 6.2.1	Included in 6.2.1	Included in 6.2.1
6.2.1 Reduce Operator and Project Management/ Technical Support/Reporting Labor	Cost Reduction	$0	($113,000)	($1,130,000)	($915,000)
6.2.2 Optimize Monitoring Program	Cost Reduction	$0	($9,000)	($90,000)	($73,000)
6.2.3 Consider Decreasing the Frequency of Vapor Phase GAC Replacements	Cost Reduction	$0	($3,000) to ($5,000)	($30,000) to ($50,000)	($23,000) to ($41,000)
6.4.1 Develop an Exit Strategy • Continue with P&T • Monitoring only • Aggressive remediation (e.g., air sparging)	Site Closeout	• $0 • $20,000 • $145,000	Annual costs would likely be as follows: • $255,000 per year for approximately 10 years • $100,000 per year for approximately 10 years • $150,000 per year for one year and $100,000 per year for 1 to 10 years thereafter		
6.4.2 Considerations if P&T is Required for a Number Years and Maintenance is an Increasing Concern[3]	Site Closeout	$225,000 to $300,000	$0	$225,000 to $300,000	$225,000 to $300,000

Costs in parentheses imply cost reductions.

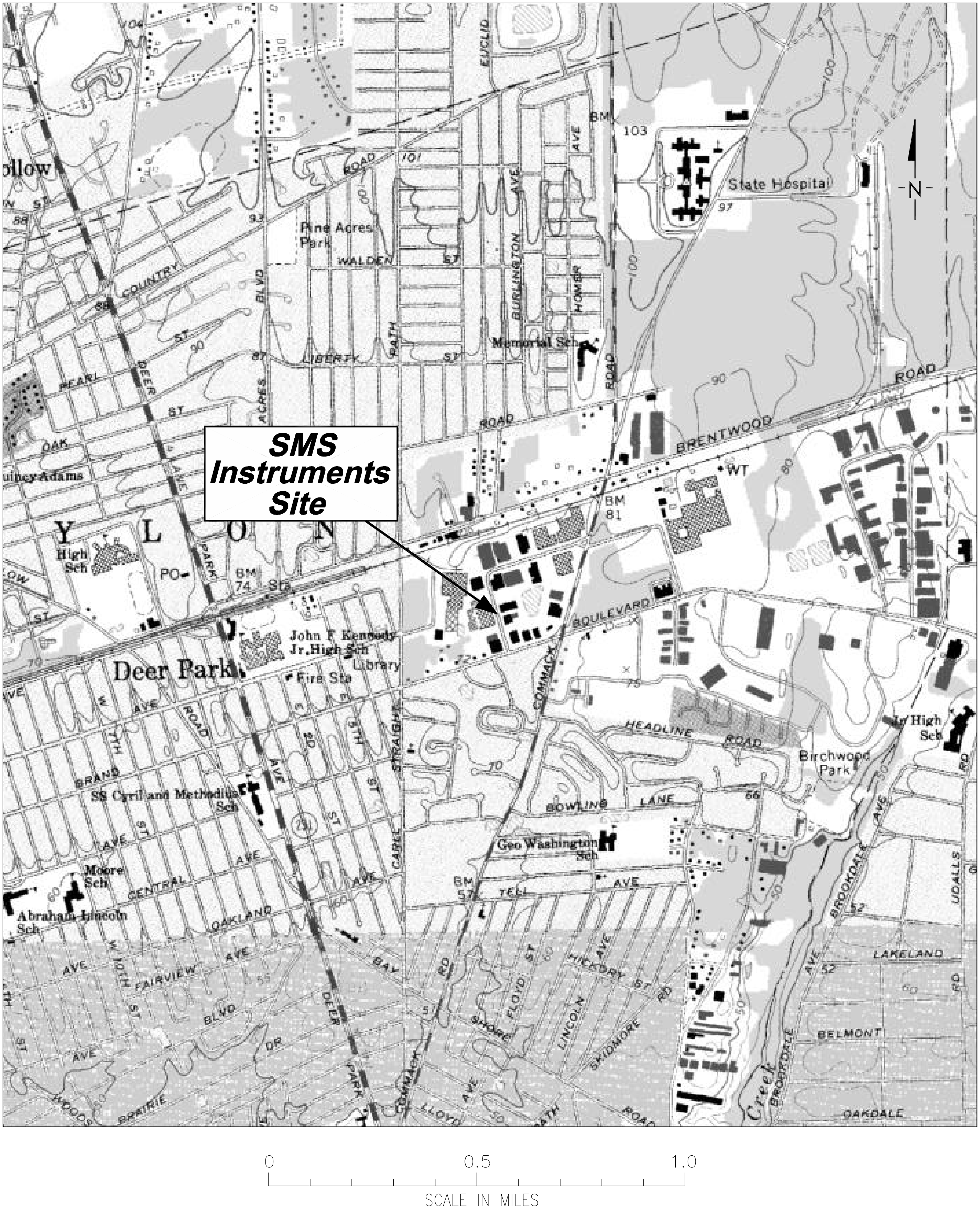
[1] assumes 10 years of operation with a discount rate of 0% (i.e., no discounting)

[2] assumes 10 years of operation with a discount rate of 5% and no discounting in the first year

[3] this is a consideration for the future only and not a recommendation for specific action at this point.

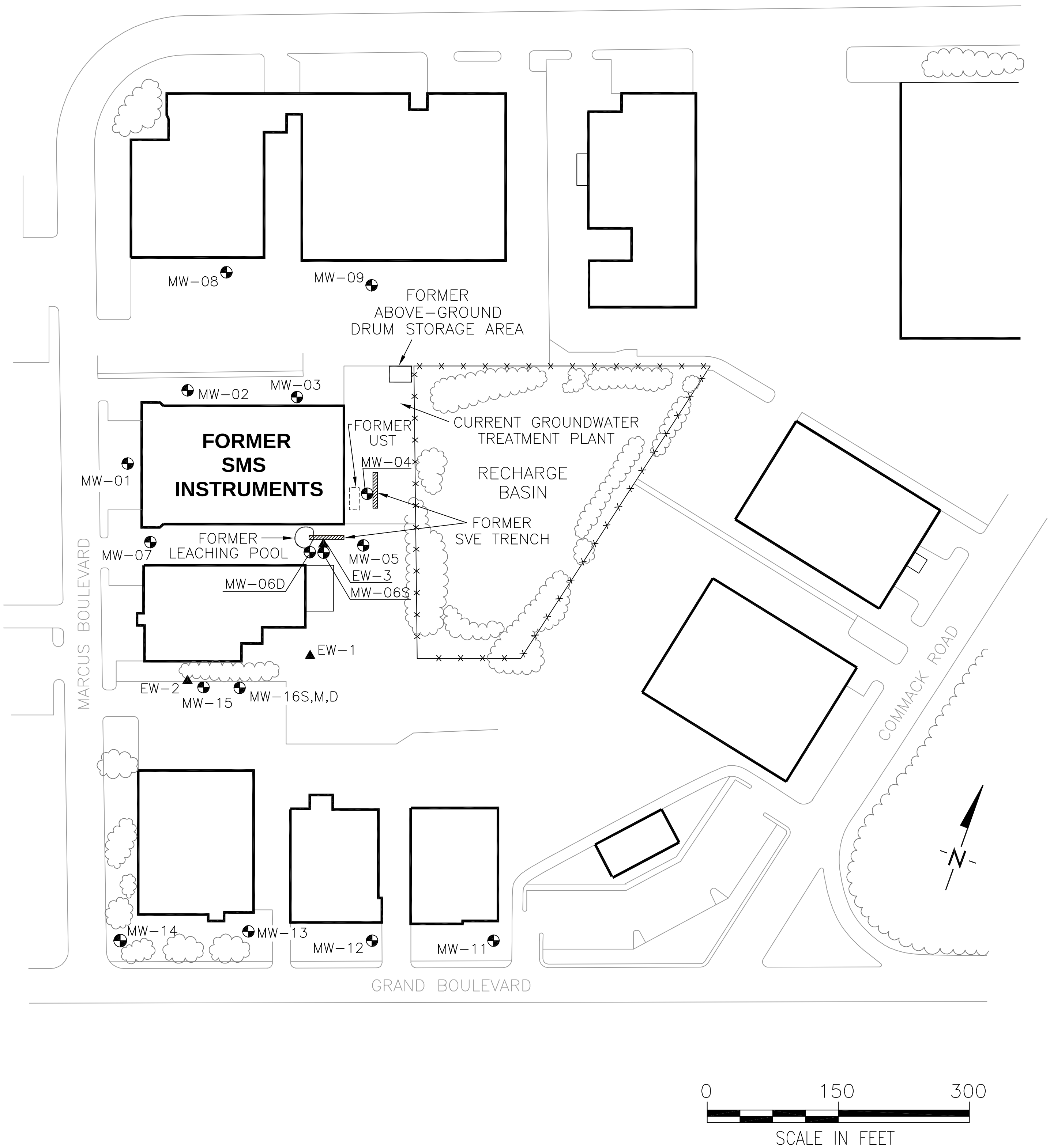
FIGURES

FIGURE 1-1. SITE LOCATION MAP.



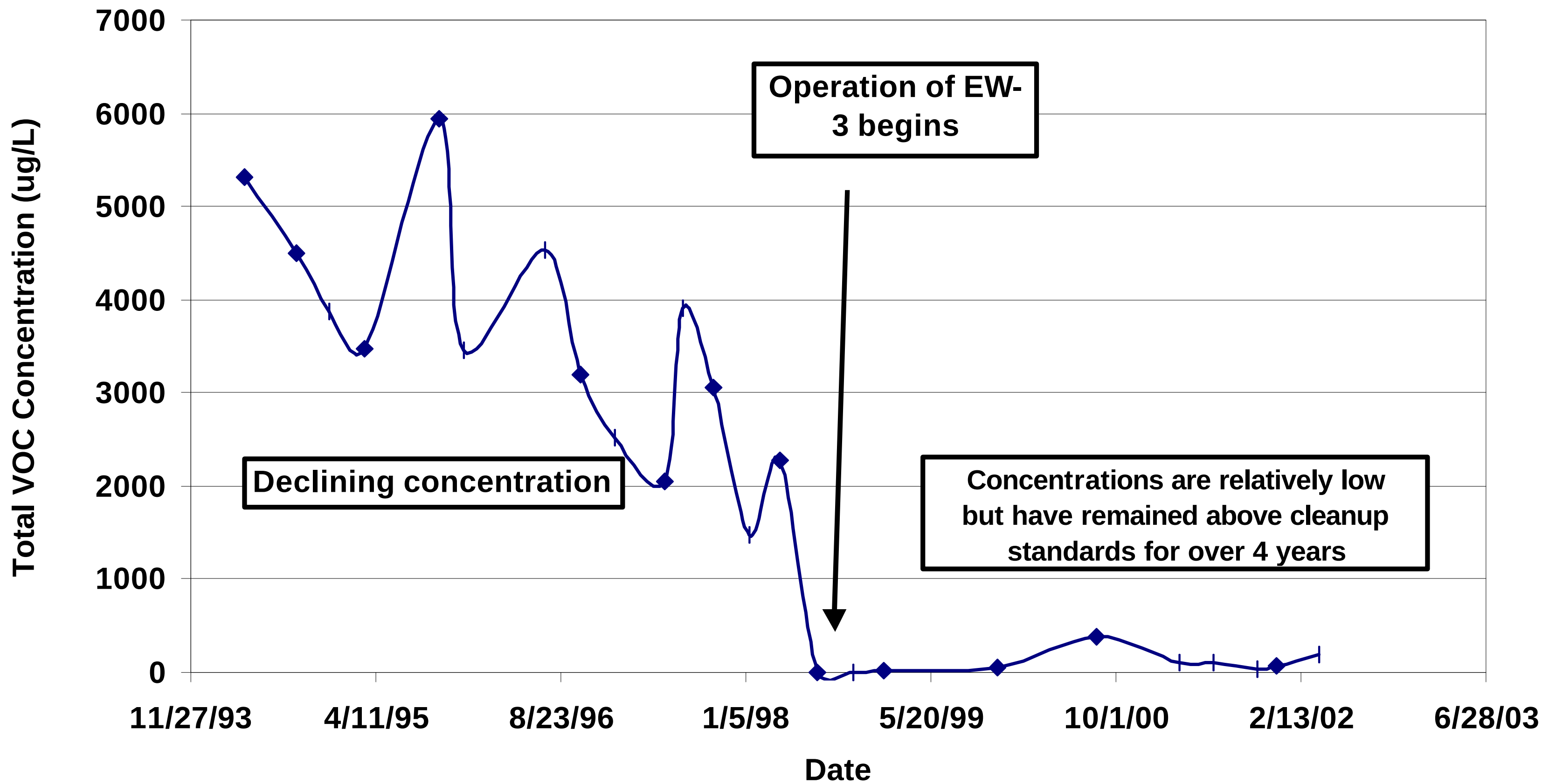
(Note: This figure is taken from the USGS Greenlawn Quadrangle.)

FIGURE 1-2. THE FORMER SMS INSTRUMENTS FACILITY, SURROUNDING AREA, AND WELL LOCATIONS.



(Note: This figure is taken from various figures generated by CDM Federal under work assignment 019-2LR5.)

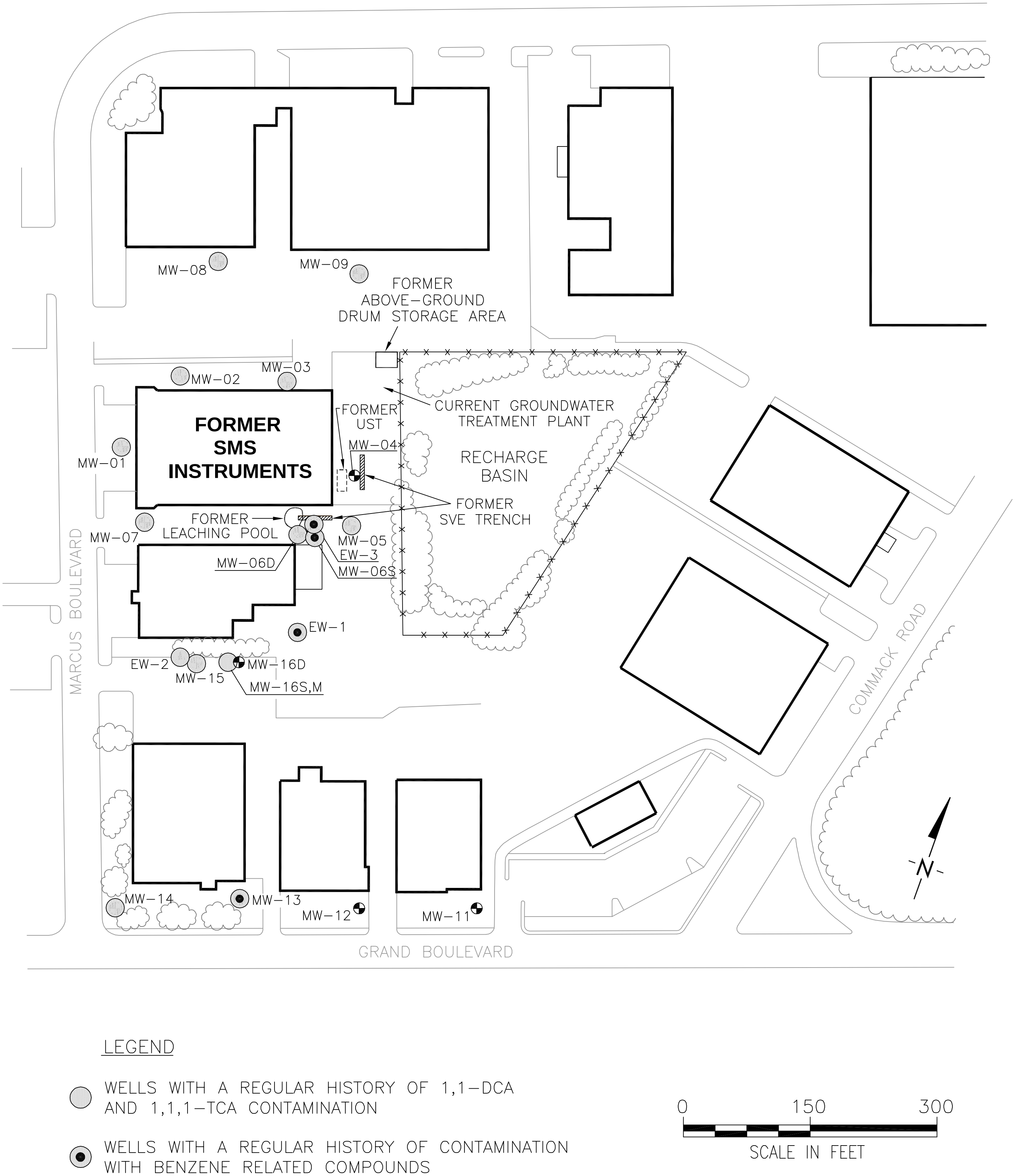
FIGURE 4-1. VOC CONCENTRATION TREND IN MW-6S



The VOC concentration in MW-6S (source area) declined between 1994 and 1998 due to the natural flushing of clean water through the site. EW-1, located at the downgradient boundary of the site, was installed to capture contamination before it moved offsite. The 1998 installation of EW-3 in the source area accelerated aquifer restoration. Concentrations are orders of magnitude lower than during the original investigations; however, they have remained consistently above cleanup standards. Data collected in sampling events since April 2002 have not been processed or reported as of July 2003.

(Note: This figure was compiled by the RSE team based on electronic data provided by CDM in July 2003.)

FIGURE 4-2. THE EXTENT OF SITE-RELATED AND NON-SITE RELATED CONTAMINATION.



(Note: This figure is taken from various figures generated by CDM Federal under work assignment 019-2LR5.)