REMEDIATION SYSTEM EVALUATION

RISDON CORPORATION
DANBURY, CONNECTICUT

Report of the Remediation System Evaluation,
Site Visit Conducted at the Risdon Corporation Site
January 15, 2003

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Remediation System Evaluation
Risdon Corporation
Danbury, Connecticut

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NOTICE AND DISCLAIMER

The U.S. Environmental Protection Agency (U.S. EPA) funded the work described herein and preparation of this document by GeoTrans, Inc. under General Services Administration contract GS06T02BND0723 to S&K Technologies, Bremerton, Washington and under EPA contract 68-C-02-092 to Dynamac Corporation, Ada, Oklahoma. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

This report has undergone review by the EPA site managers and EPA headquarters staff. For more infomation about this project, contact: Mike Fitzpatrick (703-308-8411 or fitzpatrick.mike@epa.gov) or Kathy Yager (617-918-8362 or yager.kathleen@epa.gov).

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, including estimates of resulting net cost impacts, 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 (the responsible party and the regulators) 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. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders.

The Risdon Manufacturing Corporation facility, located in Danbury, Connecticut at the intersection of Old Newtown Road and Newtown Road, manufactures cosmetic containers. On-site practices historically included electroplating, chromating, acid/solvent stripping, degreasing, buffing, polishing, lacquering, hot stamping, silk screening, and assembly. The facility began operation in 1956, and some of these practices still continue after a number of facility modifications have been implemented. Historical manufacturing activities have led to chlorinated hydrocarbon contamination of ground water, soil, and soil vapor as well as metals contamination of the soil and ground water.

Two separate P&T systems and one soil vapor extraction (SVE) system operate at the facility. Off-site ground water and soil vapor contamination are present. The primary potential receptors include residences and commercial buildings potentially susceptible to contaminant vapors and surface water within 500 feet of known site-related contamination.

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.

Most recommendations pertain to improved effectiveness. The recommendations are prioritized such that addressing crucial items, such as controlling potential human exposures controlled and stabilizing the plume, should be implemented first. Recommendations include the following:

High Priority

- sample indoor air at surrounding residences, as planned, and add indoor air sampling at commercial buildings (including the Risdon facility) and install venting systems as necessary (Recommendation 6.1.1)

- develop and implement institutional controls (Recommendation 6.1.2)

- as planned, install additional on-site extraction wells to contain ground water contamination at the site boundary and prevent further off-site migration in both overburden and bedrock (6.1.3)

- inspect and rehabilitate, as necessary, the LA ground water recovery wells (6.1.4)

- install a new treatment system capable of handling the combined flow from the MFA, LA, and new extraction wells (6.1.5)

Intermediate Priority

- update the site conceptual model (Recommendation 6.1.6)

- control migration of vapors in subsurface by enhancing SVE system (Recommendation 6.1.7)

- update the ground water model and use regularly to evaluate control of contaminant migration offered by onsite wells (Recommendation 6.1.8)

- delineate the off site plume in both overburden and bedrock (Recommendation 6.1.9)

- develop a site exit strategy that includes the set of site conditions that will allow active remediation (i.e., the P&T and SVE systems as well as off-site remedies) to be discontinued (Recommendation 6.4.1)

Other recommendations include improvements to O&M and ground water reports, and repairing a damaged well cap. No recommendations are identified to directly reduce costs. However, the RSE team has considered cost-effectiveness in determining the scopes for the effectiveness recommendations.

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 pilot project conducted by the U. S. EPA Office of Solid Waste (OSW) and Office of Superfund Remediation and Technology Innovation (OSRTI). The objective of this project is to conduct Remediation System Evaluations (RSEs) of pump and treat (P&T) systems operating under the Resource Conservation and Recovery Act (RCRA). The following organizations are implementing this project.

Organization	Key Contact	Contact Information
USEPA Office of Solid Waste (U.S. EPA OSW)	Mike Fitzpatrick	5303W USEPA Headquarters Ariel Rios Building 1200 Pennsylvania Avenue, N. W. Washington, DC 20460 phone: 703-308-8411 fitzpatrick.mike@epa.gov
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Dynamac Corporation (Contractor to U.S. EPA)	Daniel Pope	Dynamac Corporation 3601 Oakridge Boulevard Ada, OK 74820 phone: 580-436-5740 fax: 580-436-6496 dpope@dynamac.com
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TABLE OF CONTENTS

List of Tables

List of Figures

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 P&T systems funded and managed by Superfund and the States). Due to the opportunities for system optimization that arose from those RSEs, EPA OSRTI and OSW are performing a pilot study of conducting RSEs at RCRA sites. During fiscal year 2003, RSEs at up to five RCRA sites are planned in an effort to evaluate the effectiveness of this optimization tool for this class of sites. GeoTrans, Inc. is conducting these evaluations, and representatives from EPA OSW and 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

A 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 (the responsible party and the regulators) 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. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders.

The Risdon Corporation facility was selected by EPA OSW based on progress made toward Environmental Indicators and comments from the EPA project manager for the site . 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:

- Kathy Yager from EPA OSRTI
- Deborah Sherer and Kristie Moore from EPA OSW

EPA OSRTI and EPA OSRTI are jointly conducting this RSE Pilot Study for RCRA sites.

1.3 DOCUMENTS REVIEWED

Author	Date	Title
CT Bureau of Waste Management, Site Remediation and Closure Division	9/12/1990	Preliminary Assessment Report, Risdon Corporation
Groundwater Technology	10/22/1991	Status Report, Remedial Activities for Risdon Corporation
Groundwater Technology	4/16/1993	Quarterly Report, 12/11/1992 through 3/31/1993
A.T. Kearny, Inc.	4/14/1995	Initial Assessments and Stabilization Evaluation of RCRA Facilities, Risdon Corporation
Haley & Aldrich, Inc.	4/1995	Summary Report of Investigative and Remedial Work, Risdon Manufacturing Company
Haley & Aldrich, Inc.	2/1996	Groundwater and Remedial Systems Monitoring 1995 Annual Report, Risdon Manufacturing Company
Haley & Aldrich, Inc.	2/1997	1996 Annual Remediation and Monitoring Report
Woodard & Curran, Inc.	1/1999	RCRA Facility Investigation Report
Woodard & Curran, Inc.	8/1999	Interim Corrective Measure Evaluation Report, Risdon Corporation
Woodard & Curran, Inc.	11/5/1999	RCRA Corrective Action Environmental Indicators
US EPA	6/23/2000	RCRA Corrective Action Environmental Indicator Determination at Risdon-AMS Corporation
Woodard & Curran, Inc.	10/30/2000	Transmittal of Response to Comments of Environmental Indicator Determination and Interim Measures Evaluation Report for Risdon Corporation

Author	Date	Title
Woodard & Curran, Inc.	11/30/2000	Transmittal of Response to Comments of RCRA Facility Investigation Report for Risdon Corporation
US EPA	2/15/2001	RCRA Corrective Action Environmental Indicator Determination at Risdon-AMS Corporation
Woodard & Curran, Inc.	4/20/2001	Response to EPA's RFI Comment 1
Woodard & Curran, Inc.	10/5/2001	Off-Property Soil Vapor Survey Work Plan
Woodard & Curran, Inc.	4/30/2001	Evaluation of Potential Indoor Air Quality Impacts and Soil Vapor Survey Work Plan
Woodard & Curran, Inc.	11/6/2001	Response to USEPA Comments on Off-Property Soil Vapor Survey Work Plan
Tetra Tech EMI	11/17/2001	Health and Safety Plan for Field Oversight and Split Spoon Sampling
Woodard & Curran, Inc.	12/21/2001	Baseline Groundwater Monitoring Report and Revised Groundwater Monitoring Plan
Woodard & Curran, Inc.	2/12/2002	MFA SVE System Initial Operations Evaluation Report
Woodard & Curran, Inc.	2/14/2002	Revised On-Property Soil Vapor Survey Work Plan
Woodard & Curran, Inc.	4/11/2002	Groundwater Monitoring Report, January - March 2002
Woodard & Curran, Inc.	4/18/2002	Off-Property Soil Vapor and Groundwater Sampling Report
CT DPH	6/12/2002	Health Consultation, Vapor Intrusion Potential at Properties Adjacent to Former Risdon Corporation Facility
Woodard & Curran, Inc.	6/28/2002	On-Property Soil Vapor Survey Report
Woodard & Curran, Inc.	9/26/2002	Groundwater Monitoring Report, July 2002
Woodard & Curran, Inc.	½003	Groundwater Monitoring Report, October 2002

1.4 PERSONS CONTACTED

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

Kenny Gulledge - Crown Cork & Seal Company, Inc. (parent company of Risdon Corporation)
Project Manager, Department of EH&S

Gilbert Ryan, PE - Woodward & Curran
Project Manager

Carolyn Casey	- USEPA Region 1 Project Manager
Vinnie Mastriani	- Risdon Plant Wastewater Plant Operator

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 LOCATION AND HISTORY

The Risdon Manufacturing Corporation facility, located in Danbury, Connecticut at the intersection of Old Newtown Road and Newtown Road, manufactures cosmetic containers. On-site practices historically included electroplating, chromating, acid/solvent stripping, degreasing, buffing, polishing, lacquering, hot stamping, silk screening, and assembly. The facility began operation in 1956, and some of these practices still continue after a number of facility modifications have been implemented. Historical manufacturing activities have led to chlorinated hydrocarbon contamination of ground water, soil, and soil vapor as well as metals contamination of the soil and ground water.

The property consists of 5-acre manufacturing facility surrounded by paved parking areas, including a paved parking area to the west of the facility that overlies a former surface impoundment area (the "lagoon area"). Figure 1-1 presents a map of the Risdon property and the surrounding area. The area surrounding the facility is primarily commercial or light industrial with interspersed residences. A Medsource facility is located across Old Newtown Road to the northwest, a residence is also located on Old Newtown Road to the north, and office space and a private residence/private iron works facility is located to the northwest on Broad Street. The Still River is located beyond these properties to the northwest, approximately 100 feet from the Risdon property.

A brief summary of the site history and environmental activities are summarized below.

~1956	disposal of metal hydroxide wastewater to lagoons commences
1982	beginning of the investigative work and closure of the former wastewater lagoons; all material from the lagoons was removed to the water table (approximately 14 feet below grade)
1987	subsurface investigation began in order to fulfill USEPA post-closure requirements
1989-1990	ground water quality investigation in the area of the former wastewater lagoons and design of a ground water and soil remediation system
1990	installation and startup of three ground water recovery wells in the former lagoon area (LA) with water treated by an air stripper
1992	further investigation of possible source areas including the LA and the metals finishing area (MFA)
	Installation of a soil vapor extraction system and an air/steam sparging system in the LA (the sparging system never operated at full capacity and has not operated at all after October 1995)
1993	installation and startup of a soil vapor extraction (SVE) and pump and treat (P&T) system in the MFA

9/1993	replacement of 1,1,1-trichloroethane (1,1,1-TCA) for degreasing with trichloroethene (TCE)
1994	placement of an asphalt cap over the LA and addition of 6 ground water recovery wells to the MFA remedy
1996	comprehensive ground water monitoring event
1997-1998	supplemental investigative work for the RCRA Facility Investigation report including pump testing and a bedrock investigation
1/1999	RCRA Facility Investigation Report submitted to EPA
8/1999	interim Corrective Measure Evaluation Report submitted to EPA suggesting the installation of two additional ground water extraction wells
11/1999	environmental Indicator Determination Checklist submitted to EPA
6/2000	LA SVE system was shut down due to a blower failure and has not been restarted due to the relatively low mass removal prior to the failure
2/2001	public water supply survey submitted to EPA
12/2001	Baseline Ground Water Monitoring Report and Revised Ground Water Monitoring Plan submitted to EPA
4/2002	Off-Property Soil Vapor and Ground Water Sampling Report submitted to EPA demonstrating contamination has migrated off site resulting in elevated concentrations of chlorinated hydrocarbons in off-site soil vapor and ground water contamination
6/2002	On-Property Soil Vapor Survey Report submitted to EPA
	Health Consultation conducted by U.S. Department of Health and Human Services submitted to EPA recommending indoor air sampling at adjacent residences

1.5.2 POTENTIAL SOURCES

Although 29 areas of concern (AOCs) have been identified on site, these AOCs can be grouped into two general source areas: the lagoon area (LA) and the metal finishing area (MFA).

The LA consists of former lagoons where metal hydroxide waste was discharged between 1956 and 1982. In 1982, the lagoons were closed and the material in them was excavated to the water table (an approximate depth of 14 feet below grade). As of September 2001, contamination from chlorinated solvents, primarily 1,1,1-TCA and its degradation products (i.e., 1,1-dichloroethane and 1,1-dichloroethene) remains in concentrations indicative of dense non-aqueous phase liquid (DNAPL). Specifically, 1,1,1-TCA concentrations in four wells (MW-6, MW-9, MW-12, and MW-304) have been found at concentrations exceeding 1% of its solubility. DNAPL in the LA may provide a continuing source of dissolved ground water and soil vapor contamination.

The degreasing operations appear to be the primary sources of contamination in the MFA. Facility improvements and changes in operation beginning in 1992 (including removal of all but one degreaser and placement of the remaining degreaser in a room with a stainless steel floor and berm) have reduced or eliminated the likelihood of additional releases of contaminants to the subsurface in the MFA. However, as with the LA, ground water concentrations are indicative of DNAPL, which may serve as a continuing source of dissolved ground water and soil vapor contamination. Evidence for DNAPL is provided both in the magnitude and vertical extent of contamination. Sampling and analysis of monitoring wells in the MFA in 1996 resulted in concentrations of 1,1,1-TCA, TCE, and PCE that exceeded 100,000 ug/l, 40,000 ug/l, and 70,000 ug/l, respectively. All of these maximum concentrations for the respective compounds exceed 1% of the solubilities. Furthermore, concentrations of TCE as high as 34,000 ug/l have been found in MW-508C, which is a deep bedrock well. In the absence of strong vertical hydraulic gradients, the presence of elevated concentrations at depth are suggestive of DNAPL that is descending due to a density that is greater than the surrounding ground water. Although ground water monitoring for chlorinated hydrocarbons also occurred in September 2001, monitoring wells in the MFA were not sampled. However, data from this more recent sampling event reveal continued elevated concentrations of TCE downgradient of the MFA (60,000 ug/L in MW-111) and in bedrock (23,000 ug/l in MW-508C).

Chlorinated hydrocarbon contamination in the ground water from both the LA and MFA also serves as a source of potential soil vapor contamination both on and off site.

Ground water also has elevated concentrations of metals such as copper and zinc. There does not appear to be an ongoing source of VOC ground water contamination from current practices at the facility, but a limited number of soil samples from 1994 hand augers in the MFA had Toxicity Characteristic Leaching Procedure (TCLP) test results for some metals that exceed the relevant Connecticut Pollutant Mobility Criteria (Haley and Aldrich, 1995).

1.5.3 HYDROGEOLOGIC SETTING

The site is located to the east of the Still River, which flows north past the site to its confluence with the Housatonic River. The area receives approximately 50 inches of rainfall per year and drainage is to the north along the Still River toward the Housatonic River. The site elevation ranges from approximately 296 feet above mean sea level (MSL) to 308 feet MSL (Woodard and Curran, January 1999). Subsurface material generally consists of fill overlying glacio-lacustrine deposits, glacial till deposits, and weathered rock over bedrock. Due to variations in depositional activity some strata are not present in all locations. The fill primarily consists of sand and gravel, the glacio-lacustrine deposits primarily consist of sand and silty clay, and the till primarily consists of sands with cobbles or boulders (Haley and Aldrich, April 1995). In general, the unconsolidated glacio-lacustrine sediments and weathered bedrock are considered to form two interconnected aquifers. At the facility, the depth to bedrock is approximately 20 to 30 feet below ground surface (bgs). Figure 1-2 depicts a representative cross-section of the subsurface. The orientation of the cross-section is provided in Figure 1-3. Bedrock elevation decreases to the north (Woodard and Curran, January 1999).

The depth to ground water beneath the facility is approximately 10 feet bgs. Ground water flows to the north along the Still River toward a wetland approximately one half-mile to the north of the facility, and eventually into the Still River. Pumping test data at multiple wells interpreted with the Cooper Jacob method suggest that hydraulic conductivity in both the unconsolidated sediments and the weathered bedrock ranges from approximately 13 ft/day to 130 ft/day. The hydraulic conductivity of the competent bedrock is on the order of 1 ft/day or less (Woodard and Curran, January 1999).

Site documents (Woodard and Curran, January 1999) suggest that vertical ground water flow is affected by the till layer and the presence of competent bedrock. This document suggests that, where present, the till layer inhibits vertical flow into the bedrock. It also suggests that the low hydraulic conductivity of the competent bedrock further limits downward flow. Regardless, the bedrock elevation decreases to the north, and as indicated in the subsequent sections of this report, ground water contamination has been found with increasing depth to the north suggesting downward contaminant migration.

1.5.4 POTENTIAL RECEPTORS

The ground water in the area surrounding the facility has a GB classification, which designates uses for industrial process water and cooling water. It is presumed unsuitable for human consumption without treatment. As a result, the primary potential receptors of concern for ground water contaminated with volatile organic compounds (VOCs) such as TCE and TCA are surface water and indoor air. The Still River and the wetland to the north of the site are the potential surface water receptors. Site documents indicate that the Still River has a Class B designation, which means that designated uses include fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses including navigation. The various buildings in the area, including residences with basements, are potential indoor air receptors. Specifically, Connecticut Department of Public Health has evaluated indoor air quality concerns at five properties downgradient of the site:

- Residence, Old Newtown Road
- Residence, Broad Street
- Commercial, 4 Old Newtown Road
- Commercial, 11 Old Newtown Road
- Commercial, Augusta Drive

The Risdon facility itself is also a potential receptor for indoor VOC vapors. These potential indoor air receptors are discussed further in Section 5.0 of this report.

1.5.5 DESCRIPTION OF GROUND WATER PLUME

Ground water contamination from both VOCs and inorganics such as metals and cyanide are present. The VOC plumes are discussed first, followed by the inorganic plumes. These discussions are limited to the extent of the plumes and the concentrations within the plumes. A discussion of how the contamination relates to potential receptors and the applicable remediation standards is included in Section 5.0 of this report.

<u>VOC plumes</u>

The last comprehensive round of ground water sampling for VOCs (including chlorinated solvents) occurred in August 1996, and the results are summarized in the *Annual Remediation and Monitoring Report* (Haley and Aldrich, February 1997) and the *RCRA Facility Investigation Report* (Woodard and Curran, January 1999). Subsequent monitoring for VOCs also occurred in September 2001 and October 2002 as well as during the *Off-Property Soil Vapor and Groundwater Sampling Report* (Woodard and Curran, April 2002). The data indicate that ground water plumes of chlorinated hydrocarbons originate in both the LA and MFA areas and extend offsite. A site map indicating the extent and magnitude of contamination is presented in Figure 1-3. Concentrations are greatest in the MFA and along the northeastern (downgradient) boundary of the site. As indicated from direct-push samples GW-1A, GW-1B, and GW-1C, VOC contamination extends at least 500 feet beyond the site to the northeast toward the commercial property at 4 Old Newtown Road as well as the other commercial buildings and the wetland further downgradient. Ground water contamination also extends off-property toward the private residence on Old Newtown Road to the north, where samples were collected from MW-15 and the direct-push locations GW-2A and GW-2B.

Along the northeastern boundary of the Risdon property, near the MW-508 cluster, the TCE concentrations increase with depth. The 1996 data from the MW-508 cluster showed a TCE concentration of 340 ug/L between 7 and 12 feet bgs, a concentration of 5,100 ug/L between 16 and 19 feet bgs, and a concentration of 41,000 ug/L between 34 and 49 feet bgs. Similar increases in concentration with depth were also evident in the 2001 and 2002 sampling.

Inorganics Plumes

The inorganic ground water contamination is primarily limited to cyanide contamination in MW-15, copper contamination in the LA, and beryllium, copper, nickel, silver, and zinc contamination along the northeastern boundary of the site (MW-111, MW-113, and MW-601B). The extent of inorganic contamination in ground water downgradient of the site has not been defined.

2.0 SYSTEM DESCRIPTION

2.1 SYSTEM OVERVIEW

There are two separate P&T systems currently operating:

- *Lagoon Area (LA) System*. Operating since 1990, this system currently includes ground water extraction/treatment but no SVE.

- *Metal Finishing Area (MFA) System*. Operating since 1993, this system includes ground water extraction/treatment plus SVE.

In 1992 a soil vapor extraction (SVE) and air sparging component were added to the LA. The air sparging did not operate at full scale due to fouling problems and was shut off permanently in 1995. The SVE system included 17 four inch diameter wells. By 1996 the SVE system was recovering only a small amount of mass (<0.5 lbs of VOCs per day). The SVE system was shut off in June 2000 when the 10 HP blower malfunctioned. The blower was not repaired or replaced due to the cost of the blower and the low VOC recovery rate of the system.

Details of the current LA system and MFA system are provided below.

2.2 EXTRACTION SYSTEM

LA System

The LA system began operation in 1990 with ground water extraction at 3 wells installed to the bedrock surface, approximately 36 to 38 feet bgs (RW-1 to RW-3). The extraction system is intended to provide hydraulic containment of contamination originating from the LA, with a design extraction rate of 3 gpm per well (total design extraction rate from the three wells is 9 gpm). The extraction wells are located in the parking lot area west of the site, within underground vaults. The wells have above-ground centrifugal pumps (which apparently replaced submersible pumps shown in the design drawings) operating based on down-hole Warrick level control probes. Separate 1-inch diameter galvanized steel lines for each well route the extracted water to the interior of the warehouse building where each line has a throttling valve, sampling port and flow meter. The lines are then combined in a 2-inch diameter header and routed to the air stripper.

MFA System

The MFA remediation system began operation in May 1993 with 6 dual-phase extraction wells (RVW-101, RVW-103 through RW-106, and RW-108) and 2 ground water recovery wells (RW-101C and RW-108A). Six new 4-inch diameter ground water recovery wells were installed in 1994 (RW-302, RW-303, and RW-401 through RW-404), and ground water recovery from the dual-phase wells was discontinued. Therefore, ground water extraction currently occurs from 8 recovery wells, all of which are located within the production and wastewater treatment areas of the enclosed Risdon building. These wells have pneumatic extraction pumps that discharge when filled (Woodard and Curran, April 2001).

The 6 previously used dual-phase (air and liquid) extraction wells are now used solely as SVE wells, and two additional vapor recovery wells (VES-102 and VES-109) have also been added. All 8 wells are two inches in diameter. In September 2001 an evaluation of the SVE system indicated PID readings of 0 in discharge vapor from all 8 wells. Since 1995 system operation has consisted of cycling groups of wells on and off (Woodard and Curran, April 2001).

2.3 TREATMENT SYSTEM

LA System

Treatment for VOCs is performed with a packed tower air stripper. The air stripper was designed for 15 gpm with about 35 mg/l total VOC influent and 2 mg/l total VOC effluent. It has a 1 HP blower producing about 226 scfm. The air stripper effluent is pumped from a transfer tank to the plant pH neutralization system prior to discharge to the POTW. The pH neutralization system is operating at about 20 gpm during plant operating hours which is near its capacity. The air stripper emissions are vented directly to the atmosphere because VOC mass released is well below the general limit of 15 tons/yr for individual pollutants (CTDEP RSCA 22a-174-3(a)(1)(D)) and below the limits for specific hazardous air pollutants (limits are identified in the Haley & Aldrich "Summary Report of Investigative and Remedial Work" dated April 1995).

MFA System

All of the treatment equipment associated with this system are located in the production and wastewater treatment areas within the enclosed Risdon building. The extracted ground water is routed to a strainer and then to a Aeromix Systems Breeze™ diffused aeration type air stripper with a 1.75 HP blower. The stripper has a hydraulic capacity of 175 gpm but is limited by treatment efficiency due to air flow and retention time. From the diffused aeration unit, the water is routed to the plant cyanide destruction and metals removal system. This plant system is treating about 10 gpm during plant operating hours and is reported to be near capacity. Effluent from those plant treatment processes is then discharged to the POTW. VOC vapors from the diffused aerator are routed through two 55 gallon VGAC units. The MFA system operates only during the facility operating schedule because it relies on the labor associated with the plant wastewater system.

Extracted vapors from the SVE wells were initially treated with a catalytic oxidation unit. Off-gas treatment was discontinued in November 1994 because untreated emissions were in compliance with limits identified in the Haley & Aldrich "Summary Report of Investigative and Remedial Work" dated April 1995.

2.4 MONITORING PROGRAM

Monitoring of the treatment processes is relatively limited. Influent samples are not regularly collected and analyzed for any of the ground water or vapor recovery systems. Effluent of all treated water that is discharged to the POTW was previously sampled and analyzed monthly for total toxic organics, but this has been reduced to semi-annually. Samples are analyzed for copper and silver weekly, and sampling for chromium, nickel, and cyanide has been reduced to semi-annual sampling. Air sampling for the SVE systems and the air stripper off-gas is not monitored because it is well below the reported requirement of 15 tons/year total. All process sampling is conducted by the facility water treatment plant operator.

Ground water monitoring was restarted in September 2001 with a baseline event. The previous comprehensive sampling event was in 1996. The sampling locations and frequencies for the ground water monitoring plan are summarized in the following table.

Sampling Frequency	Sampling Parameters	Monitoring Wells
Quarterly for one year (9/2001 through 10/2002)	13 Priority Pollutant Metals and Cyanide	<u>LA</u> MW-1, MW-2, MW-3, MW-8, MW-10, MW11, MW-15 <u>MFA</u> MW-111, MW-113, MW-601B
Annually	VOCs	<u>LA</u> MW-1, MW-2, MW-3, MW-9, MW-10, MW-11, MW-14, MW-15 <u>MFA</u> MW-111, MW-112, MW-508, MW-508C, MW-601B

All samples are collected with low-flow sampling. Metals are analyzed using EPA Method 6010B (7470A for mercury and 7060A for arsenic), cyanide is analyzed using 9010B, and VOCs are analyzed using 8021C. Now that quarterly monitoring for metals and cyanide has been completed for one year with consistent results, the facility and its contractors have recommended reducing the monitoring for metals and cyanide to annually. Therefore, VOCs, metals, and cyanide will be sampled and analyzed in a single annual event to occur in September of each year.

Ground water elevations are collected from all site monitoring and ground water recovery wells and from the 7 Medsource monitoring wells during each sampling event. The headspace of each well is monitored with a PID prior to measuring the ground water elevation.

The ground water monitoring and elevation measurement results are summarized in monitoring reports.

At the time of the RSE visit, the facility contractor received comments from EPA on a work plan for indoor air sampling. The details of this plan and the comments have not been reviewed by the RSE team and are not discussed in this report.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

Currently, the site is in the investigation phase; however, due to detected contaminant concentrations in the subsurface, specifically ground water, Interim Corrective Measures (ICMs) have been implemented at the site since 1990. The objective for the Lagoon Area (LA) ICM is to contain and prevent migration of VOC contaminated ground water from the former lagoon area. The objective of the Metals Finishing Area (MFA) ICM is to reduce contaminant concentrations in the source area and to contain/prevent migration of contaminants from the source area via ground water flow.

The overall remedial objective for the facility is to achieve an EPA-approved determination of Completion of Corrective Action Activities and terminate interim status as a RCRA land disposal facility. The path to completion involves the typical phases of investigation and remediation under the RCRA Corrective Action Program, which include investigating the site, assessing risk, developing media protection standards and objectives, performing a Corrective Measures Study, implementing the selected Corrective Measure, and final site closure/completion. In addition to the overall objective, the facility also has the short-term objective of achieving site stabilization through the demonstration of achievement of Environmental Indicators CA725 – Current Human Exposures Under Control and CA750 – Migration of Contaminated Groundwater Under Control.

In accordance with Section 22a-133k-1(b) of the Regulations of Connecticut State Agencies, the CTDEP Remediation Standard Regulations (RSRs) are not directly applicable to the facility; however, the criteria and standards have been used by the facility and EPA as guidelines. In that regard and with respect to ground water, and given that ground water in this area is classified as GB, the following criteria are being used:

- ensure that impacted ground water does not interfere with any existing uses of ground water (currently there are no identified uses of ground water within the boundaries of the plume); and

- demonstrate compliance with the surface water protection criteria and volatilization criteria (see the following table):

Constituent of Concern	Surface Water Protection Criteria	Industrial/Commercial Volatilization Criteria	Residential Volatilization Criteria
VOCs			
1,1 Dichloroethene (1,1 DCE)	96 ug/L	6 ug/L	1 ug/L
Tetrachloroethene (PCE)	88 ug/L	3,820 ug/L	1,500 ug/L
1,1,1 Trichloroethane (1,1,1 TCA)	62,000 ug/L	50,000 ug/L	20,400 ug/L
Trichloroethene (TCE)	2,340 ug/L	540 ug/L	219 ug/L

Constituent of Concern	Surface Water Protection Criteria	Industrial/Commercial Volatilization Criteria	Residential Volatilization Criteria
Inorganics			
Total Cyanide	0.052 mg/L	N/A	N/A
Arsenic	0.004 mg/L	N/A	N/A
Total Beryllium	0.004 mg/L	N/A	N/A
Total Copper	0.048 mg/L	N/A	N/A
Total Nickel	0.88 mg/L	N/A	N/A
Total Silver	0.012 mg/L	N/A	N/A
Total Zinc	0.123 mg/L	N/A	N/A

Information is taken from the CTDEP Remediation Standard Regulations

It should be noted that demonstration of the volatilization criteria is achieved by demonstrating that there are no risks to applicable receptors via the vapor migration pathway to indoor air (in addition to ground water data, this can be accomplished through the use of indoor air or soil vapor samples). If this approach is followed, then achievement of the volatilization criteria for ground water is not relevant. Compliance with the surface water protection criteria is demonstrated by an average of the plume or compliance at the point of discharge of the plume to surface water; therefore, achievement of the criteria at each well is not needed.

As indicated above, the objectives of the current ICMs are hydraulic containment and to some extent source zone containment reduction. To demonstrate compliance with the two EIs and ultimately the RSRs, additional investigation of remedial alternatives/enhancements will be required.

3.2 TREATMENT PLANT OPERATION STANDARDS

Water from the two P&T systems and the treated wastewater from the plant are discharged to the POTW. The discharge standards included in the August 1999 Interim Corrective Measure Evaluation Report are presented in the following table.

Parameter	Average Monthly Limit	Maximum Daily Limit
Cadmium	0.1 mg/L	0.5 mg/L
Chromium, Total	1.0 mg/L	2.0 mg/L
Copper	1.0 mg/L	2.0 mg/L
Nickel	1.0 mg/L	2.0 mg/L
Silver	0.1 mg/L	0.43 mg/L
Zinc	1.0 mg/L	2.0 mg/L
Cyanide, Amenable	0.1 mg/L	0.2 mg/L
Cyanide, Total	0.65 mg/L	1.2 mg/L
pH	6.0 - 9.5	-
Total Oil & Grease	50.0 mg/L	100.0 mg/L
Total Toxic Organics	-	2.13 mg/L

No limits are stated for aluminum, iron total suspended solids, and methylene chloride

The permit requirements listed in the ICM Evaluation Report include variable sampling frequencies from weekly to annually depending on the parameter. As stated in Section 2.4 of this report, the facility reported that they take effluent samples semi-annually for most parameters. Both silver and copper are sampled weekly.

An NPDES permit was issued to the site but was discontinued in 2000. Limits were similar to the POTW limits except TTO, which had a limit of 0.25 mg/L.

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

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

Ground water levels are collected and interpreted with each monitoring event. The potentiometric surface map presented in the January 2003 Ground Water Monitoring Report is included as Figure 4-1. It shows what appears to be influence of both P&T systems on the regional ground water flow. For example, the map shows that the regional gradient flattens in the MFA where extraction is occurring and cones of depression near each of the LA extraction wells. The contours, however, are influenced by the water elevations measured from operating extraction wells. Because extraction wells are subject to well losses and have very localized drawdown due to pumping, water levels from these wells are not necessarily indicative of the water level in the surrounding formation. As a result, if other water level measurements are not made in the area, some of the contours may show excessive influence due to pumping and perhaps an overestimated interpretation of plume capture. Specific examples of where the contours may overestimate the influence of pumping are as follows:

- The water level at active recovery RW-2 (280.06 ft) is used. In its absence, the 288 ft contour may have been drawn much closer to MW-5 (287.97 ft) rather than MW-3 (288.54 ft), effectively eliminating the large trough in the potentiometric surface. The cones of depression from RW-1 and RW-2 would then have appeared much more limited as it is for RW-3 where the effect of pumping is almost unnoticeable at nearby well MW-11.

- The water levels at active recovery wells RW-101C, RW-108A, RW-303, and RW-404 are all used and other monitoring wells are not located in the immediate vicinity. As a result, the 292 ft contour may be artificially shifted to the south with a trough that suggests influence from pumping. In actuality, the trough and influence from pumping may be significantly smaller.

The monitoring report also does not provide the extraction rates for the various wells. Although extraction rates for the LA wells were originally 3 gpm each for a total of 9 gpm, the pumping has likely changed. In 1996, the total extraction rate was estimated at 3.5 gpm, and during the RSE site visit the flow totalizers for these wells revealed a total pumping rate of approximately 4.5 gpm, with RW-3 not operating. To better resolve the influence of pumping on the regional hydraulic gradient, the pumping rates should be provided along with the potentiometric surface maps, when possible.

4.2.2 CAPTURE ZONES

A capture zone analysis with a numerical model and particle tracking was provided as part of the August 1999 Interim Corrective Measure Evaluation Report to help evaluate potential locations for additional extraction wells. However, no other capture zone analyses have been conducted of the currently operating P&T systems. The potentiometric surface maps provided in the ground water monitoring reports may be used in an attempt to interpret capture if compared to the plume maps or target capture zones; however, for the above stated reasons, the capture may be inconclusive or overestimated. The provided potentiometric surface maps are also not sufficient to evaluate capture in the bedrock or in the vertical direction.

The degree of capture in the MFA, LA, and at the northeastern property boundary are discussed below.

<u>MFA</u>

In the MFA, the pumping rate is generally below 1.5 gpm. With the following conservative parameters a water budget or simplistic analytical capture zone calculation suggests that capture would require pumping on the order of 5 gpm to 10 gpm, which is greater than the actual pumping rate.

- hydraulic conductivity (K = 13 ft/day)
- background gradient (I = 0.02 ft/ft)
- saturated thickness (b = 20 ft)
- plume width (w = 200 ft)
- factor of safety (generally between 1.5 and 2.0) to account for additional ground water contributions from recharge, surface water, or underlying formations (F = 1.5)

$$Q = F \times K \times i \times b \times w \times (\text{conversion factors})$$

$$\mathrm{Q} = 1.5 \times 13\ (\mathrm{ft / day}) \times 0.02\ (\mathrm{ft / ft}) \times 20\ \mathrm{ft} \times 200\ \mathrm{ft} \times \left(\frac{7.48\ \mathrm{gallons}}{\mathrm{ft}^3} \times \frac{1\ \mathrm{day}}{1440\ \mathrm{minutes}} \right) = 8.1\ \mathrm{gpm}$$

<u>LA</u>

Because the LA extraction wells are only operating at half of their intended rate (approximately 4.5 gpm rather than 9 gpm), capture may be compromised in the LA. The above analytical calculation, which is also applicable to the LA, suggests that the reduced pumping rate is nearly equivalent to the low-end approximation of what may be needed. Downgradient wells MW-10, MW-14, and MW-15 have shown decreasing concentrations, suggesting that plume migration has been somewhat mitigated. However, it is unclear if pumping at the current rate will continue to limit migration as effectively.

<u>Northeastern Boundary</u>

EPA, the facility, and the RSE team agree that capture is not provided along the northeastern border of the property where some of the highest VOC concentrations have been measured (e.g., near well MW-111 and MW-508C). In the *Interim Corrective Measure Evaluation Report* (Woodard and Curran, 1999), the facility and its contractors suggested the installation of two additional pumping wells to provide containment of the plume at the property boundary. However, those wells have not been installed to date because the site team as a whole has focused on other site-related issues, including characterization of offsite ground water and soil vapor contamination.

4.2.3 CONTAMINANT LEVELS

Ground water monitoring was not performed regularly since 1996, but ground water sampling and analysis was restarted with a sampling event in September 2001 in which 25 of the 36 wells were sampled. The sampling program included wells on or within 300 feet of the site. Annual sampling for VOCs is now conducted at 13 wells. The following table reports the 1996, 2001, and 2002 concentrations of the more prevalent VOCs at 11 of the 13 wells that are included in the monitoring plan.

Monitoring Well	General Location	Year Sampled	1,1 DCE (1 ug/L)*	1,1,1 TCA (20,400 ug/L)*	PCE (88 ug/L)*	TCE (219 ug/L)*
MW-3	LA	1996	166	516	ND	10,840
		2001	320	1,200	ND	13,000
		2002	170	900	ND	15,000
MW-9	LA	1996	1,322	80,756	ND	1,789
		2001	17,000	58,000	ND	4,500
		2002	NS	NS	NS	NS
MW-10	West of LA	1996	ND	56	ND	14
		2001	300	960	ND	180
		2002	10	17	ND	6.6
MW-11	North of LA	1996	227	2,574	ND	2,675
		2001	370	1,100	ND	1,900
		2002	340	910	ND	1,800
MW-14	North of LA (offsite)	1996	31	80	ND	82
		2001	ND	10	ND	11
		2002	ND	9.7	ND	7.9
MW-15	North of LA & MFA (offsite)	1996	240	851	ND	11,252
		2001	20	60	ND	1,300
		2002	ND	32	ND	1,200
MW-111	Northeast boundary	1996	1,870	10,126	1,264	269,385
		2001	<1000	2,800	1,900	60,000
		2002	<200	870	920	25,000
MW-112	Between LA & MFA	1996	680	1,640	360	4,519
		2001	<500	<500	<500	26,000
		2002	<250	<250	<250	14,000
MW-508	Northeast boundary	1996	209	ND	ND	9,237
		2001	<50	<50	<50	2,000
		2002	<10	19	<10	970
MW-508C	Northeast boundary (bedrock)	1996	N/A	N/A	N/A	N/A
		2001	820	660	<500	23,000
		2002	<1000	<1000	<1000	34,000
MW-601B	Northeast boundary	1996	N/A	N/A	N/A	N/A
		2001	380	1,100	1,000	3,100
		2002	330	1,200	850	3,000

** Represents the most stringent applicable Connecticut remediation standard (see Section 3.1)*

In general, concentrations within the LA source area (MW-3 and MW-9) or within the influence of the LA recovery wells (MW-11) are not decreasing. However, concentrations in wells downgradient of the LA recovery wells (MW-10, MW-14, and MW-15) are decreasing, indicating that contaminant migration has been somewhat mitigated by these wells.

Concentration data are not available within the MFA, but concentration data are available along the northeastern (downgradient) property boundary. Concentrations at MW-111 and MW-508 are decreasing, but the concentrations in other wells appear to have no discernible trend. Persistent TCE contamination two orders of magnitude above the most stringent applicable TCE standard of 219 ug/L has been found in bedrock (MW-508C), 20 feet below MW-508. This indicates that not only is contamination migrating offsite in the overburden, it is migrating offsite in the bedrock. Furthermore, these TCE concentrations of over 11,000 ug/L are indicative of DNAPL.

Off-property sampling associated with the off-property vapor study in 2002 indicates VOC contamination above the most stringent applicable standards 500 feet to the northeast (GW-1A,B,C and MW-1) beyond the Medsource facility and immediately adjacent to a residence on Old Newtown Road (GW-2A,B). The horizontal and vertical extent of offsite contamination cannot be determined from current or previous sampling events.

With regard to the inorganic contaminants, copper, nickel, and zinc have been found along the northeastern boundary of the property at stable concentrations well above the surface water protection criteria. There are no inorganics sampling results from locations downgradient to complete delineation of these compounds. Cyanide has been repeatedly detected above 0.13 mg/L at MW-15, the only well located downgradient of the site sampled for inorganics. This compares to the surface water protection criteria of 0.052 mg/L.

4.3 COMPONENT PERFORMANCE

The P&T systems in both the MFA and the LA and the SVE system in the MFA are maintained by the plant operator. Although they are attended to on a daily basis, regular monitoring was not conducted, or documentation of that monitoring is not available. Therefore, the effectiveness or efficiency is not readily discernible since 1996 when more detailed records were available.

4.3.1 EXTRACTION SYSTEM WELLS, PUMPS, AND HEADER

<u>LA System</u>

The LA ground water system operates 24 hrs/day continuously except for the winter holiday and mid-summer shutdowns, which are approximately two weeks each. The most recent data (from 1996) indicates the system influent averaged about 3.5 gpm (all 3 wells combined pumping 24 hrs/day). A check of the system flow rate during the RSE visit indicated that the flow rate was about 3 to 5 gpm. During the RSE site visit totalizers on each well were observed over a several minute period. RW-1 was observed to be pumping continuously at approximately 1 gpm, RW-2 was observed to pump continuously at about 3.5 gpm, and RW-3 was pumping little if any water.

The pumps have never been replaced, but foot valves have been replaced on occasion.

MFA System

The combined flow rate from the extraction wells in 1996 was reported at about 1.3 gpm. The system operates only during plant operating hours (8 to 16 hrs/day, 5 days/week) so the actual flow rate is about 500 to 1,100 gpd.

4.3.2 AIR STRIPPER

LA System

The most recent data (from 1996) indicates the system influent averaged about 15 mg/l total VOCs (0.6 lbs/day). Effluent VOCs were below 0.5 mg/l in 7 of the 9 analyses reported in the1996 Annual Report. The air stripper packing is currently cleaned about once per year with nitric acid. The stripper packing has not been inspected recently, and it is likely that the acid washing is no longer completely effective and the stripper efficiency has decreased. The stripper influent VOC concentrations have not been analyzed recently. An annual stripper effluent sample is reportedly taken (recent data was not provided) and semiannual combined POTW discharge samples are taken. The samples reportedly pass applicable standards.

MFA System

For ground water, data from 1996 indicates influent total VOCs at 0.4 to 4.5 mg/l (<0.1 lbs/day of VOC mass) and effluent total VOCs < 0.05 mg/l in 9 of 10 samples. VOC treatment efficiency was typically about 99.0%. The MFA ground water system influent metals concentrations were not provided, and no monitoring wells are located in the immediate vicinity of the MFA source area.

For the SVE system, VOC mass removal from the SVE system was 1 to 2 lbs/day in 1996. Current recovery data is not available.

4.3.3 EFFLUENT/DISCHARGE

All effluent is blended with treated water from the facility wastewater treatment plant before discharge to the POTW. The facility wastewater treatment plant is reportedly operating at capacity. Although it was included in the tour of the site, its effectiveness is not reviewed as part of this RSE.

The Risdon facility does require water for their operations; however, due to the high iron and calcium content of the extracted water, treated water cannot be used for the production processes.

4.3.4 SYSTEM CONTROLS

LA

Extraction pumps and transfer pumps operate based on level controls. The design drawings indicate that extraction wells are shut off based on high-high transfer tank level or low blower pressure. The facility is manned by security while the system is operating and a system operator is on call.

MFA

The system only operates during plant hours and is maintained by the plant operator as part of the wastewater treatment plant.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF COSTS

Annual costs for operating the environmental remedies and monitoring ground water are approximately $60,000 per year. A breakdown of this annual cost is provided in the following table based on estimates provided by the facility and its contractor. These costs do not include costs associated with additional studies such as the on and off-property soil vapor intrusion studies.

Item Description	Estimated Cost
Labor: Project management and technical support	$25,000
Labor: Plant operator	$10,000
Ground water monitoring (forecasted sampling and analysis)	$5,000
Utilities: Electricity	$9,200
Well/Pump Maintenance	$2,800
Non-utility consumables (GAC, chemicals, other materials or parts)	$500
Chemical Analysis (process monitoring)	$500
Discharge fees and waste disposal (POTW)	$7,500
Total Estimated Cost	**$60,500**

4.4.1 UTILITIES

The utility costs provided are for the electricity required to operate the extraction-well pumps, ground water treatment systems, and MFA SVE system. Additional electrical costs are required for operation of the facility wastewater treatment plant, but this is not included.

4.4.2 NON-UTILITY CONSUMABLES AND DISPOSAL COSTS

Only the vapor phase GAC used for the MFA P&T system is included. Chemical costs associated with the pH neutralization and LA air stripper acid washes are not included.

4.4.3 LABOR

The plant operator is on salary for operating the facility wastewater treatment system. His responsibilities include maintenance of the two P&T systems and the SVE system. The $10,000 included in the above table represents a portion of the salary estimated by the facility.

4.4.4 OTHER COSTS

The ground water sampling and analysis cost of $5,000 provided in the table is for the forecasted monitoring program (i.e., for 2003 and beyond). The cost of $5,000 was estimated based on the cost for the 2002 sampling program that was provided during the RSE site visit. The forecasted monitoring includes annual sampling and analysis of VOCs at 13 locations and metals at 10 locations (most of which overlap with the 13 VOC locations). This forecasted monitoring program marks a decrease from the 2002 monitoring program as discussed in Section 2.4 of this report. The 2002 ground water monitoring program cost was approximated as $15,000 and included the same VOC sampling and analysis, but also included quarterly (rather than annual) sampling for metals.

4.5 RECURRING PROBLEMS OR ISSUES

The most prevalent recurring problems or issues with remedy operation pertain to the LA P&T system, because it is isolated from the other site systems and checked less frequently. Sedimentation has reportedly reduced the depth to bottom of some of the wells. In addition, fouling or other problems may be contributing to reduced extraction rates. During the RSE, RW-3 appeared to not be pumping. The flow totalizers suggested a total flow rate of approximately 5 gpm. The operator was not aware of this apparent decrease. The LA air stripper also is likely fouled beyond the potential for cleaning. However, the efficiency of the unit is difficult to determine due to a lack of influent and effluent sampling.

With regard to ground water sampling, the primary problem is that access to MW-9 is frequently limited by parked cars, which block the well despite the use of traffic cones to keep it clear. Although not necessarily a recurring issue, the RSE and site team identified that the cap for MW-12 had previously been destroyed, most likely by the snow plow, and was open to the atmosphere.

4.6 REGULATORY COMPLIANCE

The plant reportedly meets all discharge requirements. Although influent and effluent sampling is not conducted routinely, historical data suggest the mass removed by the P&T and SVE systems are likely well below the reported annual limit of 15 tons per year.

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

No releases or accidents were reported during the site visit.

4.8 SAFETY RECORD

No reportable incidents were indicated by the facility or contractor during the site visit.

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

5.1 GROUND WATER

Because ground water has a GB classification and there is a lack of potable wells in the vicinity, the primary avenues of exposure to ground water are due to volatilization of VOCs and discharge of contaminants to the Still River.

Residential and commercial/industrial properties downgradient have ground water concentrations exceeding applicable volatilization criteria. Of particular concern is the elevated VOC concentrations in the ground water near a residence on Old Newtown Road, which has a basement. Also of potential concern are the commercial buildings in the area without basements, including the Risdon office space, which directly overlies the highest recorded concentrations of site-related VOCs.

Ground water exceeding the surface water protection criteria for TCE was found in the overburden approximately 500 feet offsite in grab samples at GW-1A, GW-1B, and GW-2A. Given that contamination has been found in bedrock at MW-508C on site, it is probable that contamination above standards is present in bedrock offsite.

Furthermore, it is apparent that contaminated ground water continues to migrate off the Risdon site as the ground water extraction system is insufficient to provide hydraulic containment, particularly at the northeastern boundary of the site.

5.2 SURFACE WATER

The current data are insufficient to determine if surface water (Still River or wetlands) is being impacted by VOCs and/or inorganics, since no surface water sample results were provided to the RSE team and the offsite VOC plume and inorganic impact have not fully been delineated.

5.3 AIR

Residential and commercial/industrial properties downgradient have ground water concentrations exceeding applicable volatilization criteria. The data are insufficient to determine if humans are being impacted by VOC's, since no vapor samples from inside structures were provided to the RSE team. The CT Department of Public Health has suggested testing of the indoor air at the two residences near the site due to the high potential for vapor intrusion. Further efforts are also needed to determine if indoor air is compromised at the commercial properties, including the Risdon facility. An indoor air sampling event has been planned for late March 2003.

5.4 SOILS

Potential exposure pathways to contaminated soil were not explicitly reviewed by the RSE team. However, the site team indicated the greatest potential exposure to contaminated soil would be through construction that requires digging or work on subsurface utilities. In such cases, the air quality due to VOCs would be a primary concern rather than soil ingestion and dermal absorption. Based on discussions during the RSE site visit, no institutional controls are in place to prevent such exposures.

5.5 WETLANDS AND SEDIMENTS

The data are insufficient to determine if sediments in the Still River or if the wetland downgradient of the site are being impacted by VOCs. No sediment sample results were provided to the RSE team.

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.

The following sections provided recommendations in four categories. The recommendations are generally presented such that the more critical recommendations in each category appear first. Section 6.5 provides a suggested approach to implementation that more clearly prioritizes the recommendations.

6.1 RECOMMENDATIONS TO IMPROVE EFFECTIVENESS

6.1.1 PERFORM VAPOR SAMPLING WITHIN BUILDINGS, INSTALL VENTING SYSTEMS AS APPROPRIATE

The June 2002 Health Consultation Report recommends sampling the 2 residences because the ground water and soil gas concentrations at both indicate indoor air could be above chronic comparison values. It does not specifically recommend sampling the 3 commercial/industrial locations unless significant cracking of the slab or other structural defects are evident. Sampling at some of the commercial properties can be delayed and made contingent on the results of the residential sampling; however, the reduction in cost does not necessarily scale with the number of samples and making two trips would likely be more costly than one single trip. Sampling of air in the Risdon facility should also be considered. Facility uses of TCE and other chlorinated solvents may complicate this sampling, but sampling in the office spaces may be merited, particularly given the high soil vapor concentrations beneath that area.

A work plan should be simple, including proposed locations and use of a PID for screening inside. If VOCs are found above comparison values in indoor air, a venting system should be installed. If not, monitoring should continue at the residences and possibly the other locations on a quarterly basis for a year, and annually thereafter as long as high ground water levels are still present. For budgeting purposes, the annual cost for continued sampling at these locations over the upcoming years is assumed at $5,000 per year.

A work plan for sampling was completed by the site contractor and reviewed by EPA. Because the EPA review of this document coincided with the time frame of this RSE report, the work plan was not reviewed by the RSE team. In its comments on the draft RSE report, the facility indicated that sampling would only be conducted at the two residences and that ground water and soil vapor sampling would be conducted in addition to indoor air samples to include in the assessment of vapor intrusion. The cost of the effort was not provided.

6.1.2 DEVELOP AND IMPLEMENT INSTITUTIONAL CONTROLS

The site team should work with the local Department of Power and Water and the board of health to implement institutional controls, both onsite and offsite. These controls should clearly outline the estimated plume area. In addition, they should prevent the use of ground water without treatment within the plume area and should outline specific health and safety measures to be taken by construction or subsurface utility workers that are working within the plume area.

The cost to develop these institutional controls may range from $5,000 to $20,000, including meetings and document preparation.

6.1.3 ADD EXTRACTION WELLS TO PROVIDE HYDRAULIC CONTAINMENT NEAR THE PROPERTY BOUNDARY

Additional ground water extraction is recommended to address continued offsite contaminant migration along the northeastern property boundary and "stabilize" the site. Implementing this recommendation should be a priority short-term goal. Although this additional pumping alone would not necessarily satisfy the ground water EI, it is a crucial step because it provides a degree of plume control and it prevents further offsite migration that is more difficult to address. Additional pumping or remedial action at offsite locations can be addressed as part of more intermediate goals.

This recommended ground water extraction should serve the following purposes:

- It should work in concert with pumping from the LA to prevent offsite migration of contamination in both the overburden and the bedrock (i.e., stabilize the site).

- It should provide a zone of capture that, if possible, does not include receptors. That is, the extraction wells should be located such that contamination is not pulled near potential receptors at levels that pose an unacceptable risk.

The August 1999 Interim Corrective Measure Evaluation Report proposed locations for two extraction wells based on ground water modeling and particle tracking. EW-4 would be located between the LA and the MFA near MW-112 and would pump at approximately 3 gpm from both the overburden and weathered bedrock and EW-5 would pump at approximately 5 gpm from near the MW-601 cluster. Although these two extraction wells are appropriately located for two crucial areas of contamination, they do not address the bedrock contamination in MW-508C. Therefore, a bedrock extraction well located near MW-508C is also recommended. Based on the extraction rates at the other proposed extraction wells, an appropriate extraction rate for the third new well may be between 3 and 5 gpm. Figure 6-1 depicts the proposed locations for the three new extraction wells. All three new wells should be screened across overburden and bedrock from about 10 feet bgs to the bottom of the well.

A calculation presented in Section 4.2.2 of this report suggests that pumping on the order of 5 gpm on the low-end may be appropriate for a capture zone 200 feet in width. Together, the three new pumping wells are estimated to pump over 10 gpm.

Submersible pumps should be used at the new wells because they allow for drawdown beyond ~27 feet (~80% of a perfect vacuum), which is the maximum the aboveground pumps can draw. The extra drawdown may or may not be necessary but in case it is, submersible pumps can provide it for a cost similar to aboveground pumps. The facility might also potentially save cost on smaller vault construction by using submersible pumps.

Once installed, the new extraction wells should be pump tested for approximately 24 hours. The results of pump tests should be interpreted to determine the yield and estimate hydraulic conductivity. If these estimates are not as expected additional extraction wells may be considered. Measurement of water levels and pumping influence should occur in both the overburden and bedrock (including MW-508C) so that capture of contamination can be evaluated in both formations. Sampling for VOCs and metals should also be conducted during the pump test (during the initial pumping and near the end of pumping) to provide an indication of concentrations under pumping conditions. This is pertinent given that concentrations in extraction wells are often lower than monitoring wells and use of monitoring well concentrations could lead to over-design of a modified treatment system.

Once the extraction wells are operating continuously, their effectiveness at providing containment can be determined by interpreting potentiometric surface maps, analyzing capture with an updated ground water model (see Section 6.1.8), and monitoring changes in constituent concentrations downgradient of the expected capture zone. The current ground water monitoring program (annual water quality sampling and quarterly water level measurements) likely provides sufficient data to conduct these analyses and update the ground water model. Therefore, an increase in the sampling frequency from monitoring wells is likely not necessary. Sampling of the blended treatment system influent, however, should be conducted and reported as discussed in Section 6.3.1.

The cost for well installation is estimated at approximately $36,000, including well heads and pumps. This assumes 3 wells that are on average 40 feet deep. The well near MW-508C may be deeper (approximately 50 feet), but EW-4 may be shallower (approximately 30 feet in depth). The pump tests for the three wells, including the water disposal, interpretation, and laboratory analysis could likely be done for approximately $25,000.

6.1.4 INSPECT AND REHABILITATE WELLS AND PIPING FOR THE LA EXTRACTION SYSTEM

The LA extraction wells were originally intended to pump 3 gpm each for a total extraction rate of 9 gpm in the LA. However, measured extraction rates are lower. In 1996, the total extraction rate was measured at 3.5 gpm, and during the RSE site visit the flow totalizers suggested a total extraction rate of 4.5 gpm, with RW-3 not pumping. Decreases in concentrations at MW-10, MW-14, and MW-15 suggest that pumping has historically provided a degree of capture, but current pumping may not provide complete capture. The model simulations presented in the August 1999 Interim Corrective Measure Evaluation Report assumed RW-1, RW-2, and RW-3 were each pumping 3 gpm. These simulations suggested capture would be complete in the LA with a total extraction rate of 9 gpm.

These wells should be inspected and rehabilitated or replaced as necessary. The wells should be investigated for sedimentation that may have reduced the length of the screened interval, and the wells and the piping should be inspected for biofouling. The level of effort for the inspection and rehabilitation/replacement is difficult to estimate and depends on what the inspection reveals. The RSE team estimates approximately $15,000 for this task, which includes the inspection, chemical treatment, and replacement of some piping. It does not account for re-drilling any of the wells. The goal is to restore the LA extraction system capacity back to 9 gpm. Depending on the causes that are identified, a well-maintenance program may be advisable.

6.1.5 REPLACE EXISTING TWO TREATMENT SYSTEMS WITH ONE NEW SYSTEM CAPABLE OF TREATING A HIGHER FLOWRATE

The extracted ground water from the LA, MFA, and new extraction wells should be treated by a single, automated treatment system with a low-profile air stripper (tray aerator) that would likely be located in the current MFA treatment area. The air stripper should be capable of handling up to 50 gpm (to allow for system expansion) and the expected influent concentrations, which should be estimated based on the blended influent from the LA and MFA (samples are needed) combined with the blended influent of the new wells estimated from the pump tests. Vapor phase GAC (two 1000-pound units arranged in series) will likely be needed for treatment of the air stripper offgas. Based on the metals concentrations seen in monitoring wells and the discharge standards, metals treatment will not likely be necessary. Adjustment of pH can occur as part of this system or in a separate system.

Discharge of treated water can either be to the POTW or to surface water. Current POTW costs are approximately $7,500 for approximately 5 gpm. The estimated total extraction rate would be approximately 20 gpm to 25 gpm. Therefore, under the same permit, the POTW cost may be as high as $30,000 to $37,500 per year. Alternatively, an NPDES permit for discharge to surface water could be obtained for capital costs of approximately $10,000 for the application and testing and approximately $12,000 per year in sampling and analytical costs. Therefore, with the current information, discharge to surface water appears more cost effective and the associated capital costs are included in the cost estimate for this recommendation. Savings in piping costs may be possible if piping can run inside the facility.

Item Description	Estimated Cost
Trenching, piping, electrical, controls from LA to MFA (800 feet at $100/foot)	$80,000
Trenching piping, electrical, controls from new wells to MFA (up to 1,500 feet at $100/foot)	$150,000
Air stripper with controls (installed)	$50,000
Two 1000-pound GAC units (installed)	$10,000
pH adjustment (tank, controller, probe, metering pump, piping)	$15,000
NPDES permit application and testing	$10,000
Engineering (~20%)	$63,000
Contingency (~20%)	$75,000
Total Estimated Cost	**$453,000**

Although more water will be treated, the annual electrical costs are not expected to increase significantly because treatment will be accomplished in one location by a more efficient air stripper. Materials usage, for pH adjustment and off-gas treatment will likely increase by approximately $1,000, but the actual increase is difficult to quantify without more knowledge of the expected influent concentrations. Operator labor is expected to remain the same.

6.1.6 UPDATE THE SITE CONCEPTUAL MODEL

The site team should update the site conceptual model (not a numerical model) that documents contaminant sources, contaminant fate and transport mechanisms, and potential receptors. The conceptual model can then be used to identify data gaps, can be updated based on new data, and can serve as the basis for establishing short, intermediate, and long-term goals. The updated conceptual model, the goals, and the progress toward those goals should be included in future progress reports. Establishing goals is discussed in Section 6.4 as part of a site exit strategy.

The conceptual model should account for the persistent and elevated VOC concentrations that are indicative of DNAPL. Given the currently accessible data, it is reasonable to assume that there is a continuing source of dissolved phase contamination in the LA source area and in the MFA, and possibly migrating downgradient along the top of bedrock or through bedrock toward the northeastern property boundary.

It should also account for dissolved ground water contamination migrating offsite and to what degree this migration is limited or has been limited by pumping in the LA. Furthermore, MW-508C indicates the presence of elevated concentrations in bedrock that have migrated a few hundred feet from the source area in the MFA. Such migration could continue through bedrock. The degree to which additional pumping along the northeastern property boundary will address this deep contamination should be addressed. Another aspect to be considered is the degradation of 1,1,1-TCA to 1,1-DCE. Although 1,1,1-TCA concentrations in many locations are below standards, this chemical degrades into 1,1-DCE, which has much stricter standards, including a residential volatilization criteria of 1 ug/L. Elevated concentrations of 1,1 DCE are already evident in multiple wells.

The various potential receptors (i.e., indoor air and surface water) should also be considered. For example, once indoor air is addressed at the residence on Old Newtown Road, impacts to the Still River should be considered, especially since the river is less than 100 feet further downgradient of the residence.

The site remedy, including the addition of extraction wells, should be consistent with the site conceptual model. The documentation of this site conceptual model should occur in the annual reports (see Recommendation 6.3.1). Approximately $5,000 beyond the cost of the first annual report may be needed for an initial update to the site conceptual model.

6.1.7 RECONFIGURE SVE SYSTEM (ADD NEW SVE WELLS IN SELECTED AREAS)

The June 2002 On-Property Soil Vapor Survey Report indicated: 1) elevated vapor concentrations along the northeastern portion of the facility and also in the MFA; and 2) a rebound effect in the MFA when the SVE system is shut down. Although the soil vapors in the MFA are addressed by the current SVE wells, vapors below office space to the northeast are not. SVE has a positive affect on soil vapor concentrations. As a result, the SVE system should be augmented with additional extraction points along the northeastern portion of the property. The RSE team suggests the addition of approximately 8 new wells to a depth of 15 feet. The RSE team estimates that the well installation and associated piping could be done for approximately $30,000. With the additional mass recovery, vapor GAC will likely be required for treatment of the recovered vapor.

To minimize disruption to the office space and factory, the wells might be located just outside of the facility toward Old Newtown Road. Running the pipe for these wells (or even the extraction wells recommended in Section 6.1.3) to the treatment area in the MFA might result in cutting of the plant floor. This would likely pose a health and safety issue due to high soil vapor concentrations. Therefore, appropriate measures should be taken or alternative routes for laying the pipe should be considered. Currently, for many of the recovery wells (both SVE and P&T) within the MFA, piping is run above ground along the facility walls and ceiling.

6.1.8 UPDATE/VALIDATE GROUND WATER FLOW MODEL AFTER NEW EXTRACTION WELLS ARE ON-LINE

A well-calibrated ground water flow model is a useful tool for evaluating the effectiveness of a remedy because it considers pumping rates, estimated hydraulic conductivities, recharge, measured water elevations, and known geological information (e.g., depth to bedrock). For capture zone analyses, it can be used (along with particle tracking) to outline the interpreted capture zone. The model should be able to reasonably match measured water levels for various pumping scenarios. Therefore, the model should be calibrated to the water levels collected during the current pumping scenario as well as to the water levels that are collected after the new extraction wells have been installed. It is crucial, however, to have accurate information, such as the flow rates. Therefore, when the model is calibrated to water levels under current pumping conditions, it should account for the actual flow rate, which appears to be approximately 4.5 gpm rather than the presumed 9 gpm. The RSE team feels that the new extraction wells should be installed and on-line (a high priority) prior to updating the model.

Once the model is calibrated to multiple pumping scenarios, it should be used to evaluate capture and site stabilization. At a later time, a contaminant transport model can potentially be developed to simulate contaminant concentrations both within the containment zone and beyond the containment zone. Ground water modeling of contaminant transport may be useful in evaluating the risks of the downgradient offsite plume to various potential receptors and to guide the site team in choosing an appropriate remedy for the offsite contamination.

The modeling report that describes the calibration of the ground water model and the use of the ground water model for capture zone analyses or remedy evaluations should include or reference the following basic information:

- rationale for horizontal and vertical discretization and boundary conditions
- parameter values used and the basis for those values (i.e., hydraulic conductivity distribution, recharge, pumping
- model calibration simulations including the measured vs. simulated water levels, at multiple locations, for various pumping combinations
- simulation results for scenarios, and an assessment of how the results might change if different parameter values were assigned

This flow modeling effort is approximated to cost $20,000.

6.1.9 PERFORM OFFSITE PLUME DELINEATION

Ground water contamination has been found above the most stringent applicable standards over 500 feet from the site (GAR-MW-1 and GW-1 cluster). In addition, TCE contamination orders of magnitude above standards has been found in bedrock approximately 20 feet below the majority of the site monitoring wells. This bedrock contamination has not been delineated vertically or horizontally. Given that bedrock contamination has been found in MW-508C, a few hundred feet from the MFA or LA source areas, it is likely that this contamination has either migrated further or has the potential to migrate further.

The ground water contamination above the most stringent applicable standards should be delineated horizontally and vertically offsite. To the extent possible, monitoring wells from other properties can be used. For example, MS-MW-4 appears similar in location to the GW-1 cluster where contamination was previously found and the GAR-MW-1 well was sampled as part of the off-property air quality study. There are other areas, however, that also should have wells installed. For example, ground water at the residence on Old Newtown Road has been found to exceed standards in direct-push samples. A permanent monitoring well would be useful on this property because it is proximate to two potential receptors, the residence (indoor air) and the Still River, less than 100 feet away.

Two monitoring wells were proposed in the August 1999 Interim Corrective Measure Evaluation Report. One of those wells, MW-701 (not shown), is similar in location to some of the Medsource wells (MS-MW-5 and MS-MW-6) and may not be necessary, if those Medsource wells can be sampled. The other well, MW-702 (not shown), however, is a bedrock well adjacent to MW-15 and will likely yield valuable information with regard to the extent of the bedrock contamination found in MW-508C. The majority of the existing offsite monitoring wells are depicted in Figure 1-3.

If monitoring wells from adjacent properties can be sampled as part of the delineation effort, the RSE team estimates the need for approximately 2 additional shallow wells and up to 5 bedrock wells. However, if these additional wells cannot be used, the RSE team estimates the need for up to 10 soil borings, approximately 5 shallow wells, and up to 5 bedrock wells.

The following cost estimate pertains to the more optimistic option of using existing wells on nearby properties.

Item Description	Estimated Cost
Installation of 2 shallow monitoring wells	$8,000
Installation of up to 5 bedrock wells (over 40 ft deep)	$25,000
Survey	$1,000
Sampling of approximately 15 offsite wells (two rounds, one to coincide with annual sampling event) for VOCs and inorganics	$22,000
Total Estimated Cost	**$56,000**

It is likely that some of the offsite wells would be added to the annual sampling program for VOCs. In addition, a final remedy that addresses the offsite plume will likely be required. The scope of this remedy is difficult to determine prior to the investigation. The remedy may range from "remedy by monitoring" supplemented with model simulations demonstrating plume stabilization and acceptably low risks to potential receptors to high-intensity targeted (HIT) events in select locations to the installation and operation of offsite extraction wells. The potential future costs of monitoring and an appropriate remedy are not included in this estimate but should be revisited by the site team once the recommended investigation is complete.

6.2 RECOMMENDATIONS TO REDUCE COSTS

No specific recommendations were found to reduce the costs of current operation. The recommendations to improve effectiveness, improve technical operation, and gain site closure are intended to provide cost-effective solutions that are protective of human health and the environment. For example, the RSE team believes that installing and operating one effective treatment system, as suggested in Recommendation 6.1.6, is more cost-effective than installing and operating multiple treatment systems. In addition, clearly outlining site goals, as discussed in Recommendation 6.4.1, will help optimize the use of resources and limit site activities to those essential to meet the site goals.

6.3 MODIFICATIONS INTENDED FOR TECHNICAL IMPROVEMENT

6.3.1 INSTITUTE QUARTERLY AND ANNUAL OPERATIONS REPORTS

The P&T and SVE systems are integral to the site remedy and their performance should be routinely evaluated and documented in quarterly and annual reports. Evaluation should include routine reading of system parameters as well as regular influent and effluent sampling and comparison of these readings to expected values and permit limits as applicable. This information should be available to the environmental consultants for their review so that ground water conditions can be compared to the status and performance of the extraction and treatment systems. Rather than submitting an additional report to the already submitted quarterly ground water monitoring reports, the operations and ground water data can be included in a single ground water and O&M quarterly monitoring report that includes the following:

- summary of major issues
- weekly flow rates (by well and total)
- quarterly influent and effluent water concentrations
- monthly influent and effluent off-gas and SVE concentrations using a PID
- mass removal calculations
- daily operator logs
- quarterly water levels on a figure (with interpreted potentiometric surface)
- maintenance summary
- action items

The estimated cost is $7,500 per quarter ($30,000 per year) and includes the report and laboratory analyses for the process monitoring. An increase in operator labor to collect samples and record measurements may be expected, but this should be more than offset by the labor savings from implementing the treatment system described in Section 6.1.5.

The annual reports would summarize the quarterly reports but would also include the ground water monitoring results and an evaluation of the remedy relative to its goals:

- summary of system performance relative to goals and expected performance
- updates to site conceptual model and exit strategy
- contaminant concentrations at monitoring wells (annual sampling at approximately 25 new and existing select wells for VOCs and key inorganics)
- system influent trend analysis including graphs and figures
- a discussion of ground water hydraulic containment, trends in the plume, and cleanup progress
- surface water and/or vapor sampling results and trends

An annual report is expected to cost approximately $20,000. The ground water sampling and analysis, including offsite wells, is expected to cost approximately $15,000 per year based on unit costs consistent with the current ground water monitoring. Therefore, the total cost for all ground water and process water monitoring and reporting is approximately $65,000 per year. Given that the costs for ground water and process water sampling provided in the table in Section 4.4 is approximately $5,500, the net increase in annual costs for this recommendation, relative to the costs in the Section 4.4 table, is approximately $59,500.

6.3.2 REPAIR SURFACE CAP FOR MW-12

During the RSE site visit, the surface cap for MW-12 was observed to be destroyed (probably by snow plow), and the flush-mounted monitoring well was open to air. This cap should be replaced. Costs are negligible relative to the costs of the other recommendations.

6.4 CONSIDERATIONS FOR GAINING SITE CLOSE OUT

6.4.1 DEVELOP AN EXIT STRATEGY

The site team should develop a clear plan or exit strategy for remediation at this site. Although the site will not be ready for closure for a number of years, the plan for reaching closure should be established. Addressing crucial items such as controlling potential human exposures and stabilizing the plume should be given first priority, and delineating and remediating offsite contamination should follow. An exit strategy should do the following:

- identify all of the major environmental issues associated with the site
- prioritize those issues
- set goals for achieving those issues with specific conditions that make it clear when those goals are achieved (including the discontinuation of active remediation)
- provide measurable intermediate milestones to denote progress toward achieving those goals

This exit strategy will facilitate communication between the facility, EPA, and CTDEP and help the site team prioritize the site issues and address them in a timely manner. The RSE report summarizes some potential options for short-term, intermediate-term, and long-term goals to serve as discussion points for the site team. Actual site-specific goals should be developed by the site team. The RSE report emphasizes that the following options for goals are relatively broad and a complete exit strategy requires additional detail as mentioned in the above bullet list. The estimated cost for developing a site exit strategy is approximately $20,000, including one set of revisions and discussions with EPA and CTDEP.

<u>Example Short-term Goals</u>

General time frame: to be accomplished as soon as possible (goal should be the end of 2003).

- sample indoor air at surrounding residences and commercial buildings (including the Risdon facility) and implement venting systems as necessary (Recommendation 6.1.1)
- develop and implement institutional controls (Recommendation 6.1.2)
- install additional on-site extraction wells to contain ground water contamination at the site boundary and prevent further offsite migration in both overburden and bedrock (6.1.3)
- inspect and rehabilitate, as necessary, the LA ground water recovery wells (6.1.4)
- install a new treatment system capable of handling the combined flow from the MFA, LA, and new extraction wells (6.1.5)

Example Intermediate-term Goals

General time frame: to be accomplished in a timely manner but not at the expense of the short-term goals. Appropriate completion times for some of these goals may be during 2004 and others may be as late as 2006.

- update the site conceptual model (Recommendation 6.1.6)

- control migration of vapors in subsurface by enhancing SVE system (Recommendation 6.1.7)

- update ground water model and use regularly to evaluate control of contaminant migration offered by onsite wells (Recommendation 6.1.8)

- delineate off site plume in both overburden and bedrock (Recommendation 6.1.9)

- develop a site exit strategy that includes the set of site conditions that will allow active remediation (i.e., the P&T and SVE systems as well as offsite remedies) to be discontinued (Recommendation 6.4.1)

- evaluate risk to additional potential offsite receptors, including the Still River, wetlands, and other potential indoor air receptors

- evaluate potential remedial strategies to control continued offsite plume migration

- implement remedial strategy to control offsite migration and eliminate exposure pathways

Example Long-term Goals

General time frame: evaluations to be accomplished in a timely manner but not at the expense of either the short-term or intermediate-term goals. Appropriate completion times for these goals may be during 2008 and on a similar interval thereafter. Important remediation technologies or site-related developments could accelerate the evaluation timing.

- revisit operating remedies on a regular basis, perhaps every 5 years, to evaluate system performance and identify opportunities for cost savings due to changing site conditions

- consider alternative technologies to reduce contaminant concentrations and perhaps accelerate time to closure

6.5 SUGGESTED APPROACH TO IMPLEMENTATION

The suggested approach to implementing the RSE recommendations is generally outlined in Section 6.4.1. The recommendations covered in Section 6.3 were not discussed. The RSE team assumes that the monitoring well cap (6.3.2) will be addressed immediately and that the first quarterly report could be submitted in June 2002.

7.0 SUMMARY

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 and the public. These recommendations have the obvious benefit of being formulated based upon operational data unavailable to the original designers.

Recommendations are primarily made to improve the protectiveness of the remedy. A number of recommendations are provided. Short-term recommendations include addressing potential ongoing human health exposures, suggesting locations for additional extraction wells to prevent further migration of ground water contamination from the site, and installing a suitable treatment system to address the blended influent from all on-site extraction wells. More intermediate recommendations include updating the site conceptual model and delineating offsite contamination. Developing a site exit strategy is also recommended, and the RSE team provides a number of potential options for short-term, intermediate-term, and long-term goals. The site team should develop site-specific goals as well as specific metrics that indicate progress toward those goals.

Table 7-1 provides the net cost impacts from implementing the RSE recommendations described in Section 6 of the report. For each recommendation, the capital and annual costs are presented as well as the total cost, over the next 10 year period. The 10-year cost is provided both with and without discounting, assuming all capital costs are incurred in the first year. Although a 10-year period is assumed for this cost summary, this is not to imply that site closure will occur in 10 years. Also, additional site activities may occur, such as active offsite remediation, that have not been quantified at this point.

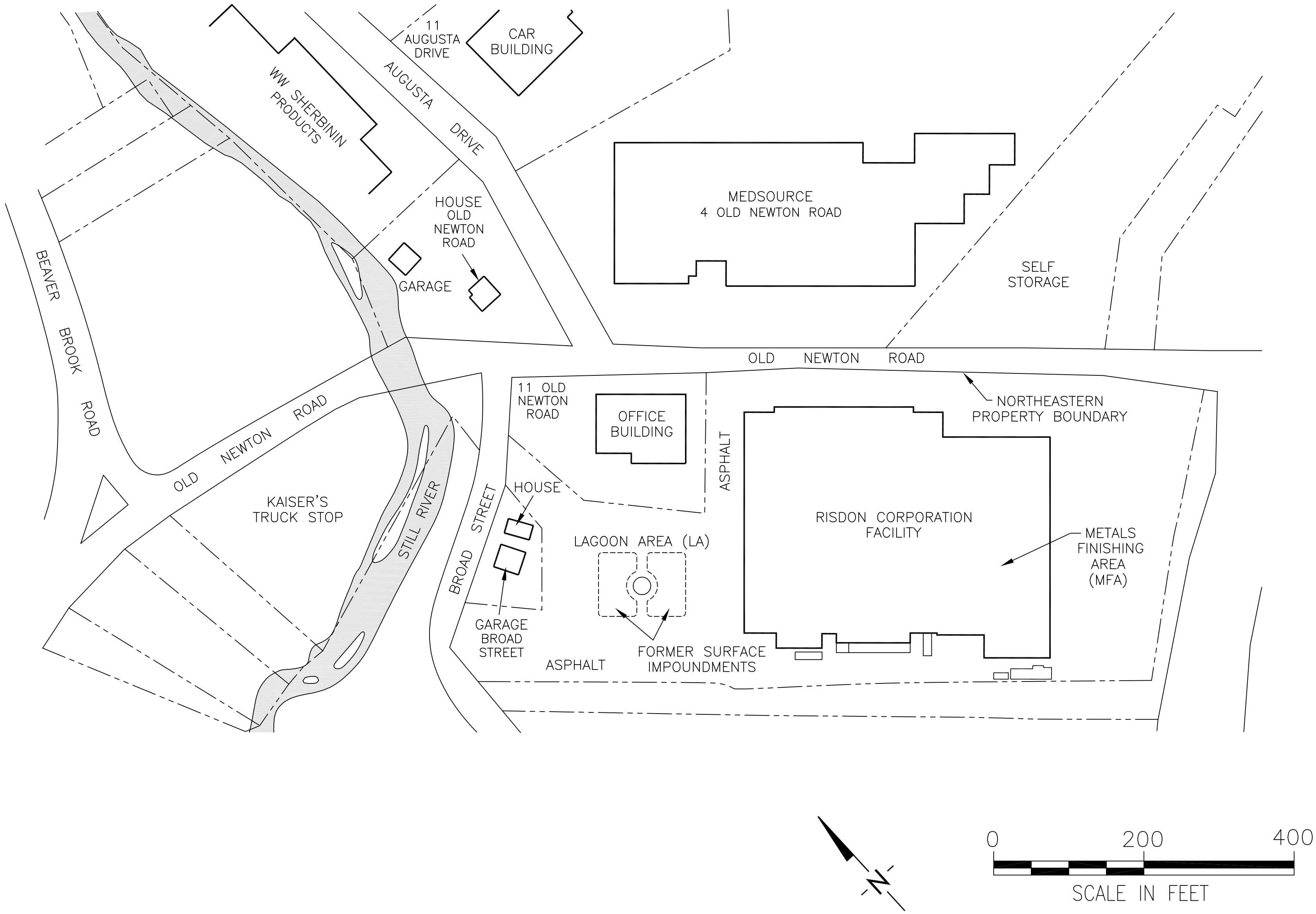
Table 7-1. Cost Summary Table by Recommendation

Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change In Costs for 10 years ($) *	Estimated Change In Costs for 10 years ($) **
6.1.1 Perform Vapor Sampling Within Buildings, Install Venting Systems As Appropriate	Effectiveness	$0	$5,000	$50,000	$40,500
6.1.2 Develop and Implement Institutional Controls	Effectiveness	$15,000	$0	$15,000	$15,000
6.1.3 Add Extraction Wells to provide Hydraulic containment Near the Property Boundary	Effectiveness	$61,000	$0	$61,000	$61,000
6.1.4 Inspect and Rehabilitate Wells and Piping For The LA Extraction System	Effectiveness	$15,000	$0	$15,000	$15,000
6.1.5 Replace Existing two Treatment Systems With One New System Capable of Treating A Higher Flowrate	Effectiveness	$453,000	$0	$453,000	$453,000
6.1.6 Update A Site Conceptual Model	Effectiveness	$5,000	$0	$5,000	$5,000
6.1.7 Reconfigure SVE System (Add New SVE Wells in Selected Areas)	Effectiveness	$30,000	$0	$30,000	$30,000
6.1.8 Update/Validate Ground Water Flow Model After New Extraction Wells are On-Line	Effectiveness	$20,000	$0	$20,000	$20,000
6.1.9 Perform Off-Site Plume Delineation	Effectiveness	$56,000	$0	$56,000	$56,000
6.3.1 Institute Quarterly and Annual Operations Reports	Technical Improvement	$0	$59,500	$595,000	$482,000
6.3.2 Repair Surface Cap For MW-12	Technical Improvement	< $1,000	$0	< $1,000	< $1,000
6.4.1 Develop An Exit Strategy	Site Closeout	$20,000	$0	$20,000	$20,000
	Totals	$676,000	$64,500	$1,321,000	$1,198,500

Costs in parentheses imply cost reductions.
* assumes a discount rate of 0% (i.e., no discounting)
** assumes a discount rate of 5% and no discounting in the first year

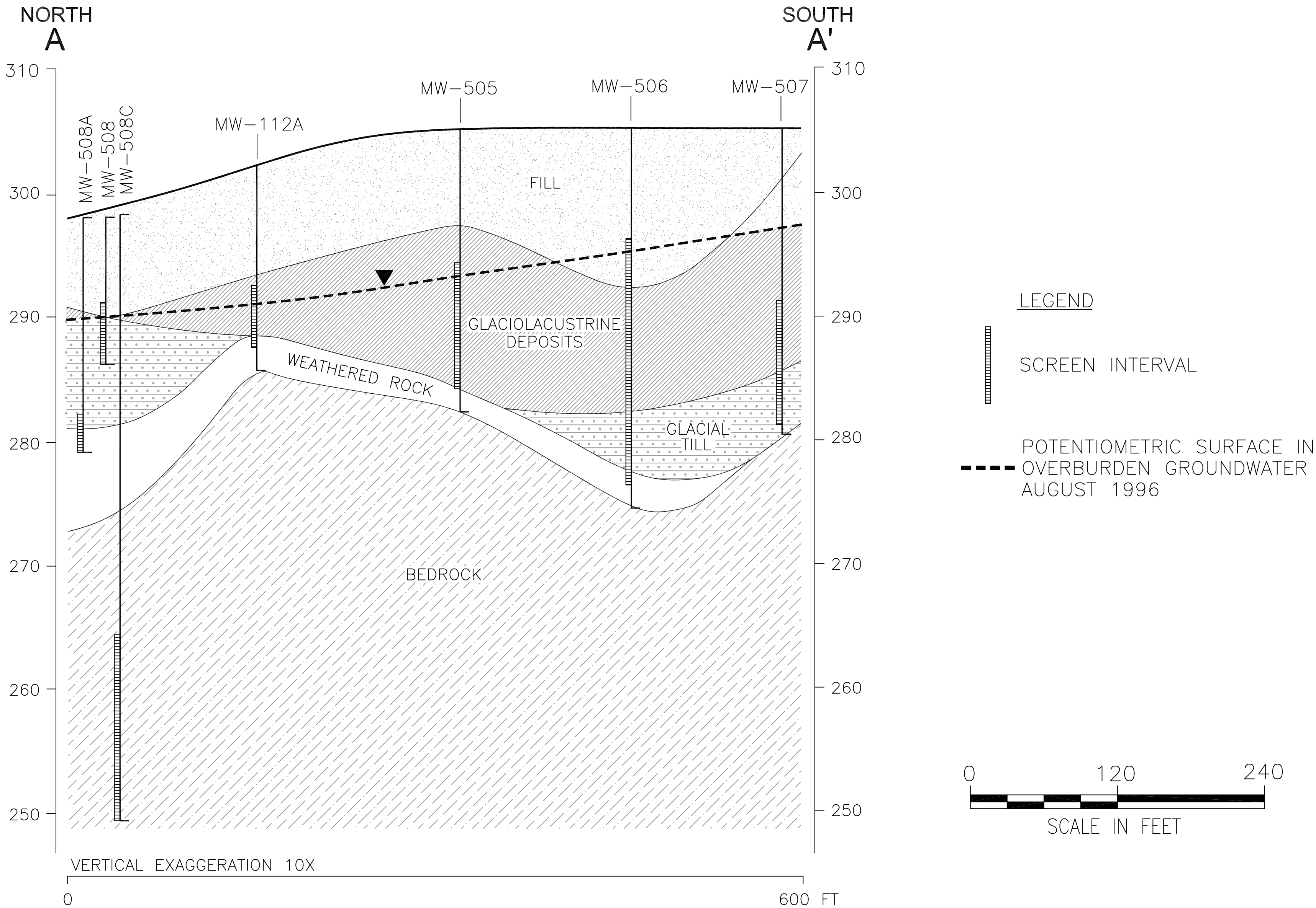
FIGURES

FIGURE 1-1. AREA SURROUNDING THE RISDON FACILITY.



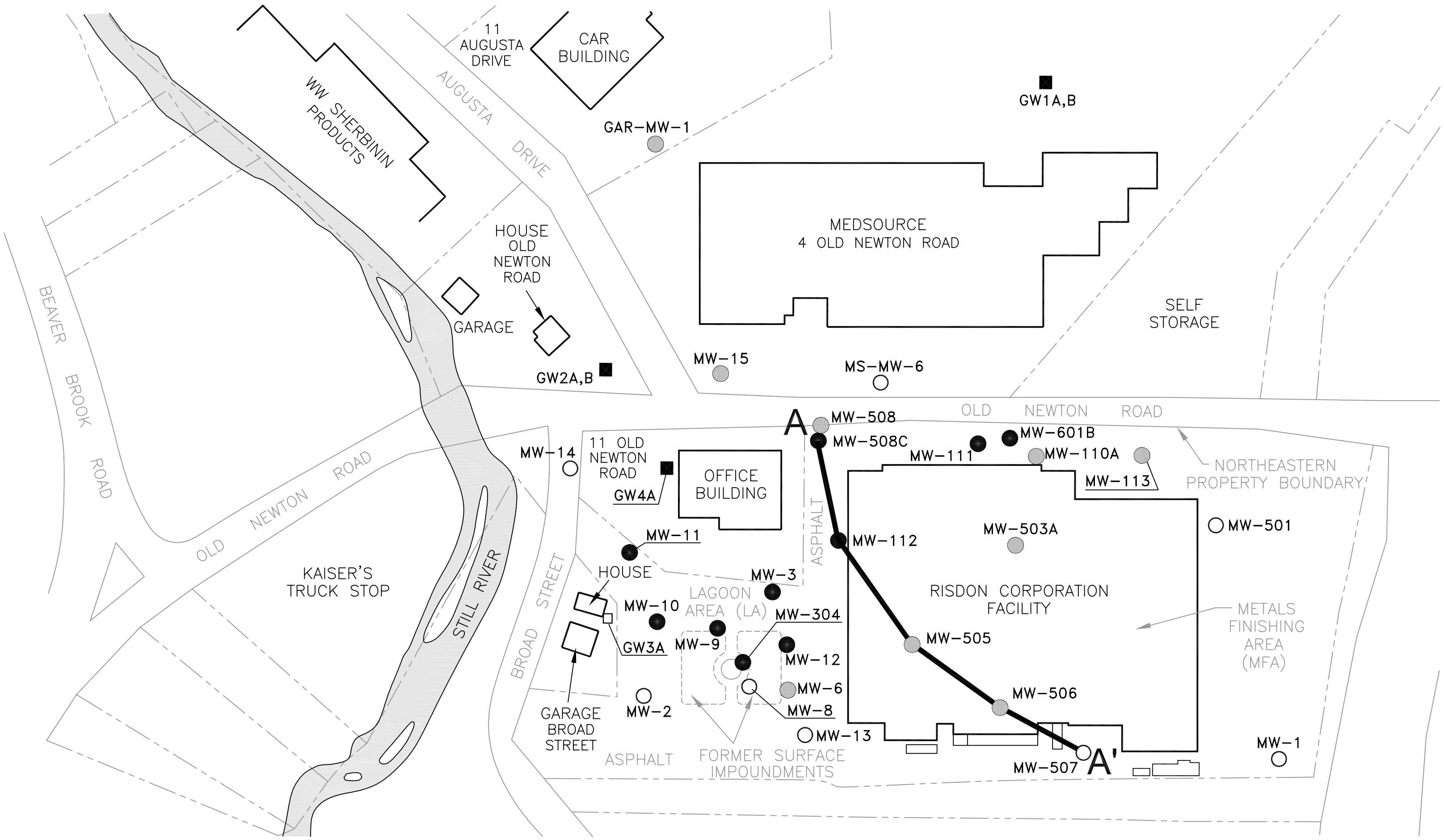
(Note: This figure is based on figures in site documents prepared by Woodard & Curran.)

FIGURE 1-2. GEOLOGIC CROSS-SECTION A-A' DEPICTED IN FIGURE 1-3.



(Note: This figure is a re-creation of Figure 5-4 from the RCRA Facility Investigation Report, Woodard & Curran, January 1999.)

FIGURE 1-3. EXTENT OF VOC CONTAMINATION BASED ON THE SEPTEMBER 2001 SAMPLING EVENT AND THE 2002 OFF-PROPERTY SOIL VAPOR AND GROUNDWATER SAMPLING REPORT. THE ORIENTATION OF CROSS-SECTION A-A' IN FIGURE 1-2 IS DEPICTED.



LEGEND

- ○ MONITORING WELLS WITH VOC CONCENTRATIONS BELOW THE STRICTEST REMEDIATION STANDARDS
- ◍ MONITORING WELLS WITH VOC CONCENTRATIONS ABOVE THE STRICTEST REMEDIATION STANDARDS
- ● MONITORING WELLS WITH VOC CONCENTRATIONS AT LEAST 2 ORDERS OF MAGNITUDE ABOVE THE STRICTEST REMEDIATION STANDARDS
- □ DIRECT-PUSH GRAB SAMPLES WITH VOC CONCENTRATIONS BELOW THE STRICTEST REMEDIATION STANDARDS
- ■ DIRECT-PUSH GRAB SAMPLES WITH VOC CONCENTRATIONS ABOVE THE STRICTEST REMEDIATION STANDARDS

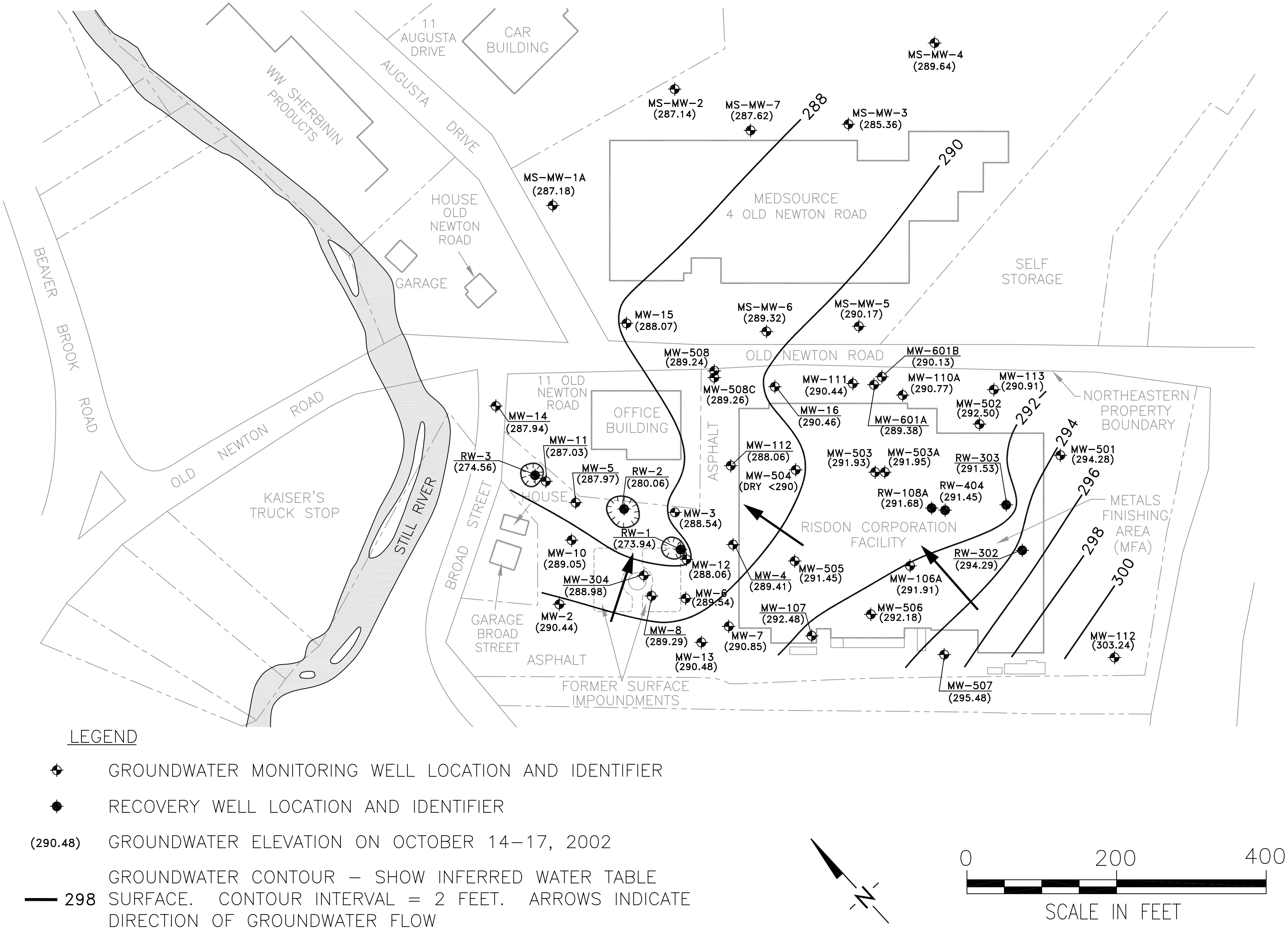
N

0 200 400

SCALE IN FEET

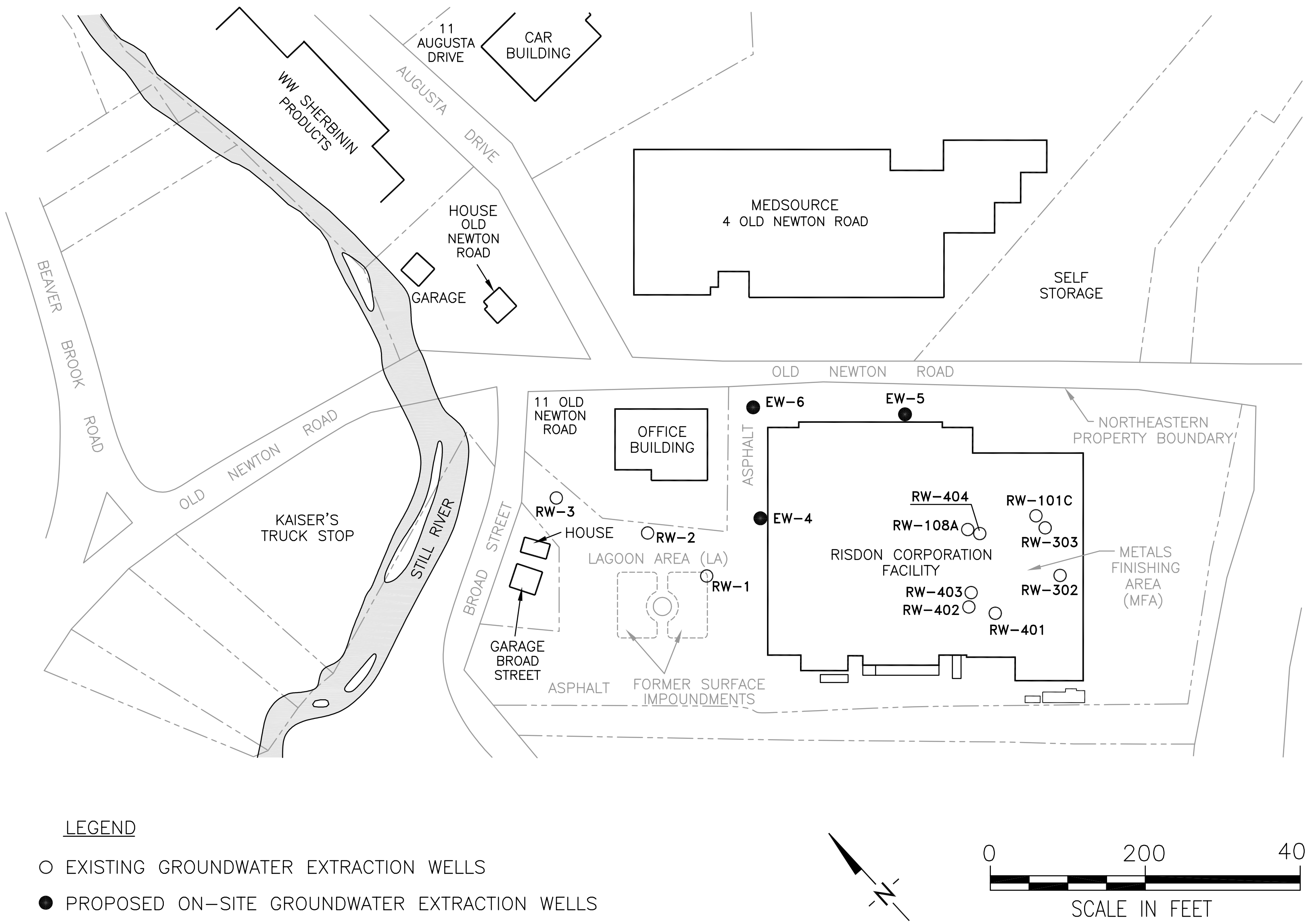
(Note: This figure is based on figures in site documents prepared by Woodard & Curran.)

FIGURE 4-1. POTENTIOMETRIC SURFACE MAP PROVIDED IN THE JANUARY 2003 GROUNDWATER MONITORING REPORT.



(Note: This figure is a re-creation of Figure 2 from the December 2002 Quarterly Groundwater Monitoring Report submitted by Woodard & Curran to EPA in January 2003.)

FIGURE 6-1. RECOMMENDED LOCATIONS FOR ADDITIONAL EXTRACTION WELLS.



(Note: This figure is based on figures in site documents prepared by Woodard & Curran.)