REMEDIATION SYSTEM EVALUATION

DOUGLAS ROAD LANDFILL
ST. JOSEPH COUNTY, INDIANA

Report of the Remediation System Evaluation,
Site Visit Conducted at the Douglas Road Landfill Superfund Site
October 29, 2003

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Remediation System Evaluation
Douglas Road Landfill
St. Joseph County, Indiana

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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 No. ST-1-15.

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 (i.e., EPA, the State, and the site contractor) 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. The recommendations are based on an independent evaluation by the RSE team and represent the opinions of the RSE team.

The Douglas Road Landfill Superfund Site is located in St. Joseph County just north of Mishawaka, Indiana. The site consists of a 16-acre capped landfill located on an approximately 32-acre lot (including the land purchased in 1999 for a wetlands treatment area) that is bordered by farmland and wooded areas to the west, residential and commercial properties south and east, and the Indiana Turnpike on the north side. A reinfiltration basin is located in the southwest corner of the property.

Disposal in the landfill occurred between 1954 and 1979. The site team reported that trichloroethene (TCE) and vinyl chloride were detected in about 10 downgradient residential wells, thereby initiating investigation work at the site. The site was placed on the NPL on March 31, 1989. The following is a brief chronology of site activities:

1994 - EPA took over the site lead and then initiated and completed the Remedial Investigation (RI). The investigation indicated that the groundwater contaminant plume had migrated about 3,800 feet southwest of the landfill.

1996 - About 95 residences in the area were connected to public water.

1/2000 - The landfill cap was completed.

10/2000 - A P&T system consisting of five extraction wells, treatment in three constructed wetlands cells, and discharge to both an on-site reinfiltration basin and Juday Creek was constructed and began full-scale operation.

10/2002 - The landfill gas collection system was activated.

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

Ground water concentrations have decreased substantially since initial sampling in 1994, 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. The annual costs of operation are about $177,800 per year.

The site team produces thorough and well prepared annual performance reports, and the RSE team notes that the project management and reporting budget is very reasonable for the quality of reporting and management. The proposed annual monitoring well sampling frequency and the analytical parameters are appropriate for the 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 recommendations to improve system effectiveness:

- Contaminant levels in monitoring wells are very low. Analysis of groundwater from individual extraction wells would provide a good indication of contaminant levels in the general area of the well, and the addition of sampling at the 5 extraction wells is recommended on an annual basis (such sampling was previously performed form 1999 to 2002). This should require less than $1,500 per year.

- A shallow groundwater investigation using direct-push technology in the areas around EXT-5 and MW-11S will provide information to the site team that will improve the site conceptual model and allow better consideration of a site exit strategy. The combined direct-push investigation, including developing a work plan and producing a report, should be completed for less than $50,000

The RSE team suggests the following recommendations for cost reduction:

- At least 25% of the site analytical program cost is due to the intensive Level IV QA/QC protocol. With considerable long-term data available there is no need to exceed Level II standards. Reducing the QA/QC level will save about $10,000 per year.

- Discharge to Juday Creek requires an expensive annual sampling and evaluation program, and alternatives should be considered. Discharge to Juday Creek may be eliminated if the extraction rate is substantially reduced or if one of the current wetlands cells (which is no longer needed to meet discharged standards) is converted into an additional reinfiltration basin. Both of these options are discussed. Savings of approximately $30,000 per year might be realized if the Juday Creek sampling program could be eliminated.

No recommendations are provided in the technical improvement category. Rather, the RSE team suggests that emphasis be placed on the site closeout, effectiveness and cost reduction recommendations.

One recommendation is provided with regard to site closeout. The RSE team recommends developing an exit strategy and provides two potential approaches. The risks that the ROD highlighted as the reasons for active remediation are no longer present at the site. Therefore, one of the approaches includes discontinuing the P&T system and monitoring for potential plume migration. Elevated arsenic levels had not migrated off the site at concentrations of concern prior to P&T operation; therefore, it is highly unlikely that elevated concentrations would migrate off of the site if the system were shut down. No VOCs are consistently above PRGs in any monitoring or extraction well. Various VOCs (benzene, 1,2-

DCA, and vinyl chloride) have periodically exceeded PRGs in 3 monitoring wells (MW-3S, MW-6S, and MW-13S) since 1999. These exceedances are at relatively random levels near the PRG values and do not represent a definable plume. The site team is encouraged to consider the exit strategy for the site before implementing modifications to the treatment system.

The second approach includes continuing to operate only EXT-1 and EXT-2 due to the elevated arsenic level. The site team may want to consider revising the PRG for arsenic to be consistent with the site effluent standard or MCL if the pump and treat system is to continue operation until the arsenic PRG is met.

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	1235 Jefferson Davis Hwy, 12th floor Arlington, VA 22202 Mail Code 5201G phone: 703-603-8888 griesert.jennifer@epa.gov
GeoTrans, Inc. (Contractor to USEPA)	Doug Sutton	GeoTrans, Inc. 2 Paragon Way Freehold, NJ 07728 (732) 409-0344 Fax: (732) 409-3020 dsutton@geotransinc.com

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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. 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
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The recommendations are intended to help the site team (i.e., EPA, the State, and the site contractors) 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. The recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team.

The Douglas Road site was selected by EPA OSRTI based on a recommendation from the associated EPA Region. 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.

The RSE team was also accompanied by the following observer:

- Jennifer Griesert from EPA OSRTI

1.3 DOCUMENTS REVIEWED

Author	Date	Title
US EPA	7/13/1995	Record of Decision, OU1
US EPA	5/3/1996	Record of Decision, OU2
CH2M Hill	9/2000	Interim Remedial Action Report, Volume 1& 2
US EPA	9/11/2002	First Five Year Review Report for Douglas Road Landfill Superfund Site
CH2M Hill	1/2003	Long-Term Remedial Action 2002 Performance Report
CH2M Hill	9/2003	Long-Term Remedial Action 2003 Performance Report
CH2M Hill	10/2003	Excel Spreadsheet of Sampling Data (updated through September 2003)

1.4 PERSONS CONTACTED

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

Dion Novak, RPM, EPA Region 5
Kevin Herron, Indiana DEM

Dan Plomb, Project Manager, CH2M Hill
Roger Shields, Site Operator, CH2MHill

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 SITE LOCATION AND HISTORY

The Douglas Road Landfill Superfund Site is located in St. Joseph County just north of Mishawaka, Indiana. The site consists of a 16-acre capped landfill located on an approximately 32-acre lot (including the land purchased in 1999 for a wetlands treatment area) that is bordered by farmland and wooded areas to the west, residential and commercial properties south and east and the Indiana Turnpike on the north side. A reinfiltration basin is located in the southwest corner of the property. The location of the site and the surrounding area are depicted in Figure 1-1. The site layout including monitoring wells, extraction wells and pipelines is shown on Figure 1-2.

In the early 1950s the landfill area was excavated and the gravel removed for use in the construction of the turnpike. Uniroyal Plastics, Inc. leased the gravel pit and used it as a disposal repository between 1954 and 1979. From 1954 to 1971, the landfill was used to dispose of solvents, fly ash, paper, wood stock, rubber and plastic scrap, and from 1971 to 1979, the landfill was used to dispose of fly ash only. In December 1979 the landfill was closed. Site contamination was first discovered when trichloroethene and vinyl chloride were detected in about 10 residential wells downgradient of the landfill.

1986 - The EPA nominated the site for inclusion on the National Priorities List.

1989 - The EPA placed the site on the NPL list and Uniroyal agreed to perform an RI/FS.

1991 - Uniroyal filed for bankruptcy and discontinued work on the RI/FS.

1994 - EPA took the site lead and completed RI work.

1995 - A Record of Decision (ROD) was issued for OU-1. The ROD selected remedy included installation of a composite cap, collection of landfill gas, collection of surface water drainage and groundwater, and source area monitoring.

1996 - A Record of Decision (ROD) was issued for OU2. The ROD selected remedy included groundwater extraction, treatment by artificial wetland, and a combination of reinfiltration and surface water discharge.

1996 - A city waterline was extended to provide water to about 95 homes that were impacted or could potentially be impacted by site contamination.

1999 - Pumping was initiated in the downgradient extraction well EXT-5 to provide water for wetland planting and acclimation.

2000 - Construction of the cap and P&T system was completed, and the P&T system began operating.

2002 - Active landfill gas collection was initiated (the vents had been connected during cap construction) after elevated methane levels were found on the east side of the landfill.

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

According to site documents, Uniroyal disposed of approximately 302,400 gallons of liquid waste including methyl ethyl ketone, acetone, tetrahydrofuran, toluene, hexane, and xylenes at the landfill. The landfill has been capped, limiting leaching by precipitation, but the waste may periodically be in contact with groundwater. The landfill gas system is removing methane as well as VOCs from the landfill waste. Based on the concentrations of contaminants in groundwater adjacent to the landfill (both pre- and post-cap) it appears that minimal contaminant source mass, if any, is reaching ground water. Monitoring well MW-11S, located about 1,250 feet west of the landfill and slightly north of the historic plume location, has had consistently higher tetrachloroethene (PCE) concentrations than any other monitoring wells and no detections of any other VOCs. Additionally, PCE has not been detected in the landfill gas extraction system effluent. No alternative contaminant source has been identified for the contamination at this well, but no investigation has been conducted upgradient from MW-11S. Therefore, a source of PCE may exist upgradient of MW-11S.

1.5.3 HYDROGEOLOGIC SETTING

The site overlies the prolific sand and gravel outwash deposits of the St. Joseph surficial aquifer. An intermediate clay till deposit separates the aquifer into upper (shallow and intermediate) and lower (deep) zones. Private water supplies and the public supplies for South Bend and Mishawaka rely on the St. Joseph aquifer.

Groundwater at the site is typically present between 10 and 20 feet below ground surface. Monitoring wells at the site are screened in shallow (about 15 to 30 feet bgs), intermediate (about 35 to 55 feet bgs) and deep (about 90 to 100 feet bgs) zones. There is no confining unit between the brown sand of the shallow zone and the brown sand and gravel of the intermediate zone. The gray sand and gravel of the deep zone is separated from the upper zones by a 5 to 15 foot thick silty clay layer. Site groundwater impacts have been found only in upper zone wells. A potentiometric surface map generated during the May 2003 groundwater sampling suggests a shallow zone hydraulic gradient for the site of approximately 0.003 feet per foot directing ground water flow to the west. In the area of the landfill and wetlands, the flow direction has a southerly component. The average hydraulic conductivity is reported to be 215 feet per day. Using an average porosity of 0.30 results in a groundwater velocity of about 800 feet per year.

1.5.4 RECEPTORS

The primary potential receptors are residential water supply wells. Residential well and monitoring well sampling from the RI indicated impacts as far as 3,800 feet southwest of the landfill. A water line was extended to provide water to about 95 residences, including about 10 that had VOCs detected in their wells. Residential wells are still in use downgradient of the landfill, outside of the plume area. Well and surface water sampling indicates that VOCs did not reach Juday Creek.

1.5.5 DESCRIPTION OF GROUND WATER PLUME

In May 2003, the following wells had contamination exceeding the proposed remediation goals (PRGs).

Well	Contaminant Exceeding Standard	May 2003 Concentration (ug/L)	PRG (ug/L)
MW-6S	Arsenic 1,2- Dichloroethane Benzene	29 10 4.4	2 1 2.8
MW-3S	Arsenic	15	2
MW-4S	Arsenic	4.3	2
MW-10S	Arsenic	5	2
MW-13I	Arsenic	2.1	2
MW-13S	Arsenic	2.1	2

Note: The extraction wells were not sampled in May 2003.

Figure 1-3 presents the extent of arsenic above PRGs based on the May 2003 sampling event. The most significant arsenic impacts are at MW-3S (15 ug/L), which is located less than 100 feet downgradient of the landfill, and MW-6S (29 ug/L), which is located less than 500 feet downgradient of the landfill. The arsenic impacts at MW-6S and MW-3S are relatively stable, and the other arsenic impacts are above the PRGs but are below 5 ug/L (the MCL is 10 ug/L).

In addition to the VOCs listed in the above table, tetrachloroethene (PCE) was detected at 35 ug/l in MW-11S (May 2003) and TCE was detected at 7.5 ug/L at EXT-5 (last sampled December 2000). Although there is no PRG for PCE, the US EPA MCL for PCE is 5 ug/l. The PRG for TCE is 5 ug/l (equal to the US EPA MCL). Both the PCE and TCE impacts may be from an off-site source. The PCE concentrations at MW-11S, which is located approximately 1,250 feet west (side-gradient) of the north boundary of the landfill, have gradually decreased since 2000.

Figure 1-4 presents the monitoring locations where VOCs were above PRGs and/or MCLs based on the May 2003 sampling event. VOC concentrations have remained relatively stable at MW-6S. Historical sampling of monitoring wells indicates a significant decrease in VOC concentrations in MW-3S, which previously had the highest concentrations found at the site. Total VOC concentrations (not including tetrahydrofuran) have decreased from 61.6 ug/l in November 1999 and 128 ug/l in November 2000 to 4.2 ug/l in May 2003.

2.0 SYSTEM DESCRIPTION

2.1 SYSTEM OVERVIEW

The original alternative selected in the ROD included extraction from five wells (EXT-1 through EXT-5) at a combined rate of 830 gallons per minute. The actual extraction rate from the system was about 300 gpm in 2003. The extraction has been focused on EXT-1 and EXT-2 (about 150 gpm combined) immediately downgradient of the historical landfill contaminant source and EXT-5 (about 150 gpm) downgradient in the area of the former residential well impacts. Wells EXT-3 and EXT-4 are located downgradient of the site reinfiltration basin and were located there to potentially intercept infiltrated water if treatment was not sufficient. Pumping from these two wells has since been determined to be unnecessary since the infiltrating water and groundwater in the wells meets cleanup criteria.

The treatment system consists of two parallel lined constructed wetland cells followed by a lined constructed wetlands polishing cell. The combined wetland area is 8.8 acres. The treated water is discharged to a reinfiltration basin adjacent to the polishing cell and a vegetated “filter strip” adjacent to Juday Creek. These features are indicated on Figure 1-2. Emergency discharge to the City of Mishawaka POTW is available if it is ever needed. The reinfiltration basin was designed to be 1.8 acres but was constructed at about one half that size. The discharge of treated groundwater, precipitation, and surface water runoff to the filter strip is limited to 225 gpm, and the remaining water is infiltrated. The system is automated to prevent high levels in the cells by shutting off extraction wells. This typically occurs during heavy precipitation events.

The monthly sampling of the combined extraction system influent from January to September 2003 showed only one detection in the influent above the effluent criteria (arsenic at 5.2 ug/l in May 2003). TCE was detected in three samples at 1 to 1.5 ug/l, arsenic was detected in all 9 samples at 2.1 to 5.2 ug/l, and toluene was detected in three samples at 1 to 2.4 ug/l. TCE has not been detected in any monitoring well since 2000 but was found in EXT-5 at 4 ug/l and EXT-2 at 1.4 ug/l in 2002. The following table summarizes the contaminant concentrations in the plant influent for 2003. The maximum 2003 influent concentration and the effluent standards are provided.

Parameter	Maximum 2003 Influent Concentration (ug/L)	Effluent Standard (ug/L)
Arsenic Lead	5.2 <3.0	5.0 Not listed
Chloroethane	1.1	No limit
Vinyl Chloride	not reported	2.0
Trichloroethene	1.5	5.0
1,2 Dichloroethane	<1.0	5.0
Benzene	<0.5	5.0
1,1 Dichloroethane	<1.0	90.0
Toluene	2.4	Not listed

Given these low influent concentrations and an extraction rate of 300 gpm, the maximum mass loading to the treatment system is about 0.02 pounds of VOCs per day and about 0.02 pounds of arsenic per day. In comparison the landfill gas extraction system has removed about 0.4 pounds of VOCs (~75% toluene) per day since it was activated in October 2002.

2.2 EXTRACTION SYSTEM AND INJECTION SYSTEM

The current extraction system includes EXT-1 (also referred to as EXT-1A, EW -1, EXT-01), near MW-6S about 400 feet downgradient of both the capped landfill and MW-3S. EXT-2 is about 350 feet directly south of EXT-1. EXT-3 and EXT-4 are located along the same north-south axis at the south end of the reinfiltration basin. EXT-5 is about 3,600 feet downgradient of the landfill, southwest of the middle of the capped landfill. Each well is 10 inches in diameter and about 55 feet deep with 22 to 27 feet of stainless steel screen. The wells are outfitted with 7.5 to 15 HP pumps, and the wellheads are completed in 3 foot square underground vaults. Flow control valves are used to maintain continuous flow from the well pumps. An HDPE header pipe connects the wells and runs to the head of the wetland cells. Two control panels with separate autodialers are utilized: one for EXT-5 and one for the other wells. The panels have controls for each pump and flow rate readouts from the pumps and outfall.

2.3 TREATMENT SYSTEM

The constructed wetlands system consists of 8.8 acres of wetlands in three cells. Cells 1 and 2 are parallel primary treatment cells each handling half of the extracted flow. Cell 3 is a polishing cell for the effluent of both cells. The wetland system was designed with consideration for precipitation for a hydraulic residence time (HRT) of 4 days assuming a 2-foot operating depth. The actual HRT in 2003 has ranged from 5 to 18 days due to the lesser groundwater extraction rates in comparison to the design. The system design (Interim Remedial Action Report; September 2000) estimated a VOC and arsenic removal rate of about 15%, and all estimated influent concentrations during design, except vinyl chloride (2.1 ug/l versus 2.0 ug/l), were below the proposed discharge limits. Both vinyl chloride and arsenic estimated influent and effluent concentrations were above the proposed remediation goals (PRGs).

The actual VOC removal rate in 2003 is difficult to estimate since TCE was the only VOC detected and it was detected in the influent in only 3 out of 9 months, but the VOC removal rate appears to be over 30%, and the arsenic removal rate in 2003 has been about 40%. Influent and effluent concentrations have been below the discharge limits since operation began except for the influent in May 2003, but both the influent and effluent have typically been above the PRGs.

The reinfiltration basin allows about 100 gpm of treated water back into the aquifer. This is significantly less than the design rate (reported to be 6 inches per hour, which translates to more than 2,000 gpm for 0.9 acres) . The low reinfiltration rate, combined with the Juday Creek surface water discharge flow maximum, limits the extraction well operation. The volume reinfiltrating has been limited due to sediment buildup and algae growth. Annual dredging of the basin is conducted to maintain the infiltrating capacity, but even with corrective action the infiltration rate is an issue, particularly when precipitation generates significant runoff.

The landfill gas collection system consists of a 1 horsepower blower and a knockout tank. The collected gas is discharged directly to the atmosphere at a rate of about 90 scfm. The methane content of the vapor in 2003 has been 2.6% to 3.5 %. The total VOC concentrations have ranged from 25,750 ug/m^3 to 54,650 ug/m^3. Toluene has been 67% to 74% of the total VOCs. Other VOCs, including 1,1,1 TCA; 1,1 DCA;

benzene; chloroethane; cis-1,2-DCE; ethylbenzene; methylene chloride; xylenes; TCE; and vinyl chloride have been detected in the vapor in 2003.

2.4 MONITORING PROGRAM

All 33 current site monitoring wells (16 shallow, 15 intermediate, and 2 deep) are sampled semi-annually (future monitoring well sampling will be on an annual schedule). The combined system influent and effluent is sampled monthly. Individual extraction wells were sampled annually from 1999 to 2002. Monitoring wells are sampled by purging three well volumes with dedicated pneumatic QED sampling pumps then collecting VOC samples at a low flow rate directly from discharge tubing and dissolved metals samples through an inline field filter. Extraction wells are purged for about 5 minutes of pumping and samples are taken without field filtering Analysis is conducted for VOCs, arsenic, and lead. The resulting data are presented in a semi-annual groundwater monitoring report. A detailed surface water, sediment, and aquatic biota sampling is conducted annually in Juday Creek. QA/QC Level IV protocol is used for sample analysis. The results of these sampling programs are presented in annual Long-Term Remedial Action Reports.

The 18 landfill gas monitoring stations and the landfill gas collection system effluent vapor are checked for methane concentrations on a quarterly schedule, and the collection system vapor is also analyzed for VOCs.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

There are two RODs for the site, and a waterline extension was completed as a time critical emergency removal action. Components for the RODs for each operable unit are as follows:

OU1 (July 13, 1995) - installation of a composite barrier cap, collection of landfill gas, surface water drainage, and groundwater monitoring

OU2 (May 3, 1996) - groundwater extraction for containment, groundwater treatment by artificial wetlands, discharge, and monitoring

The OU2 ROD states that the objective of the action is to remediate contaminated groundwater, both on-site and off-site. Groundwater remediation would be expected in 20 to 60 years of operation.

The proposed remedial goals (PRGs) for the primary contaminants of concern that remain at the site as of the RSE are summarized in the following table.

Contaminant Exceeding Standard	Proposed Remedial Goal (ug/L)
Arsenic	2
Chloroethane	2,085,700
Vinyl Chloride	1
1,2-Dichloroethane	1
Benzene	2.8
Trichloroethene	5
1,1-Dichloroethane	3,530

Iron was included as a contaminant of concern in the ROD with a PRG of 380 ug/l; however, it was subsequently dropped due to its ubiquity in the area. Lead is not included as a contaminant of concern but lead concentrations are monitored. Tetrachloroethene (PCE) is not included as a contaminant of concern even though MW-11S has had PCE concentrations consistently above the MCLs. The exclusion of PCE from the contaminants of concern is probably because the PCE is likely from an upgradient, off-site source.

3.2 TREATMENT PLANT OPERATION STANDARDS

The effluent standards for the constituents of concern for discharge to Juday Creek are provided in the following table. The effluent standards for the infiltration basin are presumably the PRGs presented above.

Parameter	Effluent Standard (ug/L)
Arsenic	5
Chloroethane	No limit
1,1-Dichloroethane	90.0
1,2-Dichloroethane	5.0
Benzene	5.0
Trichloroethene	5.0
Lead	Not listed
Vinyl chloride	2.0

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The RSE team observed a site where the landfill capping and landfill gas collection remedies have been implemented, and a groundwater extraction and treatment system has been operating for 3 years. Ground water concentrations that were relatively low initially, have decreased substantially, indicating the initial success of the remedies. The ground water concentrations observed in monitoring wells and the treatment system influent indicate minimal remaining groundwater impacts at the site. The site team is beginning to consider what operations indicators or time frame should be considered for suspending and terminating active remediation. 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

Depth to water measurements are collected semi-annually, these measurements are converted into water elevations and presented in the semiannual reports. The potentiometric maps do not indicate a capture zone associated with the extraction wells; however, the location of the monitoring wells and water level measurements is not conducive to determination of capture.

4.2.2 CAPTURE ZONES

The Five Year Review (September 11, 2002) states that groundwater is being contained at the site. It was reported that groundwater modeling had been done, but the RSE team did not review any documents that indicated that containment was feasible at the actual groundwater extraction rates, which are less than 40% of the design values.

A water budget analysis as shown below provides an indication of containment effectiveness. 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 for effective capture. As stated in Section 1.5.3 of this report, the hydraulic gradient is approximately 0.003 feet per foot and the hydraulic conductivity estimated at approximately 215 feet per day. This translates to a Darcy velocity of 0.65 feet per day. The saturated thickness from the water table to the bottom of the upper zone is approximately 30 feet, and a representative width of contamination is approximately 700 feet (i.e., from MW-6S south of EXT-2). This yields a total cross-sectional area of approximately 21,000 square feet (30 feet deep by 700 feet across) to contain. Therefore, approximately 13,700 cubic feet per day (0.65 feet per day times 21,000 square feet) enter the site from upgradient during non-pumping conditions. This is equivalent to approximately 102,000 gallons per day. The pumping rate from EXT-1 and EXT-2 is approximately 150 gpm combined (approximately 216,000 gallons per day), so the amount of ground water extracted from EXT-1 and EXT-2 is approximately a factor of 2 times greater than the amount of ground water flowing through that portion of the site based on the reported hydraulic data. A water budget analysis, therefore, supports that capture is provided.

An evaluation of water quality data from monitoring wells downgradient of the expected capture zone is inconclusive for determining capture zone effectiveness because a VOC plume was never clearly delineated by monitoring wells. However, the TCE concentrations at downgradient extraction well EXT-5 and the combined system influent have decreased since full-scale pumping began in October 2000. The TCE concentration at EXT-5 was 7.5 ug/l in November 2000 and 4 ug/l in December 2002. The combined influent TCE concentrations were 4.7 ug/l to 6.3 ug/l in the first three months of operation and have been below 1 ug/l for the past five months (May to September 2003). This again supports that capture is provided.

4.2.3 CONTAMINANT LEVELS

Ground water contamination at the site has decreased substantially since the RI. The RSE team attributes this decrease to a productive aquifer augmented by the recent groundwater extraction. The following table provides maximum ground water concentrations prior to remediation (i.e., from the 1994 RI and other sampling prior to full-scale groundwater extraction in October 2000) and the maximum concentrations from the May 2003 sampling event.

Contaminant Exceeding Standard	Maximum Pre-Remediation Concentration(ug/L)	Maximum May 2003 Concentration (ug/L)
Chloroethane	91 (MW-3)	39 (MW-6S)
1,2-Dichloroethane	16 (MW-3)	10 (MW-6S)
1,1-Dichloroethane	8.3 (MW-3)	<1
Tetrahydrofuran	15,000 (MW-3)	<2
Tetrachloroethene (PCE)	110 (MW-11S)	35 (MW-11S)
Trichloroethene (TCE)	7.5 (EXT-5)	<1
Benzene	55 (MW-3)	4.4 (MW-6S)
Arsenic	35 (MW-3S)	29 (MW-6S)

As is evident from the table, most contaminant concentrations have decreased significantly. They are, however, not low enough to meet the cleanup standards at all wells (see Section 1.5.6) and conditions have been nearly stable for the past three sampling events since May 2002.

The site-related contaminantion found in MW-3S (and MW-6S) appears to be limited to the source area and the area immediately downgradient of the source area because the wells further downgradient between the source area and EXT-5 (MW-9S,-9I,-10S, and -10I) do not have (and have not recently had) significant impacts.

TCE is the main contaminant of concern detected in downgradient well EXT-5. TCE is not detected in EXT-1 and is less than 2 ug/l in EXT-2 so it is unclear if the containment provided at the landfill by these 2 wells helps reduce downgradient TCE concentrations. Therefore, the TCE impacts found in groundwater extracted from EXT-5 could be from an unidentified source possibly south of the site. Because concentrations at EXT-5 are decreasing, any additional TCE source is likely minimal.

PCE is not a constituent of concern, and the PCE contamination in MW-11S appears to be from an off-site source. MW-11S is side-gradient of the landfill and the chemical signature at MW-11S very different from the other site wells. None of the other site wells have or have had detectable PCE concentrations, and MW-11S has undetectable concentrations of other site-related contaminants. These impacts are outside of the extraction well capture zones and appear to be decreasing with time. The site team intends to allow these concentrations to further attenuate without remedial action.

4.3 COMPONENT PERFORMANCE

4.3.1 EXTRACTION SYSTEM WELLS, PUMPS, AND HEADER

The extraction wells continue to operate effectively. Pumping has appropriately been focused on EXT-1 (October 2002-2003 average rate of about 50 gpm), EXT-2 (about 79 gpm) and EXT-5 (about 132 gpm). Pumping at EXT-3 and EXT-4 has averaged less than 20 gpm each. Pumping rates are limited by the infiltration basin capacity but the extraction rate appears to be sufficient for containment of groundwater under the northern portion of the landfill where historical impacts were found. Pumping at EXT-5 captures groundwater from an extensive downgradient area. There were no problems reported with the pumps or PVC and HDPE piping.

4.3.2 CONSTRUCTED WETLAND

The 8.8 -acre constructed wetlands are operating at less than 50% of the design capacity. The system has a capacity of about 4.3 million gallons at a 2-foot operating depth. The design hydraulic residence time of 4 days accommodates over 650 gpm of influent (about 4.5 inches/day hydraulic loading rate). The system has operated in 2003 with monthly hydraulic loading rates ranging between 1.0 to 3.9 inches per day with an average of 2.04 inches per day. The treatment efficiency for VOC and arsenic removal, which is greater than 30% and about 40% respectively, has been higher than the design of 15%. The influent to the system has been below the effluent standards for all but one month (arsenic at 5.2 ug/l versus the 5.0 ug/l standard in May) in 2003, so that typically no treatment is required. An algae growth problem has been addressed by the application of barley straw.

4.3.3 REINFILTRATION BASIN

The reinfiltration basin has been the limiting process in the extraction/treatment/discharge system. The basin was constructed smaller than originally designed due to property availability and has had algae and sediment fouling problems. The basin has allowed a groundwater outflow of about 80 gpm in 2002 and 116 gpm in 2003, which is reduced from the initial 2001 rate of about 230 gpm. Dredging and mechanical scraping of the basin floor has been used to maintain capacity. With the additional Juday Creek discharge capacity, the available extraction rate has likely been sufficient for hydraulic containment of the northern portion of the site.

4.3.4 JUDAY CREEK DISCHARGE

The allowable discharge rate to the filter strip adjacent to Juday creek is 225 gpm. The approximately 500-foot long by 60-foot wide filter strip contains 5 perforated drains in a vegetated, bermed area. The city is maintaining the filter strip as part of the agreement with the site team. Annual sampling and studies have not indicated impacts from the Douglas Road site from the filter strip discharge.

4.3.5 CAP AND LFG SYSTEM

The landfill cap has minimized leaching of contaminant from the landfill and allowed the landfill gas extraction system to effectively remove VOC mass from the landfill. The landfill gas system, consisting of 15 extraction points and a 1 HP blower discharging about 90 cfm, has recovered over 20 times more VOC mass than the groundwater extraction system in the year that it has been in operation. In addition the landfill gas system has successfully alleviated a gas migration issue. The state will be taking over cap and landfill gas system maintenance by the end of 2003.

4.3.6 SYSTEM CONTROLS

The system has high level alarms, flow meters and pump on/off controls at two separate panel locations (at EXT-5 and a location near the site for the other four extraction wells) that the plant operator can monitor to determine and adjust system parameters. These control panels each have an autodialer to contact the operator during off hours.

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

The budgeted annual costs for system O&M are approximately $177,800 per year for 2004. This is reduced from about $200,000 per year in 2002 and 2003 due to the planned reduction from semi-annual to annual groundwater monitoring frequency. A breakdown of the budget 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 $86,000 by more than 100% but appear appropriate relative to other Fund-lead P&T systems.

Item Description	Estimated Cost	% of Total Cost
Labor: Project management, technical support, reporting	$41,300 per year	23%
Labor: Groundwater and Juday Creek sampling	$28,700 per year	16%
Labor: Plant operator, process sampling	$45,800 per year	26%
Analytical: Monitoring wells	$8,300 per year	5%
Analytical: Process	$9,300 per year	5%
Analytical: Juday Creek	$20,200 per year	11%
Utilities: Electricity	$16,700 per year	9%
Infiltration Basin Maintenance/Dredging	$7,500 per year	4%
Total Estimated Cost	**$177,800**	

4.4.1 UTILITIES

At any given time, the treatment system has approximately 30 HP of pumps operating. The contractor project manager indicated that utilities cost approximately $16,700 per year, which is consistent with a unit electrical cost of approximately $0.06 per kWh.

4.4.2 INFILTRATION BASIN MAINTENANCE

Regular annual dredging of the infiltration basin has been necessary to remove sediment and algae to maintain infiltration flow. The cost per dredging event is $7,500.

4.4.3 LABOR

Labor is the largest component of annual costs, contributing over 65% of the costs. The plant operator works part time checking the system at least 3 times per week. This totals less than 20 hours per week including responding to alarm calls. System operating labor is budgeted at a reported cost of $45,800 per year. With respect to project management, technical support, and reporting, a reported cost of $41,300 per year and an estimated hourly rate of $100 per hour, including overhead, should translate to approximately 413 hours per year, or approximately 8 hours in a 40-hour week. The cost for sampling labor of $28,700 per year includes annual sampling of the 33 monitoring wells, 3 surface water and sediment locations, and fish tissue. In addition, habitat and aquatic community assessments are completed.

4.4.4 CHEMICAL ANALYSIS

The budget for analytical costs in 2004 is about $37,800. This expense has recently been reduced by reducing the monitoring well sampling frequency and obtaining updated laboratory prices. Monitoring well analysis costs are budgeted at $8,300 for analysis of 33 well samples plus QA/QC samples for VOCs, arsenic, and lead. Process analysis includes a total of 24 system influent and effluent samples plus QA/QC samples for the same parameters as the monitoring wells at a cost of $9,300 per year. Juday Creek surface water, sediment, and fish tissue sample analysis includes a wide range of parameters and extensive QA/QC analysis at a cost of about $20,200 per year. The Juday Creek sampling program is considered to be excessive by the site team, but it was a condition desired by the public to obtain the surface water discharge permit. The Level IV QA/QC protocol used for sampling analysis accounts for over 25% of the analytical costs. For long-term system O&M Level IV QA/QC is not required at many Superfund Sites and the RSE team could not identify any reasons why it should be continued at Douglas Road.

4.5 RECURRING PROBLEMS OR ISSUES

The contractor reports the following recurring problems.

- Algae Growth: This was a problem in both the constructed wetlands and the infiltration basin. As the wetland vegetation has become established the algae has been less of a concern. Development of an algae mat on the floor of the infiltration basin has continued to be an issue limiting the basin capacity. The use of barley straw to reduce algae in late 2002 and 2003 has helped the problem; however, annual dredging of the basin is still planned.

- Stormwater Run-off: With the infiltration basin infiltrating capacity limited (in part due to algae growth) to about 100 gpm from an initial capacity of about 250 gpm and a higher design capacity, the available infiltrating rate controls the amount of groundwater that can be extracted. In periods of heavy precipitation, groundwater extraction must be reduced or suspended.

4.6 REGULATORY COMPLIANCE

The treatment system has consistently met effluent standards and stayed within the maximum discharge flow limit.

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 at the time of the risk assessment, carcinogenic risk associated with exposure of a hypothetical adult resident to contaminated groundwater at the site was as high as 3.8×10^{-3} due to bis(2-ethyl hexyl phthalate, arsenic, dibenzo (a,h) anthracene, vinyl chloride and indeno(1,2,3-c,d) pyrene. Carcinogenic risk due to off-site exposure was as high as 3.2×10^{-4} due to vinyl chloride, arsenic, and TCE. Of these compounds only arsenic, TCE, and vinyl chloride are considered site contaminants of concern. In the most recent groundwater sampling event only arsenic (MW-3S, MW-4S, and MW-6S) and 1,2-Dichloroethane (MW-6S) were found at levels above proposed remediation goals.

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. Site-related contamination may have been able to migrate off site prior to initiation of groundwater extraction. This migration may be combined with migration from unidentified off-site contaminant sources including that indicated by PCE impacts at MW-11S. The remedy, in its current form, is incapable of providing complete capture of the contamination at MW-11S.

It is beyond the scope of the RSE to evaluate the current risks associated with the site. However, it appears that risks have been reduced. The site has been capped and fenced, city water line was extended to impacted and neighboring residences, and contaminant concentrations have decreased in monitoring wells and extraction wells over time. Residential wells, however, are still in use downgradient of EXT-5 and may be potentially at risk if plume capture is interrupted or is not sufficient.

5.2 SURFACE WATER

The closest downgradient surface water is Juday Creek, located approximately 1,600 feet south of the site. Impacts to Juday Creek have not been identified.

5.3 AIR

The primary route for impacts to the air is from the landfill gas system off-gas. The VOC levels are well below the threshold requiring vapor controls. Site wells do not indicate elevated levels of ground water contamination. Therefore, VOC vapor intrusion in this area is not likely an issue requiring attention. The landfill gas collection system has been effective in preventing gas migration to the east of the site

5.4 SOILS

The soil contamination associated with the site has been capped with a composite barrier and fenced. No further protectiveness issues related to soil are expected.

5.5 WETLANDS AND SEDIMENTS

Sediments sampling in Juday Creek has not indicated any impacts from the site. The main treatment component at the site is lined constructed wetlands.

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 SAMPLE EXTRACTION WELLS ANNUALLY

The extraction wells were sampled annually from 1999 to 2002, but not in 2003. Analysis of groundwater from individual extraction wells provides a good indication of contaminant levels in the general area of the well. For example EXT-5 had TCE concentrations of 7.5 ug/l in 2000 and 4.0 ug/l in 2002. Sampling of EXT-5 on a regular basis would determine if TCE concentrations continue to decline and remain below PRGs. Sampling of EXT-1 and EXT-2, the focus of on-site containment efforts, will also be useful to determine the trends of contaminants of concern. This sampling should be considered part of the effort to develop an exit strategy. Sampling of the 5 extraction wells on an annual basis is recommended and should require less than $1,500 per year. The RPM indicates that these wells will be sampled in Spring 2004.

6.1.2 INVESTIGATE OFF-SITE SOURCES AND REMAINING DOWNGRADIENT IMPACTS

Based on the ROD, PCE is not a contaminant of concern at the site but it is present at MW-11S at concentrations consistently above the MCL, unlike any other VOC at the site. PCE has not been detected at any other monitoring well at the site or in landfill gas analysis. The site team recognizes that MW-11S is outside of the capture zones of the system extraction wells and plans no active remediation in the area. The PCE impact in MW-11S is very likely from an unidentified source north of the site. The RSE team is concerned that the unidentified source could present a greater human health risk than the Douglas Road landfill impacted groundwater at this time. Although investigation of the potential source and delineation of impacts is likely beyond the defined scope of the EPA effort at Douglas Road, we recommend a groundwater investigation with direct-push sampling be conducted to characterize the level and extent of PCE impacts in this area. Conceptually, the investigation would be initiated with a historical map review and site walk to determine if any former dry cleaners or other solvent use facilities were/are present within one mile upgradient of MW-11S. Based on the initial findings, shallow groundwater samples would be taken with a geoprobe at accessible locations northeast of MW-11S and near any potential downgradient receptor. About 5 to 10 shallow samples would be taken for VOC analysis, so the expense of the effort would be relatively low.

The extent and level of TCE remaining in the area around EXT-5 is not well understood and the TCE (and to a lesser extent vinyl chloride) impacts at EXT-5, MW-14S, MW-15S, MW-16S and former residential wells in the area do not show a clear connection (in current or 1994 plume maps) to groundwater impacts near the landfill. TCE is present in the landfill gas and the landfill may well have been the source of the downgradient TCE impacts, but cometabolism of TCE near the source area may have removed the TCE from ground water. The RSE team recommends groundwater samples be taken with a direct-push methods along Douglas Road east of EXT-5 and also north and west of EXT-5. Another 5 to 10 shallow samples would be taken for VOC analysis. At a minimum this sampling would indicate the extent and degree of the remaining TCE impacts in this area.

The investigation in these two areas will provide information to the site team that will improve the site conceptual model and allow better consideration of a site exit strategy. The combined investigation, including developing a work plan and producing a report should be completed for less than $50,000.

6.2 Recommendations to Reduce Costs

6.2.1 Reduce Analytical QA/QC Requirements

At least 25% of the site analytical program cost is due to the intensive Level IV QA/QC protocol. With considerable long-term data available there is no apparent need to exceed Level II standards. Reducing the QA/QC level will save about $10,000 per year. Many Superfund sites in long-term O&M stages do not perform the rigorous QA/QC found at this site.

6.2.2 Consider Converting the Wetland Polishing Cell to an Infiltration Basin

Discharge to Juday Creek requires an expensive annual sampling and evaluation program, and alternatives should be considered. If the existing treatment system were to continue operation at the present rate (extraction potentially over 300 gpm), additional infiltration capacity would be necessary to eliminate the need for surface water discharge to Juday Creek. The existing polishing cell of the treatment system is not needed to meet effluent standards (no treatment at all is typically required). The current polishing cell, at 1.8 acres, could provide over 200 gpm of additional infiltrating capacity based on the performance of the current basin. To convert the cell to an infiltration basin the liner and sediment would require removal and disposal and piping modifications would be necessary. Based on the cost of dredging the existing basin, converting this cell to an infiltration basin should require $100,000 or less. If the Juday Creek sampling program could be eliminated, approximately $30,000 per year might be saved. Therefore, this recommendation appears cost-effective if the remedy is expected to operate for three more years at an extraction rate greater than the capacity of the infiltration basin. If operation is expected for a number of years, but extraction can be reduced below the capacity of the infiltration basin, then discharge to Juday Creek (and the associated costs) could likely be eliminated without any capital expenditures. Implementation of this recommendation should be delayed until the recommendations in Section 6.4.1 are considered.

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 an Exit Strategy

Although the remedy has not yet achieved its specific objectives (i.e., restoration to applicable standards), the risks that originally required 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 suggests the following potential approaches that could be adopted as the basis for the remedy exit strategy.

Option 1: Continue operating the P&T system until all contaminants of concern are at or below background concentrations

Given that arsenic concentrations have not substantially decreased over the past four to five years in MW-6S with the current P&T system, this approach will likely take many years to be successful, and might not ever be successful. This approach would provide continued capture at the landfill with EXT-1 and EXT-2. Downgradient groundwater extraction at EXT-5 could likely be terminated, especially if the contamination in and around EXT-5 remains below PRGs as it currently is. The sampling recommended in Section 6.1.2 might further confirm that concentrations near EXT-5 are sufficiently low to discontinue pumping from this location. This approach would likely eliminate the need for discharge to Juday Creek and would therefore reduce annual operating costs to below $150,000 if the Juday Creek sampling program could be discontinued.

Option 2: 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. Elevated arsenic levels had not migrated off the site at concentrations of concern prior to P&T operation, and it is highly unlikely that elevated concentrations would migrate off site if the system were shut down. No VOCs are consistently above PRGs in any monitoring or extraction well. Various VOCs (benzene, 1,2 DCA, and vinyl chloride) have periodically exceeded PRGs in 3 monitoring wells (MW-3S, MW-6S, and MW-13S) since 1999. These exceedances are at relatively random levels near the PRG values and do not represent a definable plume. To proceed with shutting down the system, 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 landfill gas system would continue to operate, and the site team would continue with its monitoring program to 1) monitor for attainment of the cleanup criteria and 2) monitor for contaminant migration to determine whether or not the P&T system should be 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 $75,000 per year.

6.5 SUGGESTED APPROACH TO IMPLEMENTATION

The RSE team suggests implementing recommendations 6.1.1 and 6.2.1, which would provide for more comprehensive aquifer sampling while reducing annual O&M costs to approximately $170,000. The site team should then focus on the exit strategy as described in Section 6.4.1. The investigation discussed in Section 6.1.2 may be necessary to determine how to implement the exit strategy and provide verification that it is appropriate.

With respect to recommendation 6.4.1, the RSE team suggests proceeding with the second option: 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 2004. If the P&T system is not discontinued, then recommendation 6.2.1 should be considered.

7.0 SUMMARY

The RSE team observed a site where the soil remedy had effectively contained soil contamination and landfill gas collection is removing source area mass, 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. 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.

Recommendations to improve effectiveness in protecting human health and the environment include sampling extraction well influent on an annual basis as well as investigating the potential for off-site sources and the extent of remaining site impacts. Recommendations to reduce costs include reducing analytical QA/QC requirements and potentially converting an unnecessary treatment system component into an infiltration basin so that discharge to Juday Creek (and possibly the expensive Juday Creek sampling program) can be terminated. 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 two potential approaches for consideration. The risks that the ROD indicates as the reason for active remediation are no longer present. Therefore, the recommended approach includes discontinuing the P&T system and monitoring for potential plume migration.

Table 7-1 summarizes the costs and cost savings associated with each recommendation in Sections 6.1 through 6.4. 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.

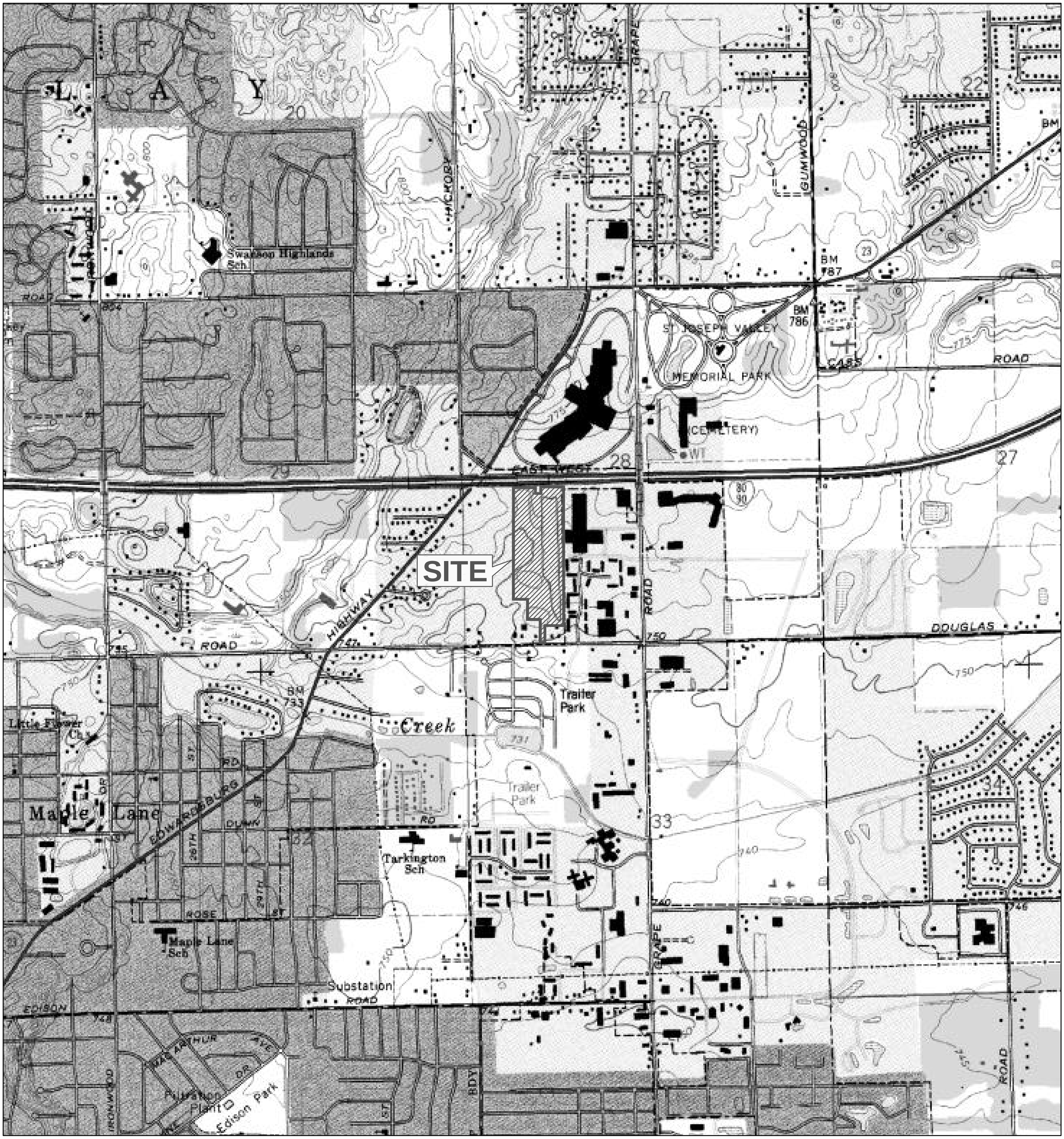
Table 7-1. Cost Summary Table

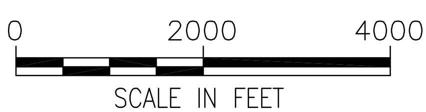
Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change In Life-cycle Costs ($) [1]	Estimated Change In Life-cycle Costs ($) [2]
6.1.1 Sample Extraction Wells Annually	Effectiveness	$0	$1,500	$15,000	$12,000
6.1.2 Investigate Off-Site Sources and Remaining Downgradient Impacts	Effectiveness	$50,000	$0	$50,000	$50,000
6.2.1 Reduce Analytical QA/QC	Cost Reduction	$0	($10,000)	($100,000)	($81,000)
6.2.2 Consider Converting Cell 3 to an Additional Infiltration Basin	Cost Reduction	$100,000	($30,000)	($200,000)	($143,000)
6.4.1 Develop and Exit Strategy	Site Closeout	$20,000	$0 to ($95,000)[3]	$0 to ($950,000)[3]	$20,000 to ($750,000)

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 change in costs is in addition to any changes associated with 6.1.1 and 6.2.1

FIGURES

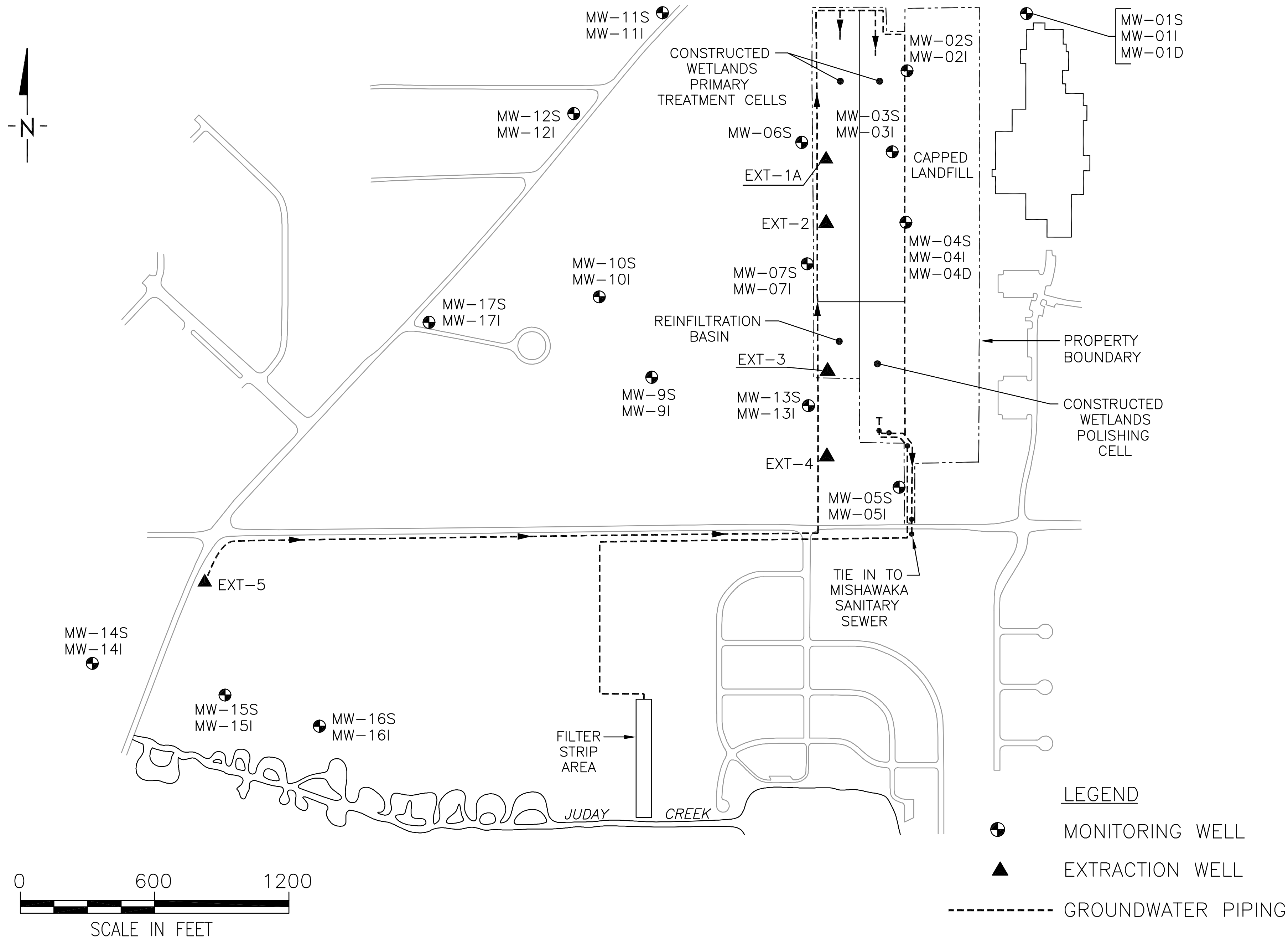
FIGURE 1-1. SITE LOCATION MAP.





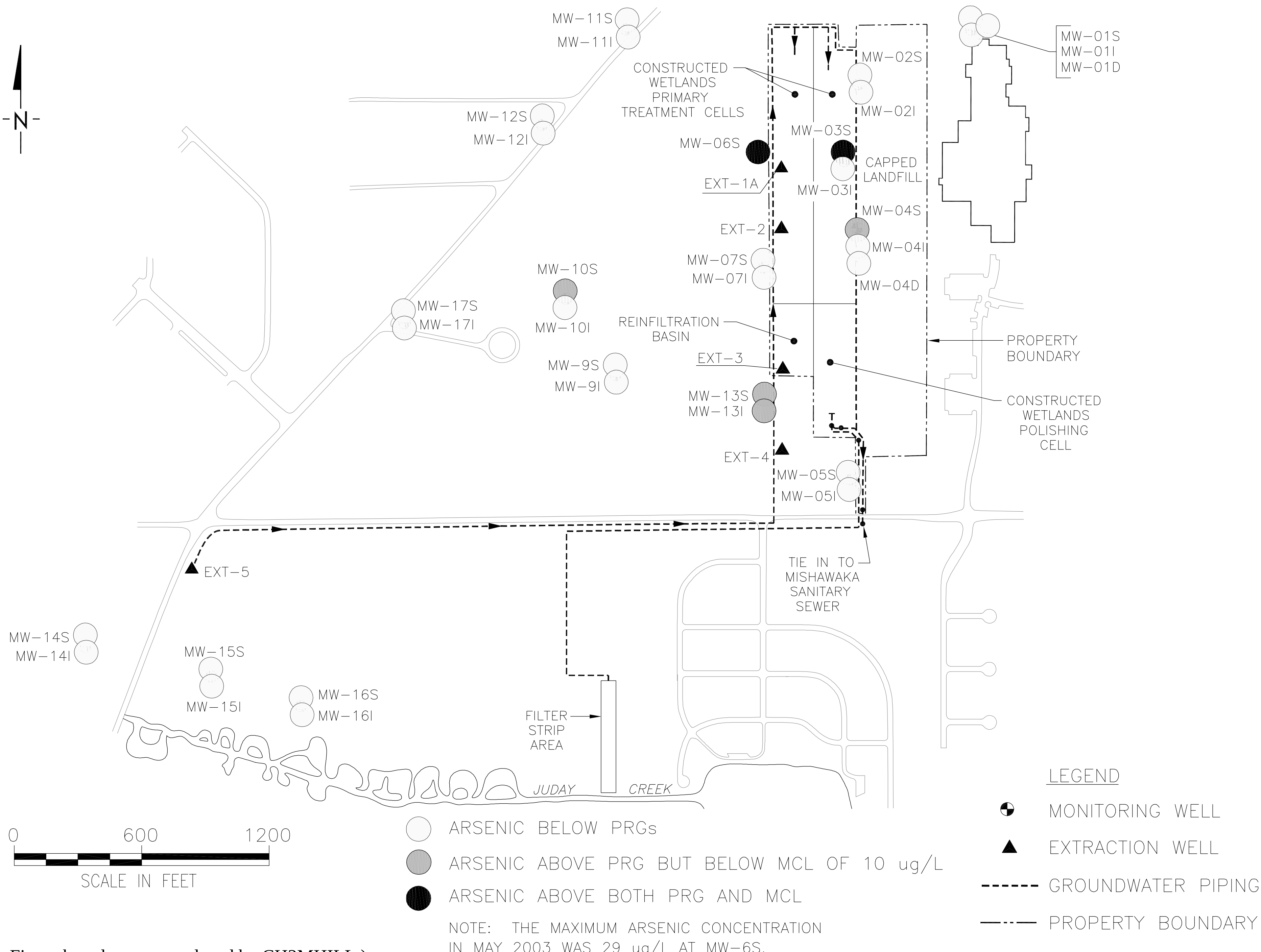
(Note: This figure is was developed from U.S.G.S. Quadrangle, South Bend East, IN (1992).

FIGURE 1-2. GROUNDWATER MONITORING WELL AND EXTRACTION WELL LOCATIONS AND GROUNDWATER PIPING LAYOUT.



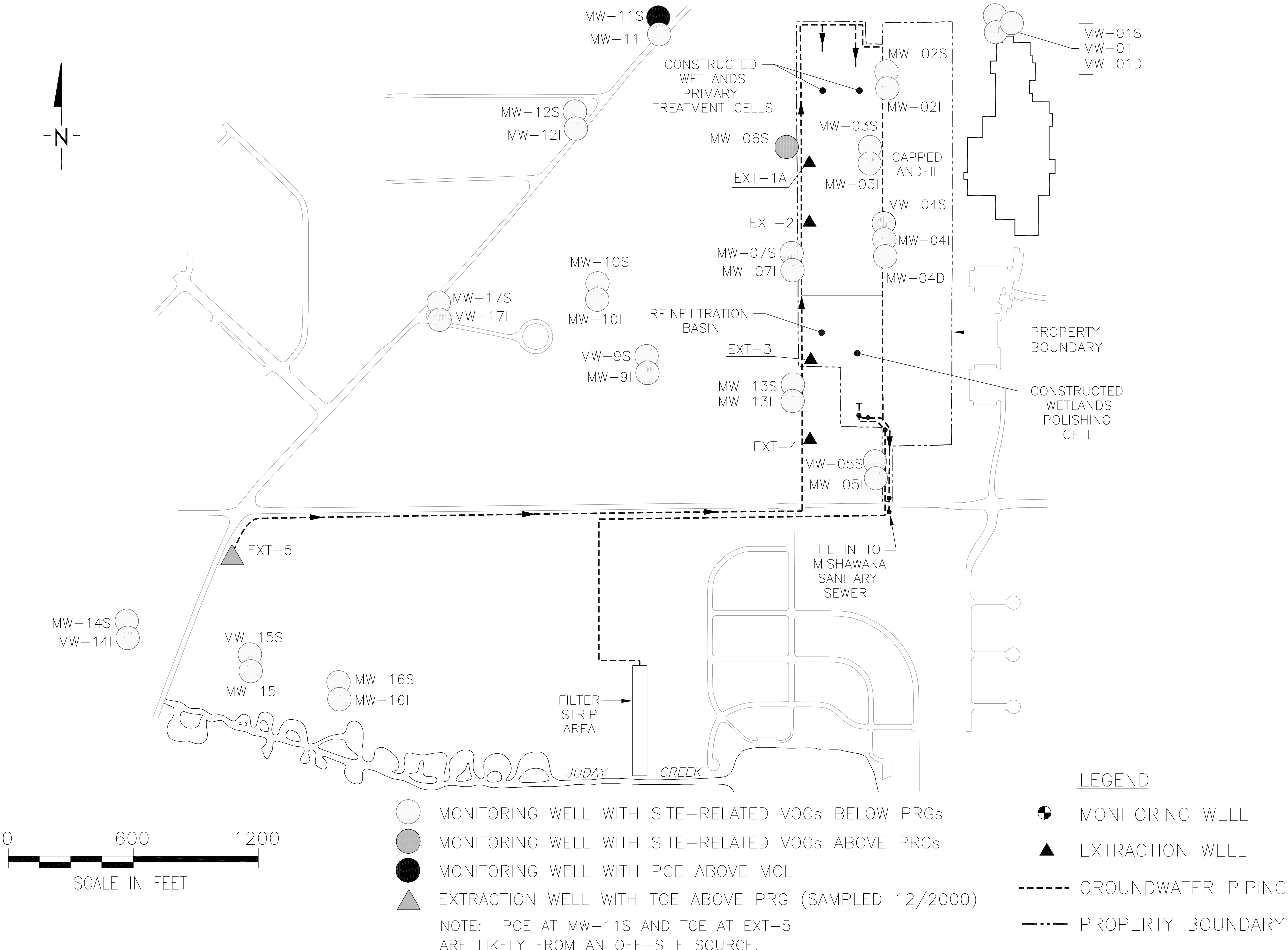
(Note: Figure based on one produced by CH2MHILL.)

FIGURE 1-3. MONITORING LOCATIONS WHERE ARSENIC EXCEEDED PRGs IN MAY 2003.



(Note: Figure based on one produced by CH2MHILL.)

FIGURE 1-4. MONITORING LOCATIONS WHERE VOCs EXCEED PRGs AND/OR MCLs IN MAY 2003.



(Note: Figure based on one produced by CH2MHILL.)