SECOND FIVE-YEAR REVIEW REPORT

2010 FIVE-YEAR REVIEW REPORT

for

Stamina Mills Superfund Site
Town of North Smithfield
Providence County, Rhode Island

Prepared By:

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Date: 9/14/10

Table of Contents

Tables

Appendices

Acronyms

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
amls	above mean sea level
bgs	below ground surface
C&A	Collins & Aikman Products Company
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	constituents of concern
DCE	Dichloroethylene
DNAPL	dense non-aqueous-phase liquids
DPT	direct-push technology
ESD	explanation of significant difference
FS	feasibility study
FWAW	Forestdale Water Association Well
GAC	granular activated carbon
gpm	gallons per minute
gpm	gallons per minute
GWE	groundwater extraction system
GWTS	groundwater treatment system
lbs/year	pounds per year
MCL	maximum contaminant levels
MDL	method detection limit
MGY	million gallons per year
MPE	multi-phase extraction
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operations and maintenance
PID	photoionization detector
POTW	publicly owned treatment works
PRG	Preliminary Remediation Goal
RA	remedial action
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RI	remedial Investigation
RIDEM	Rhode Island Department of Environmental Management

ROD	Record of Decision
RPM	remedial project manager
scfm	standard cubic feet per minute
SMW	Stamina Mills Well
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TBC	to be considered
TCE	Trichloroethylene
TCL	target compound list
USEPA	Environmental Protection Agency
UV	Ultraviolet
VOC	volatile organic compound
VTS	vapor treatment system

EXECUTIVE SUMMARY

The remedy for the Stamina Mills Superfund site in North Smithfield, Rhode Island, included demolition of onsite structures, sealing and backfilling of raceways, locating and removing a septic tank and its contents, grading the site, in situ vacuum extraction of trichloroethylene-contaminated soil, groundwater extraction and treatment, excavation and removal of a historical landfill, long term monitoring, and institutional controls. The trigger for this five-year review was the *First Five-Year Review Report* in September 2005.

The assessment of this five-year review found that the remedy has been constructed and operated in accordance with the requirements of the Record of Decision and two (2) Explanations of Significant Difference.

The remedy currently protects human health and the environment because it is functioning as designed. The immediate threats have been addressed and the remedy is considered protective.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: STAMINA MILLS, INC.		
EPA ID *(from WasteLAN)*: RID980731442		
Region: 1	**State:** RI	**City/County:** Providence
SITE STATUS		
NPL status: Final		
Remediation status (choose all that apply): Operating and Complete		
Multiple OUs?* NO	**Construction completion date:** August 8, 2000	
Has site been put into reuse? NO		
REVIEW STATUS		
Lead agency: EPA		
Author name: Byron Mah		
Author title: Remedial Project Manager	**Author affiliation:** EPA	
Review period:** March 31, 2010 to September 30, 2010		
Date(s) of site inspection: June 28, 2010		
Type of review: Pre-SARA — Policy Review		
Review number: Second		
Triggering action: Anniversary of prior five year review		
Triggering action date *(from WasteLAN)*: September 30, 2005		
Due date *(five years after triggering action date)*: September 30, 2010		

Five-Year Review Summary Form, cont'd.

Issues:

Recommendations and Follow-Up Actions:

Protectiveness Statement

Because the remedial actions at the Stamina Mills Site are protective, the site is protective of human health and the environment.

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2010 Five-Year Review Report
Stamina Mills Superfund Site
Town of North Smithfield
Providence County, Rhode Island

I. INTRODUCTION

Purpose of the Five Year Review

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Five-Year Review

The United States Environmental Protection Agency (USEPA) is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The agency interpreted this requirement further in the National Contingency Plan (NCP);

40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Who Conducted the Five-Year Review

The USEPA Region 1 has conducted a five-year review of the remedial actions implemented at the Stamina Mills Superfund site in North Smithfield, RI. This review was conducted from March 31, 2010 through September 2010. This report documents the results of the review. EnSafe Inc., a consultant hired by the Performing Party (Kayser-Roth) has provided technical analysis in support of the five-year review.

Other Review Characteristics

This is the second five-year review for the Stamina Mills Superfund site. The triggering action for this review is the anniversary date of the prior five-year review, September 30, 2005. This five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure

Remedy implementation at the Stamina Mills Site required multiple activities:

- In situ vacuum extraction of the trichloroethylene (TCE) spill-area soil
- Excavation of landfill wastes from the 100-year floodplain and consolidation with landfill wastes above the floodplain
- Installation of a leachate collection system in the landfill
- Capping of the landfill
- Groundwater extraction and treatment using an ultraviolet (UV) light/hydrogen peroxide system
- Demolition of onsite structures
- Sealing and backfilling of raceways
- Location of the septic tank, testing and removal of its contents, and offsite treatment and/or disposal
- Grading of the Site

- Long-term environmental monitoring

- Institutional controls to regulate future land use at the Site and prevent the disturbance of the physical integrity of the remedy's components

Treatment is ongoing, and hazardous substances are still present onsite at concentrations above levels protective of unrestricted use.

Five-Year Review Report Format

The format for this review has been adopted from the USEPA *Comprehensive Five-Year Review Guidance* (June, 2001). Elements of the five-year review are presented as outlined below:

- Section II presents a chronology of Site events

- Section III presents the Site location information and the history of the Site, including a summary of the preliminary Site investigations, the remedial investigation (RI), the feasibility study (FS), remedial design (RD), and remedial action (RA)

- Section IV discusses the remedial actions implemented at the Site, their performance, and conclusions regarding remedy effectiveness

- Section V discusses progress since the last five-year review.

- Section VI describes the five-year review process, including the administrative components of the five-year review, community notification and involvement, document review, data review, the Site inspection, and interviews

- Section VII presents the technical review of the Site remedy using three questions:
  — Is the remedy functioning as intended by the decision documents?

  — Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

  — Has any other information come to light that could call into question the protectiveness of the remedy?

- Section VIII identifies issues at the Site that prevent the remedy from being protective
- Section IX identifies recommendations and follow-up actions for the Site remedy
- Section X issues the protectiveness statement for the Stamina Mills Site
- Section XI specifies the requirement for the next five-year review

II. SITE CHRONOLOGY

Table 2-1
Chronology of Events

Date	Event	Additional Information
1824	Manufacturing operations began under the Forestdale Manufacturing Company.	
1920s	Temporary shutdown of mill operations.	
1930s	Mill Building No. 2 burns down.	Building No. 2 area used as an onsite landfill for process wastes until approximately 1968.
1940s	Forestdale Manufacturing Company transfers ownership to Stamina Mills.	
1969	TCE-scouring system installed to remove oil and dirt from newly woven fabric. Initial reports of TCE spill.	Within a few months of the spill, the Stamina Mills Well (SMW) showed evidence that it had been affected by TCE and potable use was discontinued.
1975	Stamina Mills shuts down.	Contents of the TCE storage tank are estimated at 600 to 700 gallons.
1977	Stamina Mills destroyed by fire in October 1977.	
1978	The Town of North Smithfield installed a sewer through the Site parallel to the Branch River.	The sewer was installed 20 to 30 feet below ground surface. In places this sewer extended 10 to 20 feet into bedrock, and blasting was required.
1979	Rhode Island officials identify TCE contamination in the Forestdale Water Association Well (FWAW), a community water system approximately 800 feet north of the Stamina Mills Site.	Additional sampling of 51 private wells near the Site shows elevated TCE concentrations in at least 18 wells. At this time, groundwater was the sole source of potable water for the local residents.
1981	The State of Rhode Island and the Town of North Smithfield finance the construction of a municipal water main to serve the residential area affected by contamination north of the Stamina Mills Site.	Between 1981 and 1984 only seven of the approximately 50 affected or potentially affected residences connected to the new municipal water supply, reportedly due to connection costs.
1983	Final inclusion on the National Priorities List (NPL).	
1984	USEPA initiates a removal action to extend the existing water line and to fund residents' connection costs. Approximately 50 residences were connected.	
1986-1988	A two-phase RI was conducted to determine the nature and extent of contamination in soil, groundwater, surface water, and sediment.	
1989	The Federal District Court of Rhode Island ruled that Kayser-Roth Corporation, corporate successor to Stamina Mills, is liable for past and future response costs at the Site.	
1990	The Record of Decision for the Site was signed by USEPA on September 28, 1990.	
1991	USEPA issued an Order to Kayser-Roth to perform the ROD cleanup remedy.	

Table 2-1
Chronology of Events

Date	Event	Additional Information
1992	Kayser-Roth initiated Site preparation and predesign activities, including demolition of old mill buildings.	
1993-1996	Collins & Aikman Products Company (C&A) assumes responsibility for the cleanup of the site from Kayser-Roth. C&A completes pre-design work at the Site.	
1994	Phase I Predesign activities, including soil vapor extraction (SVE) testing and aquifer testing, were completed onsite.	Testing indicated low-vacuum SVE would be effective in permeable overburden soil, but that multi-phase extraction (MPE) would be necessary to recover TCE from highly contaminated, low permeability saprolite zones.
1995	Phase II Predesign work was completed, including installation of vapor extraction wells and performance testing.	
1997	Successful testing of the full-scale vapor extraction system completed in November 1997.	
1998-1999	Attempts to stabilize and cap the onsite landfill on the eastern portion of the Site proved hazardous to both Site workers and the adjacent Branch River. Therefore, an alternate landfill remedy was implemented to excavate, transport, and dispose of landfill materials offsite.	
2000	Successful startup of the groundwater extraction system.	
2000	USEPA issued an Explanation of Significant Differences on June 27, 2000, documenting the technical rationale for modifications to (1) groundwater treatment system, (2) vapor treatment system, and (3) the final landfill remedy.	
2002	The SVE system was mothballed in late 2002 due to extremely low vapor concentrations and the absence of significant rebound following winter shutdown periods.	
2003	The MPE system was enhanced by implementing a drop tube vapor/groundwater extraction system on 10 MPE wells.	
2004-2005	USEPA performs first five-year review.	
2005	Kayser-Roth re-assumes responsibility for the cleanup of the site due to bankruptcy of C&A.	
2005	Kayser-Roth assembles database of well owners within 0.25 miles of the Stamina Mills site.	The listing addresses the database issue/recommendation identified in the first five-year review.

Table 2-1
Chronology of Events

Date	Event	Additional Information
2006	Town of North Smithfield implements ordinance prohibiting groundwater use within the Stamina Mills Remediation Area.	The ordinance addresses the institutional controls issue/ recommendation identified in the first five-year review.
2007	Explanation of Significant Differences	To address institutional controls and incorporate a vapor intrusion study.
2008-2009	Soil vapor assessment performed along School Street and Maple Street, including near-slab, sub-slab, and indoor air testing in two residences.	Testing finds no threat from vapor intrusion in the residential neighborhood adjacent to the Stamina Mills facility. The investigation addresses the vapor intrusion issue/recommendation identified in the first five-year review. A screening against risk-based vapor intrusion screening levels targeted for cancer risk of 1E-06 using detected concentrations in multiple media such as overburden groundwater, soil gas along the streets, near-slab soil gas, sub-slab soil gas, indoor air, and ambient air. This was conducted to determine whether the vapor intrusion pathway is complete and if so, whether the levels detected would be significant or not. This assessment was qualitative and did not include a quantitative assessment of risks due to vapor intrusion. This is because the contaminant levels detective provided multiple lines of evidence indicating that although there is a complete vapor intrusion pathway, it does not cause a significant concern to site receptors.
2010	USEPA initiates second five-year review.	

III. BACKGROUND

The Site, which was a former textile weaving and finishing mill, was developed in the early 1800s. Currently it is abandoned except for remediation equipment and an old mill office building along School Street.

General Site Description and Historical Summary

The Stamina Mills Site is in Providence County approximately 0.5 mile southwest of the intersection of Highway 146 and 146A and approximately 14 miles northwest of Providence, Rhode Island (Figure 3-1; all figures are included in Appendix A). The Site covers approximately 5 acres along the Branch River in North Smithfield, Rhode Island. The Site's coordinates are 41˚59'45" N latitude and 71˚33'45" W longitude.

The Site is bounded to the south by the Branch River and several industrial and commercial facilities. Properties to the north and east are primarily residential, with some commercial usage. A dam immediately south of the Site forms the Forestdale Pond and the Site's southern boundary. This dam provided hydromechanical power for the textile mill operations. Two raceways passed under Mill Buildings No. 1 and 2 before reentering the Branch River downstream of the dam. The southeastern section of the Site includes an area in the 100-year floodplain. Because the Site is within 50 feet of the Branch River, it is considered a wetland under Rhode Island regulations.

Manufacturing operations began at the mill in 1824, when the Forestdale Manufacturing Company started processing cotton. The mill continued operations until the late 1920s when it shut down for an undocumented period of time. After the Depression, the mill reopened and in the 1940s it changed ownership and was renamed Stamina Mills. Between 1930 and 1938 the eastern portion of the mill (Mill Building No. 2) was destroyed by fire. A portion of the burned-out building footprint was used as an onsite landfill for process wastes until approximately 1968. A diagram of the mill layout is included in Appendix B, historical diagrams and figures.

The mill was shut down in 1975, and the remaining portion of the mill was destroyed by fire in October 1977. The Site remained vacant following the fire.

In 1978, the Town of North Smithfield installed a sewer across the Site parallel to the Branch River and through portions of the landfill area. The sewer was installed 20 to 30 feet below ground surface, and required blasting 10 to 20 feet into bedrock in places.

Kayser-Roth, corporate successors to Stamina Mills, initiated Site preparation and predesign activities in 1992 that included demolition of old mill buildings, debris recycling and/or removal, and Site regrading. Some demolition materials, debris, and Site soils were used as fill during regrading prior to the addition of topsoil and seeding. A 6-foot-high gated fence is present along School Street to prevent unauthorized access; the property is not fenced along the Branch River or Forestdale Pond. During remedial activities, Collins & Aikman Products Company (C&A) assumed all responsibility for the Site from Kayser-Roth.

In 1998 and 1999, attempts to stabilize and cap the onsite landfill on the eastern portion of the Site proved hazardous to both Site workers and the adjacent Branch River. As a result, C&A proposed an alternate landfill remedy which was approved by USEPA and RIDEM. The landfill contents were excavated and shipped offsite for disposal in a chemically secure landfill, as outlined in the *Remedial Action Report — Landfill Restoration* (EnSafe, December 1999). Figure 3-2, included in Appendix A, shows the Site conditions and topography after completion of the landfill restoration in 1999.

Active soil and groundwater remediation is ongoing along the central 2 acres of the Site. A groundwater extraction (GWE) system, SVE system, MPE system, above- and below-ground manifolds, and a treatment building housing both groundwater and vapor treatment systems (GWTS, VTS) are present onsite.

Site Topography, Geology, and Hydrogeology

The difference in relief across the Stamina Mills Site is approximately 40 feet from the School Street (north) to the Branch River Valley floor (south). Ground surface topography generally mimics the buried bedrock surface. Approximately 10 to 15 feet of fill, glacial till, fluvial deposits, and surface soils overlie bedrock and extend to the ground surface. A 2- to 8-foot-thick layer of brown clayey saprolite has formed at the bedrock/overburden interface due to bedrock weathering. The depth to saprolite and the depth to bedrock is highly variable across the site.

Bedrock is a fine- to medium-grained quartz biotite schist of the metamorphic Blackstone series that exhibits well-developed foliation. Richmond and Quinn have estimated the total thickness of the units to be approximately 400 feet in the Georgiaville Quadrangle. Joints and fractures in the schist appear to be generally northeast-southwest and northwest-southeast. Site wells and former (now inactive) residential wells are shown in Figure 3-3 (Appendix A). A generalized cross section of the site, developed using historical information, is shown in Figure 3-4 (Appendix A).

The basin of the Branch River originates at the confluence of the Pascoag and Chepachet Rivers. In Woonsocket, Rhode Island, the Branch River joins the Blackstone River, which flows to the south where it joins the Providence River and empties into the Narragansett Bay.

The majority of groundwater at the Stamina Mills Site is stored in and transmitted through fractures and joints in the upper portion of the bedrock aquifer encountered onsite approximately 15 to 20 feet below ground surface (bgs). The lower few feet of overburden materials are seasonally saturated, but are not regarded as a separate unit. Flow in the bedrock aquifer is toward the Branch River.

Under static conditions, regional groundwater generally flows from north to south and parallels the topography. Groundwater recharges in upland areas north of the Site and flows south toward the Branch River, then eastward, parallel to the river before discharging in the river. However, hydrogeologic investigations showed that pumping individual bedrock supply wells, including the FWAW north of Stamina Mills, can temporarily reverse the regional hydraulic gradient in such a way that the flow beneath the Stamina Mills Site is directed north toward residential areas. Reversal of the groundwater flow during previous operation of the FWAW is thought to be the mechanism by which contaminants migrated from the Site to the residential area to the north. Figures showing flow reversals during the FWAW pump test in 1988 are included in Appendix B.

Former, Current, and Future Land Use

The land to the north and east of the Site is largely residential with some commercial use. The Halliwell Memorial Elementary School is approximately four-tenths of a mile northwest of the Site. Areas directly east of the Site, which are in the floodplain of the Branch River, have been left undeveloped. The area to the south and southwest of the Site, across the Branch River, is occupied by industrial and commercial facilities.

Land use in the immediate vicinity of the Site has not changed significantly since investigations started in the 1980s.

History of Contamination

Contamination at the Stamina Mills Site was associated with historical mill operations and TCE spills that occurred during the late 1960s. Select historical photographs showing Site conditions prior to RA and during RA are included as Appendix C.

Contamination Sources

Multiple contaminant sources were identified during the RI.

TCE Tank/Spill Area

In March 1969 a TCE scouring system was installed at the mill to remove oil and dirt from newly-woven fabric. Shortly thereafter, a spill occurred during the delivery of TCE to an aboveground storage tank. The volume of solvent lost is unknown. Within a few months of the spill, the SMW showed evidence of TCE contamination and potable use was discontinued.

When the mill shut down in 1975, 600 to 700 gallons of TCE remained in the storage tank. Following the fire in 1977, the TCE storage tank could not be located. The sewer line installation in 1978 passes through the historical TCE spill area.

Septic System

A septic system was identified during investigation activities as a potential source of contamination to groundwater. A sample of sludge from the septic system's drain pipe during the RI indicated the presence of TCE.

Landfill

As noted previously, a portion of the burned-out Mill Building No. 2 footprint was used as an onsite landfill for process wastes from the 1930s through the 1960s. This landfill, estimated at approximately 5 to 20 feet thick, occupied the eastern half of the Site. The southern portion of the landfill sloped steeply down toward the Branch River, with a portion within the river's 100-year floodplain. Landfill contents were a mixture of fabric wastes, plastic, paper, wood, metal, cinders, glass, and rock interbedded with layers of sandy fill. In areas closest to the Branch River, a layer of black oily soil up to 10 feet thick extended to the bedrock surface beneath the waste. Contaminants suspected to be present in the landfill included TCE, polycyclic aromatic hydrocarbons, sulfuric acid, soda ash, salt, detergents, waste fabrics, dyes, wool oil, plasticizers, and pesticides (used for moth-proofing). The sewer line installation in 1978 passes through the historical landfill area.

At the onset of investigation activities, most of the landfill was overgrown with vegetation, including small trees, shrubs, weeds, and grass.

Raceways

During the RI the two raceways beneath the former mill buildings were identified as potential migration pathways for contamination, providing a conduit for contaminants to seep from other source areas (the septic tank, the TCE spill area, the landfill) into the Branch River either as suspended solids or as groundwater.

Discovery of Contamination

In 1979, Rhode Island officials identified TCE contamination in the FWAW, a community water system approximately 800 feet north of the Stamina Mills Site. Additional sampling of 51 private wells near the Site showed elevated TCE concentrations in at least 18 wells. At that time, groundwater was the sole source of potable water for the local residents.

Initial studies conducted as a result of the discovery of TCE in groundwater indicated that the Stamina Mills Site was the most likely source of TCE contamination, prompting USEPA and RIDEM to seek the Site's inclusion on the NPL on December 30, 1982; it was listed as final in September 1983.

Initial Response

In 1981, the State of Rhode Island and the Town of North Smithfield financed the construction of a municipal water main to serve the residential area affected by contamination north of the Stamina Mills Site. Between 1981 and 1984 only seven of the approximately 50 affected or potentially affected residences connected to the new municipal water supply, reportedly due to connection costs.

In 1984, following inclusion of the Site on the NPL, USEPA initiated a removal action to extend the existing water main and to fund residents' connection costs. Approximately 50 residences were connected.

In July 1988, USEPA initiated a second removal action that removed the contents of two deteriorating underground storage tanks and disposed of them offsite. The interiors of both tanks were decontaminated and the tanks were then decommissioned.

In August 1990, USEPA initiated a third removal action that removed the contents of an aboveground storage tank. The contents were treated and disposed of offsite, and the interior of the tank was decontaminated. The tank shell was left onsite for disposal during remedial activities.

Basis for Taking Action

Hazardous substances including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), inorganics, and/or pesticides (primarily dieldrin) were detected in Site soil, groundwater, surface water, and/or sediments. However, VOCs are the primary constituents of concern (COCs), with TCE posing the greatest concern.

Remedial Investigation Findings

A two-phase remedial investigation was conducted from 1986 to 1988 to determine the nature and extent of contamination in soil, groundwater, surface water, and sediment.

Soil

Soil samples collected during the RI from the area impacted by the 1969 TCE spill exhibited TCE concentrations up to 430,000 micrograms per kilogram (µg/kg). The spill area extended from the northeast corner of the former Mill Building No. 1 east to the base of the landfill, and then south to the Branch River. TCE contamination extended into the landfill directly above the water table near one of the raceways and the sewer line trench, and was assumed to be characterized by preferential migration through these more permeable zones.

Other compounds detected in Site soil included lower concentrations of SVOCs, inorganic compounds, and pesticides (particularly dieldrin).

Groundwater

Bedrock groundwater beneath the former TCE spill area exhibited TCE concentrations of up to 850,000 micrograms per liter (µg/L). Shallow groundwater, primarily associated with seasonal intrusion of bedrock groundwater into the overburden material, was also contaminated. Natural gradients, as well as the presence of the two raceways and the sewer line trench, were assumed to cause migration of impacted groundwater toward the Branch River.

As noted in pre-RI investigations, a TCE-contaminated groundwater plume in the bedrock aquifer was found to extend northwest from the Site into the residential neighborhood north of School Street. RI studies suggested that contaminants were drawn northward through pumping of the FWAW and other residential wells. Since operations at these wells had been terminated following installation of the water main during the early 1980s, decreasing concentrations were noted in the residential area. These decreases were assumed to be associated with natural flushing of the plume area following re-establishment of the natural gradient. Figure 3-5, found in Appendix A, shows the extent of contamination offsite during 1992.

Other compounds detected in Site groundwater included lower concentrations of SVOCs, inorganic compounds, and pesticides (particularly dieldrin).

Sediment and Surface Water

Surface water samples collected during the RI adjacent to and downstream of the spill area exhibited TCE and 1,2-dichloroethylene (1,2-DCE) contamination, with maximum concentrations found in the raceway exits. Sediment impacts directly adjacent to the Site were minimal due to the absence of sediment at the base of the dam; however, downstream of the Site, TCE, 1,2-DCE, SVOCs, dieldrin, and inorganics were quantified. SVOCs, pesticides, and inorganics were assumed to be associated with the mill and landfill operations.

Primary Health Threats/Basis for Action

The baseline risk assessment conducted during the RI calculated both carcinogenic and non-carcinogenic effects of Site contaminants under various current and future use scenarios, as shown in Table 3-1.

Table 3-1
Baseline Risk Assessment Results

	Cancer Risk		Hazard Index	
	Average	**Maximum**	**Average**	**Maximum**
Current Use Scenario				
Offsite Active Wells Groundwater Ingestion	3E-06	3E-06	0.1	0.3
TCE Spill Area Soil Ingestion	2E-06	8E-06	0.1	0.6
Landfill Area Soil Ingestion (0-5')	2E-06	2E-05	0.6	3.0
Other Onsite Soil Soil Ingestion (0-5')	1E-06	1E-05	0.07	1.0
Downstream of Site Fish Consumption	8E-03	3E-02	0.6	2.0
Upstream of Site Fish Consumption	4E-03	4E-03	0.002	0.002
Surface Water Ingestion via Swimming	5E-07	6E-07	0.02	0.04
Future Use Scenarios				
TCE Spill Area Groundwater Ingestion	8E-02	4E-01	50	200
Landfill Area Groundwater Ingestion	2E-02	7E-02	30	60
Offsite Active Wells Groundwater Ingestion	3E-06	3E-06	0.1	0.3
Landfill Area Soil Ingestion (5-20')	2E-06	3E-05	0.5	6.0

The risk assessment also identified exceedances of applicable or relevant and appropriate regulations, including:

- USEPA Maximum Contaminant Levels (MCLs)
- Ambient water quality criteria
- USEPA lifetime health advisories

Crumbling Site infrastructure and debris were also cited as physical hazards remaining onsite.

IV. REMEDIAL ACTIONS

This section outlines the selected remedy for the Stamina Mills Site.

Remedy Selection

USEPA's *Record of Decision* (USEPA, 1990; EPA/ROD/R01-90/048) was signed on September 28, 1990. The *Explanation of Significant Differences for Changing the Method of Treating Contaminated Groundwater and for Changing the Method of Capping the On-Site Landfill* (USEPA, 2000) was signed on June 27, 2000. A second Explanation of Significant Differences, signed on September 27, 2007, focused on (a) clarifying the institutional control requirements set forth in the remedy selected in the 1990 ROD and (b) incorporating into selected remedy the recommendation in the first five year review report (performed in 2005) to conduct an investigation into potential pathways for vapor intrusion.

Remedial Action Objectives

The ROD identified multiple remedial action objectives for the Site.

- Restore the groundwater to federal and state drinking water standards (or criteria when drinking water standards are not available) as quickly as possible because the aquifer is a drinking water source

- Prevent the public from direct contact with contaminated soil, sediments, and solid wastes, which may present health risks

- Eliminate or minimize the migration of contaminants from the soil into the groundwater

- Prevent the offsite migration of contaminants to the surface water above levels protective of public health and the environment

- Reduce risks to human health associated with the physical hazards while implementing remedial actions at the Site

Remedial Actions Selected

The following remedial actions were identified as major components of the Site remedy:

- Demolition of onsite structures

- Sealing and backfilling of raceways

- Locating the septic tank, testing and removal of its contents, and offsite treatment and/or disposal
- Grading of the Site
- In situ vacuum extraction of TCE spill-area soil
- Groundwater extraction and treatment using an UV/hydrogen peroxide system
- Excavation of landfill wastes from the 100-year floodplain and consolidation with landfill wastes above the floodplain
- Installation of a leachate collection system in the landfill
- Capping of the landfill
- Long-term environmental monitoring
- Institutional controls to regulate future land use at the Site and prevent the disturbance of the physical integrity of the remedy's components

Remedy Implementation

Remedy implementation began under the direction of Kayser-Roth during 1992, and was completed under the direction of C&A during 2000.

Building Investigation and Demolition

Initial Site activities addressed safety hazards that were noted during the baseline risk assessment (e.g., deteriorating structures), as well as those remedial action objectives associated with contaminant migration via the former mill structures. No cleanup goals were identified with respect to this portion of the remedy.

The building investigation and demolition process occurred during June, July, and August 1992 and included the following work activities:

- Identification of the former septic tank. The concrete cover from the vessel was collapsed and no standing liquids were identified. Visual inspection indicated the absence of sludge/still bottoms. Soil from adjacent Site work was used to backfill the vessel.

- Debris piles located on the western portion of the Site were sorted to recover recyclable metal, which was shipped offsite to the State Line Scrap Recovery facility in Johnston, Rhode Island. Wood debris and cleared vegetation were landfilled at the New England Ecological Development facility in Johnston, Rhode Island.

- Subsurface voids, including the former main building's crawlspace, the wing building basement, and the wing building extension's basement, were demolished and filled with onsite debris.

- The locations of both the new and the old raceways were confirmed using trenching operations. The old raceway was found to be blocked by sediment and fill materials. The new raceway was blocked with two reinforced concrete barrier walls approximately 15 feet east of the inlet gates.

- A sump pit was identified in a concrete box south of the raceway exits and appeared to act as a conduit for groundwater and/or surface water. The concrete box was filled with concrete to a level approximately 18 inches above the static water level in Forestdale Pond. The remainder of the box was filled with sandy loam.

- The masonry smokestack present onsite was disassembled manually. Wipe samples were collected to assess contamination; no contamination was detected in the wipe samples above contract-required reporting limits. Pigeon droppings and ash in the bottom six feet of the stack were removed with a vacuum truck and placed in a 20-cubic-yard roll off box, which was later disposed of offsite as non-hazardous special waste at the Laidlaw Waste Systems facility in Pinewood, South Carolina.

- Asbestos-containing materials were removed from the Boiler House and disposed of offsite at the Connecticut Valley Sanitary Waste facility in Chicopee, Massachusetts. The Boiler House was demolished and the debris used for grading onsite.

- Site restoration activities included regrading to promote drainage toward the Branch River, addition of a minimum of 12 inches of topsoil, and seeding. Where necessary, erosion control netting was staked into place.

Select historical photos are included in Appendix C.

Building investigation and demolition activities are documented in the *Building Investigation and Demolition Report* (Rev. B) (January 15, 1993; Sverdrup Environmental, Inc.). All onsite work was performed by Sverdrup or its subcontractors.

Soil Vapor Extraction and Multi-phase Extraction System

SVE pilot testing, design, and installation were completed as a phased process between 1994 and 1997. The ROD established performance standards for unsaturated soil in the TCE spill area, as shown in Table 4-1.

Table 4-1
ROD-Specified Soil Cleanup Standards

Compound	Hazardous Substance Cleanup Standard (µg/kg)
Trichloroethylene	195
Tetrachloroethylene	66
1,1-Dichloroethylene	17
1,2-Dichloroethylene	151

Note:
µg/kg — micrograms per kilogram

The ROD contemplated a single SVE system installed in the TCE spill area, extending from the north wall of the old mill building southeast to the Branch River. Sampling results indicated that VOC concentrations increased with depth, suggesting that most of the TCE mass had migrated vertically and accumulated at the bedrock-vadose zone interface. Figure 4-1 (in Appendix A) shows the TCE spill area, along with the network of SVE and MPE wells installed to maximize contaminant recovery.

SVE treatability testing performed in 1994 was designed to meet the following objectives:

- Determine the effectiveness of SVE in spill-area soil
- Obtain data needed for conceptual design of the full-scale treatment system
- Estimate the time required to meet cleanup standards throughout the TCE spill area

Parameter evaluation tests and point permeability tests were used to assess vadose zone characteristics in the TCE spill area. The pilot study concluded that the subsurface exhibited extreme heterogeneity, including intermingled sandy fill, silty fill, and saprolite. Data also indicated that to address saprolite, a MPE system would be required to address seasonal saturation. This enhancement, not contemplated in the original ROD, was added to improve overall mass removal.

Vapor extraction wells were installed into both vadose soil and saprolite in 1995. Soil was field tested using a jar headspace criterion of 10 parts per million volume to determine whether a location required installation of a vapor extraction well. Field efforts indicated that the areal extent of the TCE spill area was larger than previously considered in the RI. A total of 26 wells were installed in overburden material and 31 wells were installed in the saprolite/fractured bedrock material.

The final design characteristics of each SVE well were determined in the field following installation. Brief performance tests were conducted on each well; data were used to determine:

- whether the well would be included in the SVE or MPE system
- to confirm the conceptual design of the manifold sizing
- to determine SVE process equipment requirements
- to design offgas controls

Vacuums in overburden wells typically ranged from 0.6 to 54 inches of water, with airflow rates ranging from 2 to 19 standard cubic feet per minute (scfm). Vacuum in the saprolite wells ranged from 27 to 163 inches of water following dewatering; airflow rates ranged from 1 to 8 scfm. Saprolite wells yielded between 0.01 and 2 gallons per minute (gpm) under vacuum. These yield rates were confirmed through supplemental aquifer/slug testing. Testing indicated that TCE was the primary vapor contaminant.

Full-scale equipment design and system installation occurred in 1996 and 1997. Airflow modeling and Site data suggested that a remediation system removing up to 500 pore volumes per year would be practical, for a projected operational period of one to two years. However, this determination assumed complete dewatering of the saprolite material and 12 month (continuous) operation. Subsequent startup and operation later revealed that operations were limited to 6 to 8 months per year due to freezing weather. The SVE and MPE systems were designed to operate on parallel manifolds, with the SVE system using a low-vacuum blower system to extract soil vapor. The MPE system was designed to use a high-vacuum blower and submersible pumps to draw down groundwater present within the saprolite.

The final SVE/MPE design included the components listed in Table 4-2.

Table 4-2
SVE / MPE System Components

System Component	Equipment Model	Operating Parameters	Notes
SVE Blower	Roots Universal RAI 47, displacement rotary lobe blower	3 phase 460 volt 7.5 horsepower 195 scfm at 6.5 in Hg	Two blowers in place
MPE Blower	Travani TRO 300V liquid ring vacuum pump	3 phase 460 volt 20 horsepower 120 scfm at 17.5 in Hg	—
Pneumatic Pumps *	Clean Environment Model AP-2	—	Bottom entry, 2-inch submersible pneumatic pumps
MPE Air Compressor	Atlas Copco Model GA-7	50 inlet cfm at 90 psi	—

Note:
* — Pneumatic pumps were eliminated from the MPE system during 2003 due to recurring problems with siltation

Groundwater Extraction and MPE-GW Systems

The GWE system consists of 3 open borehole recovery wells (B-3, SMW, and MW-10) and their associated discharge piping, valves, and flow meters.

In 1994, samples collected from MW-10 and the SMW indicated the presence of water-bearing fractures approximately 25 to 26 feet bgs with TCE concentrations indicative of the presence of dense non-aqueous phase liquid (DNAPL). Therefore, focusing pumping on this shallow interval was deemed essential to accelerate mass removal and minimize the risk of introducing contaminants into the deeper bedrock matrix at MW-10 and SMW. A two-phase operational approach was selected to focus initial pumping on the shallow interval and subsequent pumping on both the deep and shallow intervals. Well B-3 is used to draw back the aqueous-phase plume that has migrated offsite.

Groundwater from the wells is treated in the GWTS, which consists of a holding tank, bag filters, and a skid-mounted air stripper (see Section IV for GWTS details). After treatment, the water is discharged to the Woonsocket sewage treatment plant in accordance with the Site's sewer use agreement.

Design Specifications

Before the wells were connected to the treatment system, they were redeveloped to minimize the potential for sand and grit fouling the GWTS components. After redevelopment, the wells had pumps, riser pipes, and level conductivity probes, as well as power and control wires installed. Two of the wells, SMW and MW-10, also required the installation of well packers. Well-specific information is shown on Table 4-3.

Table 4-3
Well-Specific Information

	MW-10	B-3	SMW
Depth	51 ft (with packer) 187 ft (without packer)	150 ft	50 ft (with packer) 275 ft (without packer)
Diameter/Completion	8 inch, open borehole	6 inch, open borehole	10 inch, open borehole
Yield	3-5 gpm	5-8 gpm	3-5 gpm
Pump Type	Grundfos Model 5E5 Redi-Flo4	Grundfos Model 10E8 Redi-Flo4	Grundfos Model 5E5 Redi-Flo4
Packer Depth	51 feet bgs*	No packer required	50 feet bgs*
Pump Intake Depth	44 feet bgs	144 feet bgs	45.5 feet bgs
Depth to Pump On Probe (High-Level Conductivity Probe)	33 feet bgs	43 feet bgs	34 feet bgs
Depth to Pump Off Probe (Low-Level Conductivity Probe)	43 feet bgs	122 feet bgs	44 feet bgs
Depth to Common Probe	45 feet bgs	123 feet bgs	45 feet bgs

Notes:
gpm — gallons per minute
bgs — below ground surface
* — The packers were removed in 2000/2001 and the wells were backfilled with sand to 50 feet bgs

To separate the shallow and deep portions of each well, TAM International Model 563-SD-01 inflatable packers were installed in recovery wells MW-10 and the SMW. Table 4-3 lists the packer depth settings, high-level (pump on) and low-level (pump off) conductivity probe settings, and the pump intake depth settings. However, packers were removed due to maintenance problems during 2000 and 2001, and the wells now operate with sand backfill present from terminal depth to approximately 50 feet bgs.

MW-10 and SMW were equipped with Grundfos Model 5E5 Redi-Flo4 environmental submersible pumps, with flow between 1.2 and 7 gallons per minute (gpm). B-3 was equipped with a Grundfos Model 10E8 pump, with flow between 5 and 14 gpm. All three pumps have 0.5 hp, three-phase, 460-volt motors. After system startup and debugging, typical pumping rates were measured as shown in Table 4-4.

The GWE system was started in May 2000 and has remained operational since then. Pumping is conducted in cycles, allowing groundwater to recharge almost completely before the pumps restart, and promoting a flushing effect for the most effective practical mass removal. While this mass is being removed in the shallow source zone, deep groundwater is being recovered from well B-3, setting up a hydraulic gradient toward the Site in the aqueous plume, which historically moved offsite during FWAW pumping.

Landfill Operations

Landfill restoration activities were conducted from August 3, 1998, to October 5, 1999. The Order required restoration of the onsite landfill by consolidating all landfill wastes and affected sediments, covering them with a RCRA-type cap, and installing a leachate collection system at the toe of the landfill. During initial landfill restoration activities in August 1998, it became apparent that implementation of the remedy detailed in the Order would be difficult due to Site conditions that threatened Site workers' safety and might adversely impact the Branch River. Therefore, an alternate remedy — removal and offsite disposal of all landfill wastes and affected soil and sediment — was proposed, approved by USEPA and RIDEM, and implemented.

The performance standard for excavation and offsite disposal was the removal of all landfill wastes and affected soil and sediment. USEPA confirmed whether this performance standard was achieved through visual inspection and soil sampling.

Table 4-4
Actual Recovery Well Pumping Conditions

Recovery Well and Zone	Total Operating Head (ft H_20)	Flow Rate(gpm)	Additional Comment
SMW	55 — 85	3 to 5	Operational during both phases
B-3	90 — 167	6 to 8	Operational during both phases
MW-10 Shallow	58 — 85	3 to 5	Operational during initial phase only
MW-10 Deep	115 — 170	18 to 30	Operational during terminal phase only

Work tasks completed during landfill closure included:

- Clearing and grubbing the landfill area.
- Removal of eight monitoring wells, 26 gas probes, and miscellaneous piping.
- Installation of perimeter fencing.
- Construction of a temporary holding tank.
- Test pitting and demolishing a portion of the rock retaining wall.
- Construction and maintenance of temporary erosion control features and fencing during construction activities, as needed.
- Construction and maintenance of a temporary river diversion system to allow dewatering of the construction area.
- Dewatering the construction area by pumping collected storm water and infiltrating groundwater. Pumped water was discharged to the Branch River or to a temporary storage facility to allow sediment to settle before discharge to the ground onsite.
- Reconstructing the manhole located within the 100-year flood plain by extending its elevation above 194.5 feet mean sea level.
- Excavating, dewatering, and disposing of all landfill wastes, affected soil, and sediment.
- Placement of geotextile and riprap blanket along the slope of the landfill within the 100-year flood plain.
- Installing a surface runoff drainage ditch along the 100-year floodplain elevation and the raceway exit to promote surface runoff and raceway drainage.
- Placement and compaction of backfill material and top soil.

- Placement of seed/fertilizer mixture and erosion control mat over backfilled areas.

- Installation of final erosion control measures, as needed.

Most of the landfill waste and affected soil and sediment were excavated to bedrock. After excavation, USEPA inspected the exposed bedrock to ensure complete removal prior to backfilling with clean fill. Along the northern third of the landfill, in an area where the material was not excavated to bedrock, confirmatory soil samples were collected. The samples were analyzed for the Target Compound List (TCL) VOCs and pesticides; analytical results were compared to the ROD-specified soil cleanup standards presented in Table 4-1. Because a soil cleanup standard for dieldrin was not established in the ROD, USEPA developed a dieldrin standard of 200 µg/kg for landfill restoration based on risk to the environment and human health.

In areas where confirmatory soil sample results exceeded the cleanup standard, the soil was excavated to bedrock and disposed of offsite. In areas where the cleanup standard was met, the area was backfilled with clean soil to the required final grade.

The primary landfill remedial activity was the excavation and offsite disposal of approximately 24,400 tons of landfill waste, affected soil, and sediment. This material was either disposed of at the Morrow Hollow Landfill in Wendell, Massachusetts (20,025 tons), or mixed with asphalt at the Bardon Trimount facility in Saugus, Massachusetts (2,225 tons), or Aggregate Recycling Corporation facility in Eliot, Maine (2,150 tons).

As required by the USEPA and RIDEM, confirmatory soil samples were collected in landfill areas where excavation terminated above the bedrock surface. The soil samples were analyzed for the TCL VOCs and pesticides and results were compared to ROD-specified soil cleanup standards. The sampling area encompassed the northern third of the landfill area. The objective was to confirm complete removal of affected soil. If sample results exceeded the soil cleanup standards, the area represented by the soil sample was excavated to bedrock.

Representatives from the USEPA, RIDEM, EnSafe, and The Hood Companies performed a final inspection of the landfill restoration work on October 5, 1999. In an October 7, 1999, letter, USEPA stated that no punch-list items were identified by RIDEM or USEPA during the final inspection. However, the USEPA requested that the Site be inspected periodically during the winter and following spring to ensure that erosion control measures were intact and to determine whether any additional revegetative efforts and erosion control measures would be needed.

Institutional Controls

At the time of ROD signature, USEPA noted that it had proposed institutional controls with the property owner, Hydro Manufacturing, in a consent decree lodged in federal court. Hydro Manufacturing has since been dissolved, and institutional controls were never finalized for the site. Records indicate the property was purchased at auction in August 2005; USEPA has contacted the new property owner, Sedona Associates, about recording institutional controls on the property. There are, however, institutional controls in place in the form of a town ordinance that incorporates the property onsite as well as areas beyond the property boundary of the Stamina Mills Site. The institutional controls that USEPA is seeking on the property will serve as an additional layer of controls to assure protectiveness. When this institutional control is recorded, USEPA will also seek that the town ordinance is recorded on the Stamina Mills property.

System Operations/Operations and Maintenance

Building Investigation and Demolition

Operation and maintenance (O&M), which was minimal for the building demolition area of the Site, consisted of inspections of the vegetative cover and erosion control measures installed after demolition. The results of the inspections indicate that vegetation and erosion control measures worked as designed and intended. Because the vegetation is now well-established, no further O&M is required in this area.

Treatment Systems

The GWTS consists of a holding tank for bulk storage, a liquid transfer pump operated by a variable frequency drive to transfer water from the holding tank through the water treatment system, bag filters for removal of suspended solids, and an air stripper for removal of VOCs contained in the groundwater.

The VTS treats SVE, MPE, and GWTS off-gas using two 3,000-pound granular activated carbon (GAC) vessels connected in series during summer months. An inline heater is installed within the vapor exhaust piping to reduce relative humidity and thereby increase carbon adsorption efficiency. Following treatment in the GAC, off-gas is discharged to the atmosphere. Any entrained water collected in the air-water separators is pumped to the GWTS. During winter operations, two 1,800-pound GAC units inside the treatment building are used to maintain treatment under cold weather conditions.

Instrumentation and controls for the SVE, MPE, and groundwater extraction and treatment systems consist of pressure, vacuum, and temperature gauges; level-sensing float switches; liquid differentiating conductivity sensors; pressure and/or flow sensors; and time and flow meters.

This equipment is used to monitor run times, vacuums, and flow rates, and allows the system to operate unattended. The control scheme has an autodialer incorporated to notify offsite personnel if certain process parameters are exceeded. Key operating equipment is interlocked through the master control panel.

O&M Schedule and Tasks

The GWE portion of the system operates continuously throughout the year, and the MPE portion operates from May to November of each year. The SVE system was mothballed in late 2002, due to decreasing vapor concentrations. The remediation system will operate until VOC concentrations decrease to below the cleanup standards presented in the ROD or until it is determined that it is not feasible to attain the cleanup standards.

Winter GWTS/VTS Operations

During winter operations, groundwater extraction wells SMW, MW-10, and B-3 are operational. The GWTS and VTS both require routine monthly maintenance, as described in the *Operation, Maintenance, and Monitoring Plan (O&M Plan): Full Scale Remediation System (Version 4.0)* (Envirogen, August 2000). Typical O&M activities during the winter months include, but are not limited to:

- Changing bag filters
- Checking/calibrating flow and pH meters
- Publicly owned treatment works (POTW) sampling
- Inspecting inside carbon vessels
- Vapor influent/effluent sampling using a photoionization detector (PID) or other organic vapor meter
- Recording process information (flow rates, operating parameters, etc.)

Winter operations typically require two scheduled maintenance visits per month. On average, one non-scheduled maintenance visit is required per month to respond to an alarm call.

Summer GWTS/VTS Operations

During summer operations, groundwater extraction wells SMW, MW-10, and B-3 are operational, as is the MPE drop tube system. Again, as described in the O&M Plan, the GWTS and VTS both require routine monthly maintenance. The MPE drop tube system requires checking during each maintenance visit, to ensure that drop tubes are set to the maximum depth (at the water table).

Typical O&M activities during the summer months include, but are not limited to:

- Drop tube adjustments
- Changing bag filters
- Checking/calibrating flow and pH meters
- POTW sampling (see Section VI for analytical data)
- Inspection of outside carbon vessels
- Vapor influent/effluent sampling using a PID or other organic vapor meter
- Recording process information (flow rates, operating parameters, etc.)

Summer operations typically require two scheduled maintenance visits per month. On average, one to two non-scheduled maintenance visits are required per month to respond to an alarm call.

Conversion for Winter Operations

During late October/early November, once nighttime temperatures drop below freezing, the MPE drop tube system is shut down, the manifold system is flushed with ambient air, water is drained from all necessary equipment and manifold lines, and the VTS is re-connected to the inside carbon beds.

Carbon Change-Out

As noted above, two 3,000-pound GAC vessels are located outside the treatment building, while two additional 1,800-pound GAC vessels are located inside the building. These vessels have typically required replacement every 9 to 12 months. Routine PID or organic vapor monitoring of pre-carbon, intermediate carbon, and post-carbon vapor is used to determine the need for carbon change-out.

Reporting and Sampling Tasks

Multiple sampling activities are required as a part of routine sampling at the Stamina Mills Site.

Monthly POTW Sampling and Reporting

Monthly POTW sampling involves the collection of treatment system effluent samples from a dedicated sampling port and analysis for VOCs and pH by a local laboratory. Self-Monitoring Reports and Flow and pH Monthly Reports are submitted in accordance with Woonsocket Wastewater Discharge Permit.

Quarterly Influent Stream Sampling

GWTS influent and effluent is sampled quarterly (March, June, September, and December) for VOCs from dedicated sampling ports in conjunction with POTW sampling events, and submitted to a local laboratory.

Annual MPE Well Groundwater Sampling

Groundwater samples from the 22 MPE wells are collected annually and submitted to a local laboratory for VOC analysis.

Wellhead Vapor Sampling

Vapor sampling is performed using a PID or similar organic vapor meter on 21 SVE and 31 MPE wellheads twice throughout the year, in April, prior to MPE well development, and in October following MPE system shutdown.

Landfill

Operation and maintenance, which was minimal for the landfill restoration area of the Site, consisted of quarterly inspections of the vegetative cover, erosion control measures, and riprapped slope during the first year after construction. The objective of the inspections was to determine the condition of each component.

Inspections indicated vegetation, erosion control, and slope stabilization measures worked as designed and intended. Because the vegetation is now well-established with first-phase successional growth and the Branch River's bank is protected with heavy riprap, no further O&M is required on the landfill. However, if in the future, the vegetation becomes thin or unhealthy or the riprap appears compromised, the area will be revegetated and measures will be taken to repair the slope.

O&M Cost Evaluation

Costs for the project since ROD signature are shown in Table 4-5.

Table 4-5
Project Costs to Date

Date Range	Activities	Costs
1992	Building demolition and Site clearing	$1,000,000
1993 through 1999	SVE and Groundwater RD, Construction, Startup	$5,900,000
1995 through 1999	Landfill RD and Construction/ Removal	$3,100,000
2000	GWTS, SVE, MPE operations	$150,000
2001	GWTS, SVE, MPE operations	$150,000 to 200,000 [a]
2002	GWTS, SVE, MPE operations	$160,000 to 210,000 [a]
2003	GWTS operations, MPE modifications	$170,000
2004	GWTS and MPE operations	$100,000
2005	GWTS and MPE operations, five-year review	$140,000
2006	GWTS and MPE operations	$140,000
2007	GWTS and MPE operations	$190,000
2008	GWTS and MPE operations, Soil Vapor Assessment	$290,000
2009	GWTS and MPE operations, Soil Vapor Assessment	$200,000
2010 [b]	GWTS and MPE operations, five-year review	$130,000 [b]

Notes:
[a] — Estimated costs: complete financial information unavailable
[b] — Through June 1, 2010
SVE — Soil vapor extraction
RD — Remedial design
GWTS — Groundwater treatment system
MPE — Multi-phase extraction

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

Protectiveness Statements from Last Review

The protectiveness statement from the 2005 Five-Year Review is shown below:

> *The remedy at the Site currently protects human health and the environment because residents in the area of the plume are using municipal water, and do not have an exposure pathway to contaminated soil. Residents not using municipal water are in areas not impacted by the plume.*
>
> *The remedy currently protects human health and the environment because it is functioning as designed. The immediate threats have been addressed and the remedy is considered protective in the short term. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: institutional controls need to be addressed, and vapor intrusion studies need to be conducted.*

Site activities since the 2005 Five-Year Review have addressed the long-term protectiveness concerns outlined in the protectiveness statement, namely: institutional controls have been implemented to prevent use of groundwater both on- and offsite near the TCE plume, and soil vapor assessment studies have been completed. A screening against risk-based vapor intrusion screening levels targeted for cancer risk of 1E-06 using detected concentrations in multiple media such as overburden groundwater, soil gas along the streets, near-slab soil gas, sub-slab soil gas, indoor air, and ambient air. This was conducted to determine whether the vapor intrusion pathway is complete and if so, whether the levels detected would be significant or not. This assessment was qualitative and did not include a quantitative assessment of risks due to vapor intrusion. This is because the contaminant levels detected provided multiple lines of evidence indicating that although there is a complete vapor intrusion pathway, it does not cause a significant concern to site receptors.

Status of Recommendations/Follow-Up Actions from Last Review

The status of issues and recommendations identified in the 2005 Five-Year review is documented in Table 5-1.

Table 5-1
Status of Issues and Recommendations from the 2005 Five-Year Review

Issues	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
USEPA, RIDEM, THE PERFORMING PARTY, and the Town of North Smithfield need to maintain a strong working relationship to ensure adequate offsite protectiveness of the groundwater remedy. As noted in the case of the recent well installation on School Street, current controls on offsite well installations are inadequate. The Town did not notify USEPA, RIDEM, or Kayser-Roth regarding the moratorium on potable water connections, nor did it notify the property owner of the adjacent Superfund Site and groundwater contamination. Uncontrolled well installations and pumping could interfere with the ROD-require remedy and groundwater containment, and cause contaminant migration offsite. Future well installations and/or pumping could affect the remedy's protectiveness in the future.	Institutional controls should be implemented to prevent uncontrolled well installations near the Site. The Town of North Smithfield will take the lead in developing ordinance language prohibiting potable well installation near the plume. The Town of North Smithfield will also lift the moratorium on potable water connections once adequate potable supply is obtained from the City of Woonsocket. USEPA, RIDEM, and Kayser-Roth will provide technical support to the Town of North Smithfield to secure institutional controls. A milestone of June 30, 2006 has been established for passage of the ordinance and lifting of the moratorium.	Town of North Smithfield	June 30, 2006	The Town of North Smithfield implemented an ordinance prohibiting private well use within an area defined as the Stamina Mills Remediation District (Section 8-81). The ordinance (included in Appendix D) requires notification to USEPA and RIDEM of modification of the ordinance (if any), as well as an annual report of the number and nature of violations of the ordinance (if any). The ordinance also states that the Town Administrator shall request a review of the necessity of this ordinance, and substantiation of the continuation of the ordinance, no later than January 1, 2011.	April 19, 2006

Table 5-1
Status of Issues and Recommendations from the 2005 Five-Year Review

Issues	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
During discussions regarding offsite residential wells, USEPA and RIDEM indicated that there is no current database of properties with active or inactive wells, nor any record of connection to the public water supply. Data collected prior to and during the RI are more than 20 years old. A database was completed during the 2005 five-year review and is included in Appendix E. If the Town of North Smithfield can provide water usage information, this list will incorporate data on whether residences are connected to public water supply, or whether non-potable wells are still used for outdoor or yard maintenance activities.	Kayser-Roth will maintain a listing of residential well owners and the status of their wells within 0.25 miles of the Site. This listing will include residences by street address, tax identification number, and USEPA well identification numbers. The database will be updated no less frequently than once every five years. Kayser-Roth and USEPA will also work with the Town of North Smithfield to identify residences connected to the public water supply, with a goal of incorporating these data into the list by June 30, 2006.	Kayser-Roth	June 30, 2006	A database of well owners was developed and submitted as an appendix to the 2005 Five-Year Review. The Town of North Smithfield, in its water use ordinance, identified all residences in the Stamina Mills Remediation Area as being connected to the potable water supply system. This was confirmed again in April 2010 by the North Smithfield Town Planner.	June 2005

Table 5-1
Status of Issues and Recommendations from the 2005 Five-Year Review

Issues	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
The Town of North Smithfield has expressed interest in the beneficial re-use of the Site as a recreational area. While this is not possible while the aboveground infrastructure for the remedy is present, USEPA, RIDEM, THE PERFORMING PARTY, and the Town are interested in moving forward to identify beneficial re-use options, and identifying legal issues.	USEPA, RIDEM, and Kayser-Roth will explore long-term beneficial re-use options with the new property owner and the Town of North Smithfield, including but not limited to: • Property transition and liability issues. • Institutional controls on intrusive activities. • Timing for the end of SVE/MPE operations. • Reconstruction of remediation system equipment below grade, if necessary. • Treatment building and wellhead security. • Projected O&M operations. Initial discussions regarding long-term re-use will be completed by June 30, 2006. Draft agreements with the new property owner will be developed by December 31, 2006.	USEPA, RIDEM, and Kayser-Roth	December 31, 2006	USEPA has facilitated numerous conversations with the Town of North Smithfield and the current property owner (Sedona Associates); Kayser-Roth has provided technical support to both USEPA and directly to the property owner. Beneficial re-use options and site needs are evolving as potential redevelopment opportunities are being explored. USEPA, RIDEM, and Kayser-Roth will continue to provide support on an ongoing basis.	Ongoing

Table 5-1
Status of Issues and Recommendations from the 2005 Five-Year Review

Issues	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Review of risk assessment assumptions indicated that further evaluation of the vapor intrusion pathway may be required. Discrete interval sampling, discussed in relation to the Phase III groundwater monitoring program, may provide additional insight as to whether vapor migration from groundwater is an issue. However, if data indicate groundwater contamination may be a possible source for vapor migration (e.g., if shallow interval samples exceed generic target media specific concentrations), further screening may be performed to determine if vapor migration/intrusion issues are a concern offsite north of School Street. Preliminary efforts to complete a USEPA Tier 1 and Tier 2 screening were incomplete, as documented in Section 7, due to a lack of information regarding lithology and groundwater in residential areas north of the Site.	Pending the results of discrete-interval groundwater sampling, a Tier 2 vapor intrusion screening, using borings completed in the residential area and soil gas sampling, may be performed. This screening would be used to gauge the potential for vapor intrusion into private residences north of School Street. A soil gas sampling protocol would need to be developed following evaluation of discrete-interval groundwater sampling results. Concurrently, USEPA would perform community awareness activities, and perform a survey to evaluate basement/foundation construction details for residences in the TCE plume area. This will be performed by September 30, 2006.	Kayser-Roth and USEPA	September 30, 2006	Kayser-Roth worked closely with USEPA and RIDEM to develop a work plan, field sampling plan, and quality assurance project plan to meet data quality objectives. Tier 2 field screening activities were implemented during the fall of 2008, followed by sub-slab, indoor air, and ambient air sampling activities during the winter of 2008/2009. Findings of the soil vapor assessment program indicated that there was no threat of vapor intrusion to residences north of the Stamina Mills Site.	September 2009
The Town of North Smithfield raised concerns about the fencing parallel to School Street. This could have an impact on site security.	Kayser-Roth will evaluate whether fence integrity has been compromised along School Street; if required, repairs will be implemented by December 31, 2005.	Kayser-Roth	December 31, 2005	Fencing was repaired by Kayser-Roth.	2005

Institutional Controls — North Smithfield Well Prohibition Ordinance

Groundwater use both on- and offsite is prohibited by North Smithfield Ordinance 8-81, the Stamina Mills Remediation Area ordinance. A copy of this ordinance is included in Appendix D. USEPA is seeking that the town ordinance is recorded on the Stamina Mills property as an added layer of control.

The ordinance requires annual notification of USEPA and RIDEM of any violations. There have not been any violations of the ordinance since its passage.

In preparing the five-year review, USEPA observed that the Town of North Smithfied makes many of its town ordinances available online for its residents.[1] However, the Stamina Mills Remediation District ordinance was not yet available on the Town's webpage. Posting this ordinance online, and potentially linking this website to the USEPA's Superfund information webpage, may be another way to enhance communication regarding the Site.

Well Owners Index

An updated index of properties within 0.25 mile of the Stamina Mills site and their current owners is included in Appendix E. This index was updated from the North Smithfield 2010 tax rolls.

Since the last five-year review, North Smithfield has published tax assessor information online, at http://data.visionappraisal.com/NorthSmithfieldRI/search.asp. This database provides real-time information regarding property ownership, and may be a more reliable source than a fixed database. As an alternative to a fixed database, offsite well information, cross-indexed to tax-plat and address information, can be used to quickly identify current owner information. These data are more accurate than the database approach and will be used going forward. The well index is presented in Appendix F.

Beneficial Use Options

Multiple beneficial use options have been discussed for the property over the past several years, including but not limited to:

- Recreational use (park, bicycle trail, etc.)
- Industrial use (heavy equipment storage)
- Utility development (hydropower)

[1] www.nsmithfieldri.org/TownGovernment/TownOrdinances/tabid/290/Default.aspx

Beneficial re-use options and site needs are evolving as potential redevelopment opportunities are being explored. USEPA, RIDEM, and Kayser-Roth will continue to provide support on an ongoing basis.

Soil Vapor Assessment

A soil vapor assessment was performed during 2008/2009 to address the concerns regarding vapor intrusion raised in the 2005 Five-Year Review. Investigations included groundwater, soil gas, near-slab soil vapor, sub-slab soil vapor, indoor air, and ambient air sampling to assess the presence of TCE in soil gas to provide multiple lines of evidence to determine whether there is a complete vapor intrusion exposure pathway and whether inhalation of vapors from subsurface sources would result in unacceptable risk to site receptors or not. The field investigation was developed in coordination with USEPA and RIDEM, as established in work plan, field sampling plan, and quality assurance project plan documents. Locations were biased toward areas historically exhibiting elevated TCE concentrations in groundwater; sampling was also biased temporally to occur during the winter heating season. Figure 5-1 shows the soil vapor assessment study area, and sample locations relative to the site.

The investigations, conducted from September 2008 through April 2009, met the data quality objective established in project planning documents:

- Overburden groundwater was present above the bedrock TCE plume in three of five locations, but did not exhibit TCE contamination.

- Soil gas samples collected along School Street and Maple Street exhibit TCE contamination below 1E-06 risk-based screening levels, indicating no excess risk.

- Near-slab soil gas samples collected near the 126 School Street and 134 School Street structures exhibit TCE concentrations below 1E-06 risk-based screening levels, indicating no excess risk.

- Sub-slab samples at 126 School Street exhibited TCE and PCE concentrations slightly above 1E-06 risk-based screening levels, but well below the upper 1E-04 risk threshold, indicating that risk levels are within acceptable ranges.

- Sub-slab samples at 134 School Street exhibit TCE concentrations below 1E-06 risk-based screening levels, indicating no excess risk.

- Indoor air samples at both 126 School Street and 134 School Street exhibit TCE concentrations below 1E-06 risk-based screening levels indicating no excess risk.

- Indoor air concentrations are significantly lower than sub-slab concentrations, suggesting that significant attenuation is occurring.

- Ambient air samples suggest the presence of PCE, TCE, and other constituents (e.g., benzene, carbon tetrachloride, 1,3-butadiene) in ambient/background air. Indoor air data are typically within one order-of-magnitude of ambient air concentrations.

- Many of the contaminants detected during the vapor sampling events have not been quantified in groundwater samples collected on- or offsite. Specifically, PCE (identified in the Record of Decision as a site COC) has not been quantified in groundwater since 2003, but it was detected in multiple vapor samples. These data suggest non-site related sources for chlorinated solvent contamination are present.

Investigation results indicate that TCE and PCE concentrations at most locations are below 1E-06 risk-based screening levels. Exceedances of this threshold in sub-slab soil gas at 126 School Street represent a compound-specific risk range from 1.1E-06 to 3.9E-06, at the lower end of USEPA's acceptable risk range of 1E-06 to 1E-04. Indoor air concentrations do not exceed screening values, therefore although the migration pathway from subsurface soil vapor is complete, it is not considered significant. Moreover, ambient air exhibits concentrations comparable to indoor levels and may be the primary contributor to indoor air.

Fencing Repairs

Fencing repairs were performed following the 2005 Five-Year Review. Site maintenance activities assess perimeter security issues on an as-needed basis.

Results of Implemented Actions

The actions implemented as a result of the First Five-Year review have strengthened the remedy at the Stamina Mills Site:

- Groundwater use offsite is prohibited, minimizing the potential for residential exposure to contaminated groundwater and/or contaminant migration due to residential pumping.

- Well ownership is recorded on a periodic basis to facilitate remedial actions.

- Lines of communication regarding beneficial reuse options have been established, allowing property development issues to be discussed in the context of ongoing environmental remediation activities.

- Soil vapor assessment activities demonstrated that vapor intrusion pathway does not cause unacceptable risks to the neighborhoods adjacent to the Stamina Mills Site.

- Fencing around the site was repaired and is an ongoing maintenance item for the site.

Status of Any Other Prior Issues

Beneficial re-use options and site needs are evolving as potential redevelopment opportunities are being explored. USEPA, RIDEM, and Kayser-Roth will continue to provide support on an ongoing basis.

VI. FIVE-YEAR REVIEW PROCESS

Administrative Components

USEPA notified Kayser-Roth of the start of the five-year review process in March 2010.

The review team is described in Table 6-1.

Table 6-1
Five-Year Review Project Team

Role	Team Member	Affiliation
Project Manager	Byron Mah	USEPA
Principal Consultant	Lori Anne Goetz	EnSafe Inc.
Technical Consultant	Ryan Adamson	EnSafe Inc.
Community Involvement Coordinator	Sarah White	USEPA
Hydrogeologist	Y. Jean Choi	USEPA
Risk Assessor	Chau Vu	USEPA
PRP Project Manager	Todd Howard	Kayser-Roth
Site Project Manager for RIDEM	Louis Maccarone	RIDEM

The schedule for completion of the five-year review is outlined below:

- Public notice — June 2010
- Site inspection — June 28, 2010
- Interviews — June/July 2010
- *Draft Five-Year Review* — June 2010
- *Final Five-Year Review* — September 2010

Community Notification

At USEPA's direction, community notification occurred via a public notice in the *Valley Breeze* on July 22, 2010, that a five-year review was being performed. A copy of this public notice is provided in Appendix G.

Once the *Five-Year Review* is finalized, a public notice indicating completion of the review and its findings will be placed in the *Valley Breeze*.

Copies of the *2010 Five-Year Review* will be placed in the two public information repositories:

USEPA Record Center, 1st floor
5 Post Office Square
Boston, Massachusetts 02109-3912
(617) 918-1440

North Smithfield Public Library
20 Main Street
Slatersville, Rhode Island
(401) 767-2780

Document Review

The documents reviewed for Site history and remediation data are included in Section XI — References. Pertinent sections of these documents (including RAOs, cleanup standards, etc.), are summarized in this five-year review.

Data Review

Multiple data sets were reviewed during the five-year review process, including:

- Soil vapor extraction (SVE) and multi-phase extraction (MPE) performance
- Groundwater extraction (GWE) performance
- Groundwater treatment system (GWTS) and vapor treatment system (VTS) performance
- Phase III groundwater monitoring data
- GWE monitoring data
- Annual MPE sampling results

These data sets are discussed in more detail in the following sections.

SVE and MPE-Vapor System Performance

The SVE and MPE-vapor components were designed to extract vapor from contaminated overburden (SVE) and saturated saprolite/weathered bedrock (MPE) in the former TCE spill area. SVE/MPE-vapor system performance can be evaluated using the percent of available time the system has been in operation and the quantity of contaminant mass removed.

The SVE portion of the system was operated seasonally from 1998 through 2002. However, due to low contaminant concentrations, this system has not been operated since 2003. Piping and infrastructure remain in-place.

SVE/MPE Operational Performance

SVE operations, initially limited by technical problems with photocatalytic oxidation offgas control units in 1998 and 1999, were improved significantly after the vapor treatment approach was modified to use carbon in 2000, as shown in Table 6-2. Since 2000, the system maintained operations more than 80% of the season; 2002 operations exceeded six months of uptime. From 1998 through 2002, the SVE extraction network was optimized prior to and during each operating season using static and dynamic vapor concentrations measured at wellheads. Removal was targeted specifically at those vapor extraction wells exhibiting the highest vapor concentrations, therefore the active system extracted from different SVE wells throughout the season.

Table 6-2
SVE/MPE-Vapor Operating Statistics 1998 through 2009

Year	SVE			MPE-V		
	Possible Days	Actual Days	Percent	Possible Days	Actual Days	Percent
1998	179	75	42%	—	irregular	—
1999	178	73	41%	180	54	30%
2000	180	151	84%	181	89	49%
2001	180	144	80%	178	66	37%
2002	191	191	100%	180	135	75%
2003	SVE System Not Operated			140	104	74%
2004	SVE System Not Operated			140	125	89%
2005	SVE System Not Operated			184	110	60% [a]
2006	SVE System Not Operated			192	168	88%
2007	SVE System Not Operated			190	152	80%
2008	SVE System Not Operated			193	127	66% [b]
2009	SVE System Not Operated			213	184	87%

Notes:
SVE — Soil vapor extraction
MPE-V — Multi-phase extraction, vapor component
[a] — Downtime associated with MPE liquid transfer pump/motor starter replacement
[b] — Downtime associated with GWTS repairs following controller failure/replacement
— Based upon total operating season of 6 months (180 days)
— MPE up-time in 1998 and 1999 was limited by pump siltation and treatment interruptions due to problems with the photocatalytic oxidation unit
— 2002 operating period was longer than "expected" due to early April startup (favorable weather conditions)

The MPE system at the site is operated from late April/early May through late October/early November each year. From 1998 through 2002, MPE-groundwater extraction pumps were started before the MPE-vapor system in an attempt to dewater the saprolite/weathered bedrock zone. However, seasonal fluctuations in the water table and frequent siltation of pumps prevented uniform dewatering. Increased MPE-GW pump inspections and maintenance had resulted in improved MPE uptime in 2001 and 2002, at the cost of additional labor hours, but it was not clear that dewatering operations were significantly improved. Pumping did not appear to suppress the water table uniformly over the entire TCE spill area, as adjacent non-pumping wells had not exhibited significant drawdown under pumping conditions and rapid recharge was noted during water-level monitoring events. The majority of well screens remained saturated, even under low water table conditions.

In 2003, after evaluation of performance data and O&M records, the vapor extraction and submersible pneumatic pump dewatering system used since system inception was mothballed due to siltation. Ten wells were selected for implementing a drop tube vapor/groundwater extraction system. Since 2003, the existing liquid ring pump has been used to remove air and water through flexible drop tubes set at the water table; vapor and groundwater are removed using the existing manifold system. System performance has resulted in an increase in groundwater extraction rates from the MPE system, as well as improved vapor recovery. Operational uptime has increased significantly compared to the 1998 through 2002 period, generally exceeding 80%. The ten operational wells are selected annually based on aqueous and vapor data from the MPE wells each spring, prior to system startup.[2]

SVE/MPE Mass Removal

Operation of the SVE/MPE systems was expected to be conducted for two to four years. During this period, maximum mass removal was expected to occur within the initial six to 12 operating months. Mass removal rates followed this pattern, as shown in Table 6-3 and in Figure 6-1 (included in Appendix A).

[2] These modifications, and effects on the overall remedy, are discussed in more detail in Section VII.

Table 6-3
SVE / MPE-Vapor Mass Removal Data 1998 through 2009 (pounds)

Year	SVE	MPE-V	Annual Total
1998	275	402	677
1999	206	371	577
2000	67	91	158
2001	42	24	66
2002	50	31	81
2003	SVE System Not Operated	16	16
2004	SVE System Not Operated	32	32
2005	SVE System Not Operated	13	13
2006	SVE System Not Operated	63	63
2007	SVE System Not Operated	36	36
2008	SVE System Not Operated	25	25
2009	SVE System Not Operated	48	48
Total	**640**	**1,151**	**1,791**

During the first two seasons of operation, approximately 1,254 lbs of TCE were removed from the TCE spill area. This is roughly 70% of the total mass removed by the vapor-phase system during the 1998 through 2009 period. As was expected, the bulk of this mass was obtained from the MPE-vapor system (64%). Since 2000, however, 537 pounds of TCE have been removed from the spill area, with contaminant mass attenuating significantly over time. Since 2003, data represents both contaminants in the vapor phase as well as TCE stripped from the aqueous phase in the MPE manifold. Mass removal peaks in 2006 (63 lbs) and 2009 (48 lbs) reflect variability in TCE recovery associated with water levels and associated drop tube adjustments.

Attainment of asymptotic conditions alone does not define successful performance of an SVE system, as discussed in the USEPA guidance document for assessment of soil venting performance (*Development of Recommendations and Methods to Support Assessment of Soil Venting Performance and Closure*; USEPA, 2001; EPA/600/R-01/070). However, the Site's design approach was careful to identify fully locations for vapor extraction wells and space extraction wells for effective subsurface air flow. While vadose zone soil at the Site is heterogeneous, the remedial design process accounted for subsurface variability. Given the extent of contamination, remedial design approach, system performance, and operations of the SVE system, assessment of data from 1998 through 2002 indicated vapor concentrations from vadose soil have reached an asymptotic condition, and this condition represents removal of all readily available mass from overburden soil. Any residual concentrations observed in SVE vapor were expected to be from diffusion of contaminants found in saturated saprolite/weathered bedrock (MPE).

Vapor concentrations in SVE wells were monitored periodically during the 2003 through 2010 period to gauge rebound. Initially (from 2004 through 2008), vapor concentrations were monitored in March/April, June, August, and October to monitor conditions during MPE operations. However, once it was determined that vadose zone rebound did not occur, monitoring frequency was decreased to pre-startup (March/April) and end-of-season (October). Vapor concentration data are presented in Table 6-4.

GWE/MPE-Groundwater System Performance

Similar to the SVE/MPE-vapor system, the GWE/MPE-groundwater system's performance can be evaluated using the percent of available time the system has been in operation and the quantity of contaminant mass removed.

GWE Operational Performance

Overall, as shown on Table 6-5, GWE system uptime has been better than 80% since 2001. Problems encountered since startup were primarily one-time failures of parts or subsystems, and were remedied by replacement. Appendix H contains a record of major system component replacements. Recurrence of similar problems is not expected until the service life of these parts is expended. The only recurrent causes for GWE system downtime during the operational period are associated with GWTS/VTS alarms, and, for the MPE component during the 1998 through 2002 period, siltation of pneumatic pumps.

During the five-year review site inspection, USEPA identified downtime concerns with GWE wells during the 2005 to 2010 five-year review period, specifically with respect to Grundfos pump/lead wiring connector issues which have occurred in both SMW and B-3. At USEPA's request, a technical evaluation has been prepared and included as an appendix to this five-year review summarizing the problem and corrective measures.

Flow from the GWE system has been monitored closely since 2000, when flow meters were installed as part of GWE/GWTS startup. As can be seen from Table 6-6 total flow ranges from 3 to 5 million gallons per year (MGY). Approximately 44 MG have been treated by the system since startup. Cumulative pumping volumes are shown on Figure 6-2 (included in Appendix A).

Peak flow, with all systems operating concurrently, is estimated to be 8 to 13 gallons per minute (gpm) during the winter and early spring operating season. MW-10 and B-3 produce the majority of groundwater in the GWE system. During 2008 and 2009 total flow in the GWE system decreased approximately 30% in comparison to total flow from 2005 through 2007. Reduced flow rates were likely attributable to routine impeller wear: the pump in SMW was replaced in December 2009; the pumps in MW-10 and B-3 were replaced in May 2010.

Table 6-4
Vapor Concentration in Vadose Zone Wells

Well ID	Screen Interval (ft bgs)	Well Type	August 2003		October 2003		April 2004		June 2004		August 2004		April 2005		September 2005		March 2006		June 2006		August 2006	
			VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)
O-1	2-13	SVE	1	0.5	ND	ND	0.7	0.4	0.1	0.1	0.2	0.1	0.4	0.2	1.9	0.95	0.8	0.4	1.2	0.6	1.4	0.7
O-2	2-17	SVE	3	1.5	2	1	0.3	0.2	0.4	0.2	1.2	0.6	0	0	1.2	0.6	0.5	0.25	1.5	0.75	2.2	1.1
O-3D	11.5-17	SVE	2	1	2	1	0.5	0.3	0.6	0.3	0.1	0.1	0.4	0.2	4.5	2.25	0.8	0.4	1.3	0.65	0	0
O-3S	2-9	SVE	2	1	ND	ND	ND	ND	ND	ND	1.6	0.8	0	0	0.6	0.3	0	0	0	0	0.1	0.05
O-5	2-14	SVE	1	0.5	ND	ND	ND	ND	0.6	0.3	0.6	0.3	0.4	0.2	1.3	0.65	0.3	0.15	0.6	0.3	7.4	3.7
O-6	2.5-13.5	SVE	ND	ND	3	1.5	ND	ND	0.5	0.3	0.6	0.3	0	0	1.4	0.7	0.5	0.25	0.5	0.25	2.7	1.35
O-7	2.5-15	SVE	ND	ND	1	0.5	0.3	0.2	0.6	0.3	1	0.5	0	0	0.9	0.45	0.3	0.15	0.7	0.35	1.2	0.6
O-8S	2-9	SVE	3	1.5	2	1	ND	ND	ND	ND	0.2	0.1	0.4	0.2	2.1	1.05	0.1	0.05	0.6	0.3	1.2	0.6
O-8D	11-18	SVE	NM	NM	ND	ND	4.2	2.1	11	6.5	11	5.5	2.1	1.05	1.45	0.725	4.2	2.1	1.5	0.75	0.9	0.45
O-9	2-14.5	SVE	ND	ND	1	0.5	1	0.5	2.5	1.3	2.6	1.3	1.2	0.6	3	1.5	2.2	1.1	3.6	1.8	4	2
O-10S	2.5-8.5	SVE	2	1	2	1	1.4	0.7	2.1	1.1	1.8	0.9	1.2	0.6	3.3	1.65	0.5	0.25	4.1	2.05	16	8
O-10D	10.5-16	SVE	NM	NM	16	8	0.1	0.1	16	8	20.3	10.2	4.7	2.35	10.6	5.3	24.1	12.05	0.4	0.2	9.6	4.8
O-12	7.5-18	SVE	2	1	ND	ND	1.5	0.8	2	1	5.7	2.9	2.1	1.05	16.2	8.1	6.6	3.3	5.5	2.75	12.6	6.3
O-13S	3-9	SVE	<1	<0.5	6	3	0.2	0.1	0.9	0.5	2.5	1.3	1.2	0.6	3	1.5	1	0.5	2.1	1.05	1.7	0.85
O-13D	11-16	SVE	NM	NM	3	1.5	0.4	0.2	7	3.5	11.1	5.6	0.4	0.2	4.2	2.1	13.7	6.85	0.4	0.2	7.3	3.65
O-14	2-12	SVE	ND	ND	ND	ND	ND	ND	ND	ND	0.1	0.1	0	0	2.9	1.45	0.3	0.15	0.5	0.25	0.7	0.35
O-17	2-7.5	SVE	1	<0.5	1	0.5	0.2	0.1	ND	ND	0.6	0.3	0	0	1	0.5	0	0	4.3	2.15	0.2	0.1
O-18	2-10	SVE	<1	<0.5	ND	ND	0.1	0.1	ND	ND	0.7	0.4	0.4	0.2	2.3	1.15	0.1	0.05	0.8	0.4	0.5	0.25
O-19D	11-20	SVE	3	1.5	ND	ND	ND	ND	ND	ND	ND	ND	0.4	0.2	1.2	0.6	1.5	0.75	0.6	0.3	0	0
O-19S	3-9	SVE	2	1	3	1.5	0.5	0.3	ND	ND	0.1	0.1	0.4	0.2	1.75	0.875	0.5	0.25	0.4	0.2	0	0
P-O1	2-12	SVE	ND	ND	2	1	1	0.5	0.7	0.4	0.2	0.1	0.4	0.2	5.3	2.65	1	0.5	3.2	1.6	4.8	2.4
P-O4	2-8	SVE	4	2	3	3	1.5	0.8	0.8	0.4	0.5	0.3	1.2	0.6	6.3	3.15	1.7	0.85	4.5	2.25	2.5	1.25
P-O5	2-13	SVE	3	1.5	ND	ND	2	1	1.6	0.8	1.4	0.7	2.1	1.05	12.1	6.05	3.7	1.85	4.8	2.4	2.1	1.05
P-O6	11.5-16	SVE	<1	<0.5	11	5.5	13	7.5	4.5	2.3	6.4	3.2	5.5	2.75	16.1	8.05	11.6	5.8	18.6	9.3	3.6	1.8
P-O8	9.5-14	SVE	<1	<0.5	3	1.5	0.4	0.2	8	4	9.3	4.7	1.2	0.6	3.6	1.8	8.7	4.35	7	3.5	3	1.5

Table 6-4 (continued)
Vapor Concentration in Vadose Zone Wells

			November 2006		March 2007		June 2007		August 2007		October 2007		April 2008		June 2008		August 2008		October 2008		March 2009		October 2009	
Well ID	Screen Interval (ft bgs)	Well Type	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)	VOCs[1] (ppmv)	Estimated TCE Conc.[2] (ppmv)
O-1	2-13	SVE	<5	<3	1.2	0.6	0	0	0	0	0.3	0.2	1.8	0.9	0.7	0.4	9.8	4.9	0.4	0.2	0.4	0.2	1.5	0.8
O-2	2-17	SVE	<5	<3	0.6	0.3	0.4	0.2	0.3	0.2	0.3	0.2	1.1	0.6	0.9	0.5	12.5	6.3	1.1	0.6	0.3	0.2	4.3	2.2
O-3D	11.5-17	SVE	<5	<3	0.6	0.3	0.6	0.3	0.9	0.5	0.2	0.1	3.8	1.9	1.9	1	2.3	1.2	3.3	1.7	1.1	0.6	5.8	2.9
O-3S	2-9	SVE	<5	<3	0	0	0	0	0	0	0.7	0.4	1.8	0.9	0	0	4.6	2.3	0.9	0.5	0.5	0.3	0.5	0.3
O-5	2-14	SVE	<5	<3	0.6	0.3	0.3	0.2	0.2	0.1	0.7	0.4	1.1	0.6	0.9	0.5	10.5	5.3	0.5	0.3	0.7	0.4	1.8	0.9
O-6	2.5-13.5	SVE	<5	<3	0	0	0.5	0.3	0	0	0.3	0.2	0.7	0.4	0.7	0.4	5.5	2.8	1.1	0.6	0.5	0.3	1.4	0.7
O-7	2.5-15	SVE	<5	<3	1.8	0.9	0.4	0.2	0.9	0.5	0.4	0.2	0.2	0.1	2.1	1.1	5.8	2.9	1.0	0.5	0.1	0.1	0.8	0.4
O-8S	2-9	SVE	<5	<3	0	0	0	0	0	0	0.1	0.1	0.3	0.2	0.2	0.1	6.7	3.4	0.5	0.5	0.8	0.4	0.6	0.3
O-8D	11-18	SVE	5	3	3	1.5	3.4	1.7	1.9	1	0.7	0.4	0.9	0.5	4.8	2.4	4.5	2.3	3.3	1.7	1.8	0.9	3	1.5
O-9	2-14.5	SVE	5	3	3.6	1.8	2.3	1.2	0.7	0.4	1.2	0.6	2	1	2.4	1.2	19.2	9.6	2.1	1.1	2.1	1.1	1	0.5
O-10S	2.5-8.5	SVE	<5	<3	1.2	0.6	1.5	0.8	0	0	0.2	0.1	2.8	1.4	1.9	1	48.9	24.5	2.4	1.2	2.1	1.1	3.5	1.8
O-10D	10.5-16	SVE	<5	<3	0.6	0.3	0.3	0.2	2.4	1.2	0.3	0.2	0.5	0.3	11.7	5.9	16.2	8.1	0.6	0.3	0.2	0.1	2.8	1.4
O-12	7.5-18	SVE	10	5	10.2	5.1	11.1	5.6	5.4	2.7	0.5	0.3	11.6	5.8	7.7	3.9	1.5	0.8	8.2	4.1	19.3	9.7	3.7	1.9
O-13S	3-9	SVE	5	3	1.2	0.6	1.5	0.8	1	0.5	2.1	1.1	1.4	0.7	2.7	1.4	33.3	16.7	1.1	0.6	0.3	0.2	2.1	1.1
O-13D	11-16	SVE	75.4	38	0	0	0.8	0.4	23.8	11.9	23.6	11.8	2.2	1.1	24.4	12.2	196	98	2.5	1.3	0.4	0.2	0.8	0.4
O-14	2-12	SVE	<5	<3	0	0	NM	NM	0.1	0.1	1.3	0.7	1.5	0.8	2.1	1.1	20.2	10.1	1.3	0.7	0.7	0.4	3.6	1.8
O-17	2-7.5	SVE	<5	<3	0	0	0.2	0.1	0	0	0.3	0.2	0	0	0.8	0.4	18.6	9.3	0.7	0.4	1.2	0.6	0.7	0.4
O-18	2-10	SVE	<5	<3	0	0	0.2	0.1	0.1	0.1	0.3	0.2	0.5	0.3	0.8	0.4	9.4	4.7	1.1	0.6	0.2	0.1	3.9	2.0
O-19D	11-20	SVE	<5	<3	1.2	0	1	0.5	1.6	0.8	0.4	0.2	2.1	1.1	3.4	1.7	19.6	9.8	2.4	1.2	1	0.5	2.1	1.1
O-19S	3-9	SVE	<5	<3	0	0	0.7	0.4	0.1	0.1	0.2	0.1	1.2	0.6	0.7	0.4	5.1	2.6	0.5	0.3	1.1	0.6	0	0
P-O1	2-12	SVE	<5	<3	4.2	2.1	2.5	1.3	6.4	3.2	2.1	1.1	0.3	0.2	2.7	1.4	12.9	6.5	1.5	0.8	0.4	0.2	4.1	2.1
P-O4	2-8	SVE	10	5	1.8	0.9	2.1	1.1	2	1	0.7	0.4	0.9	0.5	2.4	1.2	16.4	8.2	3.1	1.6	1.4	0.7	3.8	1.9
P-O5	2-13	SVE	5	3	3.6	1.8	6	3	5.1	2.6	4.1	2.1	1.5	0.8	4.4	2.2	44.5	22.3	3.2	1.6	1.7	0.9	2.1	1.1
P-O6	11.5-16	SVE	25.1	13	12	6	16.2	8.1	12.2	6.1	5.1	2.6	13.3	6.7	26.4	13.2	58.2	29.1	14	7	13.2	6.6	5.6	2.8
P-O8	9.5-14	SVE	10	5	1.2	0.6	1.5	0.8	6.3	3.2	4.1	2.1	2.2	1.1	11.6	5.8	19.2	9.6	5.5	2.8	0.1	0.1	2	1

Notes:
[1] — Volatile organic compound (VOC) concentrations are direct readings from photoionization detector (PID).
[2] — Reported concentration divided by two is approximate concentration as TCE.
ND — Not detected
<1 — Detection on PID but not high enough to register whole number on display
NM — Not measured
ft bgs — feet below ground surface
ppmv — parts per million volume

Table 6-5
GWE/MPE-GW Operating Statistics 1998 through 2009

Year	GWE		MPE-GW	
	Total Days	**Percent**	**Total Days**	**Percent [a]**
1998	—	—	Irregular	Irregular
1999	—	—	54	30% [b]
2000	164	77%	89	49% [b]
2001	319	87%	66	37% [b]
2002	306	84%	135	75%
2003	319	88%	104	74% [c]
2004	318	87%	125	89%
2005	287	79% [d]	110	60% [e]
2006	350	96%	168	88%
2007	321	89%	152	80%
2008	297	81%	127	66% [f]
2009	342	94%	184	87%

Notes:
1998 and 1999 data reflect air stripping of MPE-GW
GWE assessment for 2000 based on total operating season of 216 days (May 30 through December 31)
GWE assessment for 2001 and 2002 based upon total operating season of 12 months (365 days)
[a] — Percent uptime based on actual field startup/winterization dates, except as noted
[b] — MPE-GW assessment assumes total operating season of 6 months (180 days)
[c] — Optimization process ongoing throughout 2003
[d] — VTS heater element replacement
[e] — MPE liquid transfer pump/motor starter replacement
[f] — MPE downtime associated with GWTS repairs following controller failure/replacement

Table 6-6
GWE/MPE-GW Flow Data 1998 through 2009 (MGY)

Year	SMW	B-3	MW-10	MPE-GW	Total Annual Flow
1999	–	—	—	0.48	0.48
2000	0.63	1.28	0.4	0.3	2.61
2001	1.15	2.1	1.36	0.75	5.36
2002	1.41	1.77	0.9	0.28	4.36
2003	1.24	1.52	1.91	0.21	4.88
2004	1.49	1.59	1.89	0.27	5.23
2005	1.52	1.27	1.84	0.07	4.70
2006	1.58	1.56	2.02	0.16	5.32
2007	1.26	1.53	1.52	0.01	4.32
2008	0.82	1.19	1.18	0.04	3.24
2009	0.93	1.12	1.50	0.11	3.67
Total Flow	12.02	14.94	14.52	2.69	44.17

GWE Mass Removal Data

Estimated mass contributions from each of the GWE system components are shown in Table 6-7 and on Figure 6-3 (included in Appendix A). Since commencement of full-scale GWE pumping in 2000, mass removal rates have decreased from a maximum of 471 pounds per year (lbs/year) in 2000 to 51 lbs/year in 2009.

These data indicate that in 2000 and 2001, the majority of mass into the GWTS was derived from MW-10 and MPE-GW, even though flow rates from these wells comprise only 30 to 40% of the total flow to the GWTS. From 2001 through 2009, MW-10 contributed between approximately 20 and 70% of the total TCE mass recovered per year. Approximately 34% of the total aqueous mass recovered has been from MW-10. MW-10 targets a DNAPL-containing fracture identified during pre-design investigations conducted from 1994 through 1997, which indicated the majority of TCE mass is present in the saprolite and shallow weathered bedrock zones.

Mass removal rates from B-3, which recovers groundwater from offsite, have also fluctuated during the operating period, ranging from approximately 20 to 70% annually. Approximately 23% of the total aqueous mass required has been from B-3. It is important to note that natural groundwater gradients, which induce flow south toward the Stamina Mills Site, may be sufficiently protective for maintenance of the Compliance Boundary. Operation of B-3 only enhances these gradients and accelerates flow towards the property boundary.

Mass removal rates from the MPE-groundwater system since 2003 are shown as negligible due to the fact that the aqueous phase contaminants strip into the vapor stream within the MPE manifold. MPE vapor concentrations suggest that the MPE system contributed roughly between 10% and 30% of the VOC loading to the VTS during the 2003 to 2009 period, with an average contribution of approximately 33 pounds per year. The MPE's overall mass contribution (measured by combining both vapor and aqueous streams) is greater than that provided by the SMW.

SMW's mass contribution to the GWE system remains low, with no changes in removal rates.

Groundwater and Vapor Treatment System Performance

As shown in Table 6-8, the GWTS has operated consistently since installation in 2000, with a typical operations rate of 77% to 96%. To date, over 44 million gallons of groundwater have been extracted and treated at the Stamina Mills Site. Total mass removal from groundwater since 1998 has been approximately 2,200 lbs.

Table 6-7
GWE System Components — Estimated Mass Contributions

	SMW		B-3		MW-10		MPE-GW		
Year	**Mass (lbs)**	**Percent**	**Mass (lbs)**	**Percent**	**Mass (lbs)**	**Percent**	**Mass (lbs)**	**Percent**	**Annual Total**
1998	—	0%	—	0%	—	0%	110	100%	**110**
1999	—	0%	—	0%	—	0%	382	100%	**382**
2000	5	1%	97	21%	156	33%	213	45%	**471**
2001	15	4%	79	24%	143	43%	97	29%	**333**
2002	24	9%	42	16%	158	60%	37	14%	**261**
2003	6	5%	41	32%	69	55%	10	8%	**126**
2004	6	4%	35	24%	106	72%	0 [a]	0%	**147**
2005	9	13%	31	46%	28	41%	0 [a]	0%	**68**
2006	6	8%	37	52%	28	40%	0 [a]	0%	**71**
2007	27	19%	79	54%	40	27%	0 [a]	0%	**146**
2008	4	7%	47	77%	10	16%	0 [a]	0%	**61**
2009	8	16%	28	55%	15	29%	0 [a]	0%	**51**
—	**110**	**—**	**516**	**—**	**753**	**—**	**849**	—	**2,227**

Notes:
Mass flow estimated based on quarterly sampling results
Mass contributions for 2000 based on maximum concentrations; data from PS-15, Nov. 2001 assumed for MPE-GW influent
[a] — Note that aqueous phase contamination is stripped out of the MPE stream in the MPE manifold, resulting in a negligible mass estimate for aqueous removal. Total MPE mass removal is estimated as combined vapor and aqueous mass in Table 6-3.

Table 6-8
GWTS Operations Data 1998 through 2009

Year	Total Flow (million gallons)	System % Operational	Influent TVOCs (mg/L)	Effluent TVOCs (mg/L)	Total Mass Removed (lbs)
1998	— [a]	—	63 to 89	0.02 to 0.37	110
1999	0.48 [b]	—	8 to 38	ND to 0.03	382
2000	2.61	77%	0.7 to 9.0	ND	471
2001	5.36	87%	4.8 to 17.8	ND to 0.12	333
2002	4.36	84%	9.3 to 38.9	ND to 0.01	261
2003	4.88	88%	0.8 to 5.5	ND to 0.005	126
2004	5.24	87%	1.6 to 5.14	ND to 0.005	147
2005	4.7	79% [c]	2.1 to 2.5	ND to 0.6	68
2006	5.32	96%	0.4 to 3.4	ND to 0.01	71
2007	4.32	89%	2.0 to 8.0	ND to 0.005	146
2008	3.23	81% [d]	1.6 to 5.2	ND to 0.01	61
2009	3.65	94%	1.3 to 2.9	ND to 0.005	51

Notes:
mg/L — milligrams per liter
lbs= — pounds
[a] — In 1998, process data reflected combined vapor from SVE-V, MPE-V, and the air stripper. MPE-GW flow rates were not presented in the *Air Data Summary Report* (EnSafe, 1999).
[b] — In 1999, an additional 1.6 MG of potable make up water was added to the GWTS as a result of maintaining sufficient water supply to the acid scrubber
[c] — VTS heater element replacement
[d] — GWTS repairs following controller failure/replacement

Problems encountered since startup were primarily one-time failures of parts or subsystems (the VTS heater element in 2005, the controller in 2008), and were remedied by replacement. Following each shutdown event, diagnostic and troubleshooting procedures were used to identify the root cause, and any additional system improvements which could prevent future shutdowns. For example, in 2008, the controller replacement was supplemented with improved control interlocks in both HT-301 and the building sump. Recurrence of similar problems is not expected until the service life of these parts is expended.

Recurring operational problems noted within the GWTS since 2000 have included system control issues, such as bag filter and air stripper pressure sensors, holding tank high-level alarms, flow meter low-flow/sensitivity issues, seasonal water balance issues, and power outages. These operational problems are not associated with design flaws, nor do they inhibit system effectiveness. Since the primary function of groundwater extraction is mass removal (as opposed to containment) and that mass removal is governed by diffusion and dissolution, only downtime durations exceeding weeks or months would be significant when evaluating overall system performance.

VTS effectiveness has remained high since 2000, when the photocatalytic oxidation system was replaced with granular activated carbon for offgas control. Total mass removed by the VTS is approximately 4,420 lbs. Performance data are presented in Table 6-9.

Table 6-9
VTS Operations Data 1998 through 2009

Year	Average Air Flow (scfm)	System % Operational	Total Mass Removed (lbs)
1998	341	42%	788
1999	475	41%	959
2000	661	84%	640
2001	780	80%	452
2002	626	100%	356
2003	330	88%	104
2004	342	87%	169
2005	309	79%	114
2006	419	96%	200
2007	418	89%	200
2008	427	81%	154
2009	398	94%	284

Notes:
scfm — standard cubic feet per minute
lbs — pounds

Air emissions compliance data indicate that contaminant emissions rates have not exceeded Regulation No. 9 limitations during the operating period. No recurring operational problems have been noted regarding VTS performance since installation of the carbon units.

Phase III Groundwater Monitoring

Selected onsite and offsite monitoring wells are to be sampled as part of the Phase III sampling program to determine when cleanup standards have been met throughout the Compliance Boundary or to determine whether it is feasible to attain the cleanup standards. These onsite and offsite well sampling programs are described below, and are shown in Figure 6-4 (included in Appendix A).

The contaminant plume currently extends approximately 750 feet northwest of the TCE spill area. Offsite monitoring wells I-12 and I-37 are within the plume close to its northwest boundary. To provide information on plume status, these two wells will be sampled during Stage 1 (i.e., to determine whether the plume is continuing to decrease in concentration and size from the northwest towards the Site to the southeast). Additional offsite wells will be added during Stage 2 after concentrations in I-12 and I-37 decrease below MCLs. A-175 is an active well just outside the western plume boundary and is sampled to monitor conditions in the nearest active well. This well is sampled from faucets inside the building.

During the initial phases of Stage 1 monitoring (from 2001 through 2005) I-12 and I-37 were sampled using low-flow purge techniques, resulting in generation of 1,000 to 2,000 gallons of water per well per purge event; purge water was treated using granular activated carbon and discharged to nearby storm drains. In 2005 RIDEM advised that discharge of purge water from these wells would require permitting under the Rhode Island Pollutant Discharge Elimination System (RIPDES) program, as well as treatment for both VOCs and naturally-occurring metals. After consultation with USEPA and RIDEM project managers, alternate sampling techniques were evaluated. Use of passive diffusion bag (PDB) samplers was identified as the preferred sampling technique and was evaluated in June 2006. In December 2006, USEPA indicated that PDB samplers could be used as the long-term monitoring approach to evaluate trends within the aquifer.

MW-17 was also included in the initial Stage 1 monitoring (from 2001 through 2005) to gauge conditions along the southeastern plume boundary. However, in 2005 RIDEM indicated that the artesian conditions in this well and associated discharges to the Branch River during sampling would require permitting under the RIPDES program. After consultation with USEPA and RIDEM project managers, and review of historical data in this well, sampling of this well was discontinued.[3]

A total of seven wells (four onsite and three offsite) are sampled for VOCs as outlined in Stage 1 of the Phase III Groundwater Monitoring Work (Revision 2). The sample locations are shown in Table 6-10, and on Figure 6-4, found in Appendix A.

Table 6-10
Phase III Groundwater Monitoring Wells (Stage 1 Wells)

Well	Depth (ft)	Sampling	Location Sample (ft BTOC)	Technique Notes
A-175	NA	VFW Hall	Tap	1-hour purge
I-37	350	Private Residence	84-86	PDB
I-12	450	Private residence	414-416	PDB
MW-2	52	Onsite	21-23	PDB
SMW	275	Treatment Building	Dedicated sample port	—
B-10	50	Treatment Building	Dedicated sample port	—
B-3	150	Treatment Building	Dedicated sample port	—

Notes:
VFW — Veterans of Foreign Wars
PDB — Passive diffusion bag
SMW — Stamina Mills Well
ft BTOC — feet below top of casing

[3] See the *Phase III Groundwater Monitoring Work Plan, Revision 2* for more details.

To augment existing Stage 1 data, select Stage 2 wells (I-20, I-24, and I-30) were added to the program in May 2010 and sampled using PDBs. Stage 2 sample locations are shown in Table 6-11, and on Figure 6-4, found in Appendix A.

Table 6-11
Phase III Groundwater Monitoring Wells (Select Stage 2 Wells)

Well	Depth (ft BTOC)	Sampling	Location Sample (ft BTOC)	Technique Notes
I-20	364	Private Residence	54-56 150-152 300-302	PDB
I-24	119	Private residence	60-62 85-87 110-112	PDB
I-30	117	Private Residence	60-62 85-87 110-112	PDB

Notes:
PDB — Passive diffusion bag
SMW — Stamina Mills Well
ft BTOC — feet below top of casing

Offsite groundwater has exhibited decreasing contaminant concentrations in all four offsite wells, as shown in Table 6-12. A-175 has historically complied with the ROD goal for TCE in groundwater (5 µg/L). Contaminant concentrations in I-12 and I-37 have decreased by an order of magnitude since 1998.

Table 6-12
Historical Offsite Monitoring-Well TCE Concentrations
(Phase III Round 1 Wells) µg/L)

Date	A-175	I-12	I-37	MW-17
Nov-92	1	43	120	NS
Sep-93	ND (<1)	130	130	9
Dec-93	ND (<1)	150	190	44
Mar-94	ND (<1)	15	110	NS
Jun-94	ND (<1)	46	97	ND (<1)
Oct-94	ND (<1)	170	130	ND (<1)
Dec-94	ND (<1)	140	100	ND (<1)
Mar-95	ND (<1)	170	95	ND (<1)
Jun-95	ND (<1)	85	110	ND (<1)
Oct-95	ND (<1)	120	110	ND (<1)
Mar-96	ND (<1)	150	63	ND (<1)
Sep-96	ND (<1)	54	70	ND (<1)

Table 6-12
Historical Offsite Monitoring-Well TCE Concentrations
(Phase III Round 1 Wells) µg/L)

Date	A-175	I-12	I-37	MW-17
Mar-97	ND (<1)	NS	110	ND (<1)
Sep-97	ND (<1)	110	100	ND (<1)
Jun-98	ND (<1)	120	130	ND (<1)
Mar-99	ND (<1)	2	55	ND (<1)
Dec-99	ND (<1)	92	79	ND (<1)
Sep-00	ND (<1)	4	35	ND (<1)
Mar-02	ND (<0.6)	3	28	ND (<0.6)
Dec-02	ND (<0.6)	3.1	15	ND (<0.6)
Sep-03	ND (<0.6)	10	4.7	0.98
Jun-04	ND (<0.6)	2.3	14	ND (<0.6)
Jun-06	ND (<0.6)	2	8	NS
Mar-07	ND (<0.5)	1	7.4	NS
Dec-07	ND (<5)	9.6	15	NS
May-10	ND (<0.5)	1.4	2.3	NS

Notes:
TCE — Trichloroethylene
µg/L — micrograms per liter
ND (<1) — Not detected at a method reporting limit of 1 µg/L
NS — Not sampled
Phase III Sampling was deferred in 2008/2009 pending (a) completing soil vapor assessment studies, and (b) obtaining access at additional inactive private residential wells for PDB deployment.

As discussed in the Phase III Groundwater Monitoring Work Plan (EnSafe, 2001), contaminant trends in these wells will be monitored until concentrations are less than the ROD-prescribed cleanup standards. As noted above, select Stage 2 wells were also monitored during the May 2010 event. TCE results for these wells are shown in Table 6-13.

Table 6-13
Phase III Groundwater Monitoring Wells (Select Stage 2 Wells)

Well	Location Sample	TCE Concentration (µg/L)
I-20	54-56	ND (<0.5)
	150-152	ND (<0.5)
	300-302	1.6
I-24	60-62	ND (<0.5)
	85-87	ND (<0.5)
	110-112	ND (<0.5)
I-30	60-62	ND (<0.5)
	85-87	ND (<0.5)
	110-112	ND (<0.5)

Concentrations in onsite wells monitored as part of the Phase III monitoring program are typically consistent with historical data as shown in Table 6-14.

Table 6-14
Historical Onsite Monitoring Well TCE Concentrations
(Phase III Round 1 Wells) (µg/L)

Date	SMW [1]	B3	MW-1 [2]	MW-2
Nov-92	3,300	NS	NS	85,000
Sep-93	4,200	NS	NS	170,000
Dec-93	2,700	NS	NS	94,000
Mar-94	830	NS	NS	28,000
Jun-94	4,000	NS	NS	120,000
Oct-94	53,000	NS	NS	110,000
Dec-94	150	NS	NS	32,000
Mar-95	NS	NS	4,400	38,000
Jun-95	3,500	NS	13,000	130,000
Oct-95	5,300	NS	21,000	100,000
Mar-96	2,100	NS	2,700	62,000
Sep-96	1,900	NS	25,000	94,000
Mar-97	3,800	NS	5,900	32,000
Sep-97	4,100	NS	36,000	2,200
Jun-98	2,600	NS	1,900	42,000
Mar-99	4,500	NS	510	220,000
Dec-99	3,000	NS	570	16,000
Sep-00	NS	9,200	49,000	43,000
Mar-02	3,100	4,900	14,000	60,000
Dec-02	2,500	3,600	15,000	27,000
Sep-03	4,300	1,100	790	170,000
Jun-04	600	4,000	6,400	15,000
Jun-06	1,100	5,100	1,200	15,000
Mar-07	290	4,700	220	6,300
Dec-07	870	5,500	4,900	29,000
May-10	1,200	1,000	140	390

Notes:
TCE — Trichloroethylene
SMW — Stamina Mills Well
µg/L — micrograms per liter
NS — not sampled
[1] — SMW data pre-June 1995 are not depth-specific; data after June 1995 are from the 26-foot bgs interval
[2] — Prior to March 1995, MW-10 was sampled using multilevel sampling ports and data are not directly comparable; data after March 1995 are from the 26-foot bgs interval.
Phase III sampling was deferred in 2008/2009 pending (a) completing soil vapor assessment studies, and (b) obtaining access at additional inactive private residential wells for PDB deployment.

Although the wells exhibit large concentration fluctuations from one sampling event to the next, they appear to show decreasing trends over the long term. Figure 6-5 (found in Appendix A) shows the TCE plume as quantified during the May 2010 sampling event. Historical data (pre-1992) are shown in Appendix B. Trend data for B-3, MW-10, SMW, and MW-2 are shown on Figures 6-6 through 6-9 (included in Appendix A).[4]

These trends will continue to be monitored as part of Phase III monitoring.

System Monitoring Results

All quarterly monitoring data for MW-10, SMW, and B-3 obtained since system startup in 2000 are summarized in Table 6-12. This quarterly data indicates that the three wells exhibit variable concentrations throughout each year as well as over the long term.

It should be noted that operations-related data are collected more frequently (quarterly) than Phase III monitoring data presented in Table 6-15; quarterly events do not coincide with Phase III events during those months in which both events occur. Overall, the data from 2000 through 2010 correlate well; however, some variability is expected when comparing datasets, given the sensitivity of fracture flow to rainfall events and system operations. Quarterly datasets have consistently indicated seasonal variability in system influent.

Table 6-15
TCE Concentrations in SMW, B-3, and MW-10 — 2000 through 2009 (µg/L)

Date	SMW	B-3	MW-10
2000			
1st Quarter	NA	NA	NA
2nd Quarter	420	1,330	1,410
3rd Quarter	930	9,200	49,000
4th Quarter	NA	NA	NA
2001			
1st Quarter	NA	NA	NA
2nd Quarter	140	6,000	1,400
3rd Quarter	1,320	3,360	23,000
4th Quarter	1,500	3,740	12,000
2002			
1st Quarter	NA	NA	NA
2nd Quarter	360	1,200	350
3rd Quarter	3,400	5,900	56,000
4th Quarter	2,200	1,400	5,500

[4] Trends shown in Figures 6-5 through 6-9 are derived using linear regression analysis in Microsoft Excel.

Table 6-15
TCE Concentrations in SMW, B-3, and MW-10 — 2000 through 2009 (µg/L)

Date	SMW	B-3	MW-10
2003			
1st Quarter	330	1,200	1,400
2nd Quarter	590	3,400	3,400
3rd Quarter	800	4,900	8,300
4th Quarter	610	3,800	7,600
2004			
1st Quarter	720	820	2,000
2nd Quarter	370	3,200	6,900
3rd Quarter	490	3,200	13,000
4th Quarter	720	3,300	8,400
2005			
1st Quarter	750	3,400	1,700
2nd Quarter	750 [1]	3400 [1]	1,700 [1]
3rd Quarter	570 [2]	2800 [2]	3,300 [2]
4th Quarter	570	780	580
2006			
1st Quarter	710	3,700	1,700
2nd Quarter	180	1,500	240
3rd Quarter	660	2,900	4,600
4th Quarter	85	3,600	150
2007			
1st Quarter	6,400	6,200	2,600
2nd Quarter	120	4,700	160
3rd Quarter	950	8,800	10,000
4th Quarter	870	5,500	4,900
2008			
1st Quarter	320	7,500	100
2nd Quarter	370	710	200
3rd Quarter	2,200	6,600	4,600
4th Quarter	NA [3]	2,600	550
2009			
1st Quarter	170	2,100	120
2nd Quarter	1,600	2,500	1,500
3rd Quarter	1,800	330	4,000
4th Quarter	640	5,400	150
2010			
1st Quarter	990	6,700	110

Notes:
[1] — System influent samples were inadvertently not collected during the June 2004 sampling event. The data shown here was collected on July 20, 2004, and are presented for comparative purposes.
[2] — Value was taken from the 12/19/05 sampling event
[3] — SMW sample was collected due to SMW being down for repairs

MW-10 is the most variable, with concentrations typically ranging from less than 2,000 µg/L to more than 20,000 µg/L in a given year. Concentrations in MW-10 consistently peak in third quarter. These high concentrations seem to occur after seasonal high water table conditions, typically observed in Site wells in May and June.

MPE Sampling Results

2001 and 2002 sampling data from selected saprolite/weathered bedrock (MPE) wells indicated that shallow, source-area groundwater concentrations were elevated, with concentrations comparable to water from the GWE system. Ongoing monitoring of these wells during spring MPE system startup activities has tracked contaminant distribution in saprolite and shallow weathered bedrock, as shown in Table 6-16. These results are also shown on Figure 6-10, in Appendix A.

Table 6-16
Select MPE Well TCE Concentrations (µg/L)

Well	Well Depth (ft bgs)	Terminal Elevation (ft amsl)	April 2002	April 2003	April 2004	April 2005	April 2006	April 2007	April 2008	March 2009	March 2010
PS-01	21	189	5,300	740	120	180	420	69	110	83	160
PS-02	25	184	NS	360	290	45	140	56	72	39	29
PS-04	20	188	NS	2,800	6,000	660	540	1,000	1,400	390	1,100
PS-05	22	186	22,000	2,400	3,300	960	1,400	1,200	1,500	730	1,700
PS-06	25	183	NS	3,400	4,200	8,700	1,500	440	29,000	37,000	49,000
PS-07	26	182	NS	53,000	12,000	610	NS	NS	NS	NS	NS
PS-08	25	183	NS	4,200	4,900	6,200	330	420	1,500	3,700	5,000
PS-09	25	183	NS	1,200	1,600	450	640	310	1,900	2,900	1,700
PS-11	22	186	NS	1,200	1,600	NS	980	670	1,200	320	1,800
PS-12	21	186	NS	14,000	490	12,000	32,000	6,800	7,300	3,200	1,900
PS-13	24	184	NS	26,000	4,400	3,600	4,399	64,000	3,700	2,700	4,600
PS-15	28	180	30,000	7,100	940	810	520	820	440	610	390
PS-16	20	188	NS	5,800	1,900	5,700	3,300	2,200	5,900	1,200	360
PS-17	22	185	NS	3,400	3,300	1,600	1,500	1,400	900	1,400	960
PS-18	24	184	630	970	380	290	290	170	290	380	250
PS-21	23	184	NS	4,700	2,200	NS	1,600	5,400	1,400	1,300	410
PS-24	25	183	3,600	3,900	1,100	410	440	180	480	670	350
S-02	19	183	30,000	1,100	250	1,400	3,700	2,100	230	260	130
S-03	19	182	NS	26,000	160	10,000	27,000	16,000	17,000	44,000	38,000
S-06	15	186	NS	250	5,000	130	NS	410	340	180	120
S-08	16.5	186	NS	300	400	NS	10,000	290	280	340	83
S-09	14	189	NS	180	400	300	NS	240	260	350	98
S-10	18	185	2,200	450	660	740	580	470	390	420	270

Notes:
µg/L — micrograms per liter
NS — Not sampled
ft bgs — feet below ground surface
ft amsl — feet above mean sea level

These data show order-of-magnitude decreases in TCE concentrations in several MPE wells since the drop-tube modifications were implemented in 2003, including PS-01, PS-02, PS-05, PS-12, PS-13, PS-15, PS-16, PS-17, PS-21, PS-24, S-02, S-06, S-08, and S-10. The majority of the remaining wells have maintained stable concentrations (within the same order-of-magnitude) over the monitoring period. PS-06 is the only MPE well exhibiting an increase in TCE concentrations over an order of magnitude since the onset of drop-tube operations. As a result, this well has consistently been targeted for ongoing operations.[5] Of the MPE wells, only PS-06 and S-03 exhibit TCE concentrations exceeding 1% of TCE's solubility product in water, suggestive of the presence of DNAPL.[6]

Site Inspection

The Site inspection was performed on June 28, 2010. The following team members were present for the Site inspection:

- Byron Mah, USEPA
- Lori Goetz, EnSafe Inc.
- Michael Spina, EnSafe Inc.
- Robert Atwood, Resource Control Associates (EnSafe subcontractor)

The inspection team reviewed Site history and ongoing operations using the site inspection form, included in Appendix I. During the Site inspection, Mr. Mah noted the following items/issues:

- USEPA identified downtime concerns with GWE wells during the 2005 to 2010 five-year review period, specifically with respect to Grundfos pump/lead wiring connector issues which have occurred in both SMW and B-3. At USEPA's request, a technical evaluation summarizing the problem and corrective measures has been prepared and included as Appendix J.

- Inspect floor (secondary containment) for cracks quarterly. Patch cracks in floor. At USEPA's request, photographs of patches have been included as Appendix K.

[5] The MPE drop tube system's configuration is modified annually to extract groundwater and vapor from the ten most highly contaminated wells.
[6] TCE's solubility is approximately 1,100,000 µg/L in water; however, this assessment may be biased by the concentrating effects of fracture flow.

No other conclusions/findings were identified during the Site inspection. Photographs documenting Site features on June 28, 2010, are included in Appendix L.

Interviews

An interview via conference call was conducted with the Town Administrator and the Town Planner for North Smithfield on July 22, 2010. Notes from this meeting are included as Appendix M.

VII. TECHNICAL ASSESSMENT

A comprehensive technical assessment of the Site's remedy was performed as part of the five-year review. To evaluate the remedy, three questions were assessed:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Question A

Question A: Is the remedy functioning as intended by the decision documents?

Yes: Performance of the Site remedy was assessed according to the criteria outlined in the USEPA's *Comprehensive Five-Year Review Guidance*. Findings are summarized in Table 7-1, and discussed in more detail in subsequent sections.

Table 7-1
Summary of Findings: Question A

Remedial Action Performance	
Site remedy	Remedial actions associated with building demolition, raceway closure, septic tank closure, and site restoration are complete and are functioning as designed. The landfill removal, as described by the 2000ESD, removed all landfill wastes from the site.
SVE/MPE	The MPE and VTS are operating; operation of the SVE system was suspended in 2003 after mass removal rates approached asymptotic conditions. MPE modifications completed in 2003 improved overall operations, reduced system shut downs, and augmented mass removal from heavily contaminated saturated saprolite/weathered bedrock zones within the TCE spill area.
GW	The GWE and GWTS are operating as designed. Offsite groundwater concentrations continue to decrease. Hydraulic groundwater containment at the site has been effective. The plume area is contracting southward toward the Compliance Boundary. Sampling since May 2005 did not indicate the presence of TCE in wells beyond the former plume boundary. Phase III groundwater monitoring in May 2010 suggests that TCE concentrations north of the site have decreased to concentrations below MCLs.
Long-Term Monitoring	Long-term monitoring is being implemented in accordance with the *Phase III Groundwater Monitoring Work Plan (Revision 2).*

Table 7-1
Summary of Findings: Question A

Institutional Controls	The 2007 ESD requires institutional controls to be implemented to prevent use of groundwater at and near the Site. The Town of North Smithfield implemented an ordinance prohibiting private well use within an area defined as the Stamina Mills Remediation District. This includes the Stamina Mills Site as well as properties within the remediation district. The ordinance requires notification to USEPA and RIDEM of modification of the ordinance (if any), as well as an annual report of the number and nature of violations of the ordinance (if any). Onsite institutional controls in the form of easements and deed restrictions were not implemented by the former property owner (Hydro-Manufacturing). USEPA is currently pursuing discussions regarding institutional controls with the current property owner, Sedona Associates, as an additional layer of institutional control. When the institutional control on the property is recorded, USEPA is seeking that the town ordinance is also recorded on the Stamina Mills property.
System Operations/O&M	
Operations	Operations at the Site have maintained system effectiveness. Effectiveness is tracked via performance data provided to USEPA and RIDEM monthly; system progress and analytical data are documented quarterly.
Cost Variances	Causes of cost variances noted since system startup have been identified and corrective measures implemented, resulting in overall improvement in system uptime and reduction in operating costs.
Opportunities for Optimization	
Opportunities	Significant review of operations occurred in 2003. Further recommendations are made in this five-year review based on the evaluation of MPE operations data from 2003 through 2009.
Early Indicators of Potential Issues	
Equipment Breakdowns	No equipment problems or other operations issues have been identified which may present a potential remedy with system operations.
Protectiveness	No operational issues have been identified that could place remedy effectiveness at risk.
Implementation of Institutional Controls and Other Measures	
Access controls	Fencing is in place along the northern perimeter of the site.
Institutional Controls	The 2007 ESD requires institutional controls to be implemented to prevent use of groundwater at and near the Site. The Town of North Smithfield implemented an ordinance prohibiting private well use within an area defined as the Stamina Mills Remediation District. This includes the Stamina Mills Site as well as properties within the remediation district. The ordinance requires notification to USEPA and RIDEM of modification of the ordinance (if any), as well as an annual report of the number and nature of violations of the ordinance (if any). This satisfies the 2007 ESD's requirement for institutional controls. Onsite institutional controls in the form of easements and deed restrictions were not implemented by the former property owner (Hydro-Manufacturing). USEPA is currently pursuing discussions regarding institutional controls with the current property owner, Sedona Associates, as an additional layer of institutional control. When the institutional control on the property is recorded, USEPA is seeking that the town ordinance is also recorded on the Stamina Mills property.
Other Actions	No other actions (e.g., removal actions) are deemed necessary, as no immediate threats have been identified at the Site.

Remedial Action Performance

Remedial actions at the Site can be divided into two categories, as shown in Table 7-2.

Table 7-2
Remedial Actions and Components

Remedial Action Type	Remedy Component
Remedy components that have been completed and do not require O&M.	Building demolition Raceway closure Septic tank closure Landfill removal Site restoration
Remedy components that are ongoing and require O&M.	SVE/MPE and VTS Systems GWE and GWTS Systems Long-term monitoring Institutional controls

Completed Elements of the Remedy

Many aspects of the Site remedy that addressed immediate hazards to human health and the environment have been completed, including removal of physical hazards such as building ruins and raceways, removal of the landfill, and Site restoration. Landfill removal actions were more comprehensive and eliminated risk more thoroughly than the original remedy contemplated by the ROD (capping and leachate collection). These elements met the intent of the ROD and achieved RAOs. No further actions regarding these elements are anticipated.

Ongoing Groundwater Remedy Components

Groundwater extraction and treatment are ongoing. The intent of the GWE and GWTS, as described in the design documents, is to reduce contaminant concentrations within the plume area to below MCLs, thus restoring the aquifer to beneficial reuse.

The ROD initially contemplated that groundwater extraction and treatment would require 10 to 15 years. The GWE/GWTS has been operational for ten years, and significant decreases in contaminant concentrations offsite have been quantified; continued operation is anticipated for the next five-year review period. Containment of contamination to within the Site's boundary (the "waste management area," defined by the ROD as the area within the Site boundary where wastes may be left in place), appears to be occurring based on decreasing contaminant concentrations in offsite wells I-12, I-37, MW-17, and the recently monitored Stage 2 wells I-20, I-24, and I-30.

In 1999, USEPA sampled groundwater in offsite residential wells still in residential, potable use; wells sampled during the 1999 event are shown in Table 7-3; well locations are shown on the RI's Site Plan No. 4, included in Appendix B. A subset of these wells was sampled again during 2005 to verify the absence of VOCs.

Table 7-3
1999 and 2005 Sampling of Active Residential Wells

Address	Well ID	Wells Sampled July 1999	Wells Sampled May 2005
School Street	A-167	X	X
School Street	A-168	X	
School Street	A-173	X	X
Maple Avenue	A-107	X	
Kirby Lane	A-76	X	
Kirby Lane	A-78	X	
Kirby Lane	A-77	X	X
Litzen Road	A-89	X	
Litzen Road	A-86	X	
Lorraine Avenue	A-96	X	
Lorraine Avenue	A-91	X	
Lorraine Avenue	Not numbered	X	
Wildwood Road	A-205	X	
Wildwood Road	A-200	X	X
Wildwood Road	A-203	X	X
Wildwood Road	A-208	X	
Roselawn Avenue	A-146	X	
Roselawn Avenue	A-139	X	
Roselawn Avenue	A-142	X	X
Roselawn Avenue	A-143	X	X

VOCs (including TCE) were not quantified in any of these wells during either sampling event, demonstrating that the TCE plume has not migrated past the original plume boundaries.

Given contaminant concentration decreases, and the continued effectiveness of the GWE system in removing contaminant mass, this five-year review concludes that the containment and groundwater treatment portions of the remedy (the extraction wells and the GWTS) are effective.

Ongoing Soil Remedy Components

The vapor extraction and treatment portion of the Site remedy has been operational since 1998. The intent of this portion of the remedy, as described in the design documents, is to reduce contaminant concentrations within onsite soil to minimize leaching to groundwater.

The vapor extraction component of the remedy includes both SVE and MPE systems. As discussed previously, remedial design activities identified significantly more contamination in low-permeability saprolite and underlying weathered bedrock zones than had originally been contemplated in the ROD. The remedial design, therefore, included an overburden/vadose zone component (SVE) and a component that addressed a deeper, seasonally saturated zone of lower air permeability (MPE). The system operated for several years with both the SVE and MPE systems exhibiting a typical decrease in vapor concentrations.

As discussed in the *2002 Annual Report*, vapor concentrations extracted by the SVE system decreased rapidly, and mass removal rates decreased from 275 lbs/year in 1998 to between 40 and 50 lbs/year in 2001 and 2002. SVE system operations were suspended in 2003, due to low vapor concentrations and removal rates. Aqueous and vapor concentrations in the MPE area, however, remained elevated. The *2002 Annual Report* discussed Site operations in terms of USEPA's guidance document *Development of Recommendations and Methods to Support Assessment of Soil Venting Performance and Closure* (EPA/600/R-01/070), including the consideration of three distinct soil zones in support of SVE closure assessment:

- Zone 1 — consistently unsaturated media. At the Site, this zone is typically 0 to 15 feet bgs (i.e., between ground surface and an elevation of 195 feet above mean sea level [amsl]), and is addressed by the SVE system.

- Zone 2 — periodically unsaturated or saturated media associated with water table fluctuations. At the Site, this zone is 10 to 16 feet bgs (i.e., between an elevation of 194 and 200 feet amsl), and is addressed by both SVE and MPE wells.

- Zone 3 — saturated media. At the Site, this zone includes saprolite typically deeper than 16 to 18 feet bgs (192 to 194 feet amsl).

Figures 7-1 and 7-2 (found in Appendix A) show cross sections along the north and south MPE manifolds, respectively, defining Zones 1 through 3. SVE wells are not shown on these figures.

The closure guidance indicates that high contaminant concentrations in Zone 3 could re-contaminate Zone 2 through seasonal water table fluctuations and Zone 1 through vapor diffusion. Where this occurs, the guidance document indicates that less aggressive venting is appropriate, as re-contamination could be seasonal. Rather, the closure guidance suggests actions that address aqueous phase contamination and water table control, so that SVE systems are not operated to achieve excessively low cleanup criteria in the presence of a long-term Zone 3 source. Under this scenario, Zone 1 soil is determined to be "in compliance" when mass flux is primarily from groundwater upward to the vadose zone.

This approach, which supplants the concept of achieving a cleanup goal in the vadose zone as originally contemplated by the ROD, is directly applicable to the Site. As a result of recommendations made in the *2002 Annual Report*, system operations were reconfigured to concentrate mass removal on Zone 2 and Zone 3 soil:

- Operations in Zone 1 soil (e.g., the SVE system) were suspended.
- The MPE drop tube system was employed to improve dewatering but still allow vapor extraction during low water table conditions.
- Drop tubes were lowered systematically until dewatering was occurring within the screened interval of the MPE wells, within Zone 3 and typically 17 to 23 feet bgs, comparable to the primary TCE-contaminated fractures identified in MW-10 and SMW.
- Vapor concentrations in Zone 1 were monitored in SVE wells four times per operating season, to determine if vapor diffusion back into the overburden was occurring.

Operations since 2003 implemented recommendations as outlined in the closure guidance, and no rebound in vapor concentrations was observed in SVE wells.[7] This suggested that the highly permeable overburden soil was not accumulating vapor from the saprolite zone. While no overburden soil sampling was performed to confirm this, evaluations conducted in 2003 concluded that sampling was not necessary until additional mass removal occurred from the saprolite zone. Vapor data suggest that the remedy has complied with this portion of the RAO.

Continuous optimization of the MPE system from 2003 through 2009 has resulted in additional mass removal from Zone 3, but aqueous phase data collected annually prior to startup (March/April data) continues to indicate the presence of residual TCE mass. The highest concentrations, noted in PS-06 and S-03, are in wells which penetrate into weathered bedrock to elevations of approximately 185 feet msl, roughly the same elevation of the DNAPL-laden fracture in MW-10. These data suggest the residual contamination is likely collocated with shallow bedrock and/or relict saprolite fracture features similar to those noted in MW-10 during predesign.

[7] Overburden vapor monitoring frequencies were decreased to twice per year in 2008, given the lack of rebound

An evaluation of MPE operations data from 2003 through 2009 indicates that the system generally dewaters the TCE spill area 2 to 4 feet during the operating season, based on a comparison of beginning- and end-of-season water levels as displayed in Table 7-4. Maximum localized water table depression, inferred from drop tube depths, is generally between 2 and 6 feet, as shown in Table 7-5. With the exception of a few well locations, the drop tubes depress the water table to the top of the screened interval, but cannot expose a significant portion of the screen due to groundwater yield.[8] As displayed in Table 7-5, MPE system is unable to consistently depress the water table below the saprolite-bedrock interface, suggesting that further remediation of highly contaminated zones (e.g., PS-06 and S-03) using the MPE system is likely inefficient.

The SVE and MPE systems have successfully removed mass from the TCE spill area, to the point where today, mass flux through continued operation is very low (and is likely diffusion limited). Contaminants are expected to continue to diffuse from residual DNAPL and out of the saprolite/weathered bedrock matrix over the long term. Even with continued operation and optimization of the MPE system, this zone has only contributed 19% of the total mass removed since 2003, while it has required significant labor hours to effectively operate the system.[9] Continued operation of the MPE system is not expected to shorten the operational life of the GWE/GWTS, given the residual mass (and potential DNAPL) present in the saprolite/weathered bedrock in the TCE spill area. The shallow portion of the GWE system (MW10 and SWM) is expected to contain the contaminants within the saprolite/weathered bedrock zone, as it is designed to act on some of the same subsurface volumes (approximately 25 to 50 feet bgs).

The long-term containment of saturated-zone residual mass in the former TCE spill area will be more effectively managed via aqueous phase controls currently in place (the GWE pumping system). This management option is consistent with the original ROD and the Containment Boundary, which recognized contamination will remain in place within the spill area. This five year review will therefore recommend the following operational modifications to the system:

- Temporarily suspend MPE operations at the end of the 2010 operating season for evaluation of long-term shutdown of all vapor-phase removal systems

[8] 2003 assessment data indicated that groundwater yields in MPE wells are variable, ranging from 0.1 gpm to potentially more than 3 gpm based on short-term specific capacity testing. Because these wells intersect saprolitic fractures, flow is erratic based on pumping configuration, hydraulic head, etc. Extraction flow of pneumatic pumps from 1998 through 2002 was compromised by heavy siltation and iron fouling. Drop tube flow rates are insufficient to suppress the water table during high water level periods. Moreover, depth limitations on drop tube technology are approximately 20 to 25 feet bgs.

[9] Including pre-startup sampling, manifold maintenance, drop-tube adjustments, sediment-related alarm calls, etc., and additional spring/winter startup/shutdown.

Table 7-4
Historical Groundwater Elevations

MPE Well ID	Screened Interval (ft bgs)	Screen Length (ft)	Top of Saprolite (ft)*	Top of Bedrock (ft)*	4/19/2004 DTW (ft)	4/18/2005 DTW (ft)	3/27/2006 DTW (ft)	11/6/2006 DTW (ft)	3/27/2007 DTW (ft)	10/25/2007 DTW (ft)	4/3/2008 DTW (ft)	10/21/2008 DTW (ft)	3/16/2009 DTW (ft)	11/16/2009 DTW (ft)	3/24/2010 DTW (ft)
PS-1	12.5-21	8.5	11.40	17.40	11.34	13.04	14.05	13.5	12.25	13.85	13.18	13.95	12.81	12.88	10.82
PS-2	16-25	9	16.40	20.40	10.82	12	12.86	12.35	11.39	12.61	12.22	12.67	12.06	11.94	10.51
PS-4	12-20	8	15.40	18.40	10.77	13.33	15.8	14.26	12.51	15.32	13.06	14.23	12.2	13.02	10.51
PS-24	20-25	5	20.40	21.40	14.75	15.89	19.11	17.05	16.21	17.78	15.96	16.68	15.32	16.56	14.5
PS-6	17.5-25	7.5	18.90	23.40	14.38	16.16	19.53	18.4	16.32	18.7	15.47	17.62	14.76	16.89	13.6
PS-5	12.5-22	9.5	12.40	20.40	12.6	15.76	18.48	18.01	14.73	18.11	14.53	17.41	13.44	15.61	10.86
PS-13	20-24	4	20.50	21.50	13.59	15.82	19.4	18.55	15.82	18.93	14.78	17.38	14.15	16.65	12.9
PS-12	17.5-21	3.5	18.75	21.75	13.57	15.89	19.49	20.23	15.84	19.36	14.84	17.62	14	16.85	12.44
PS-11	15.5-22	6.5	15.40	18.40	13.27	15.69	**18.6**	18.36	15.77	**18.48**	14.72	17.43	13.76	16.31	12.02
PS-16	14.5-20	5.5	13.60	18.60	13.88	16.22	14.81	**19.74**	16.17	**19.27**	15.16	18.01	14.32	17.2	12.72
PS-15	20.5-28	7.5	19.25	28.25	13.91	15.09	18.55	17.48	15.92	16.75	15.08	16.29	14.43	15.93	13.36
PS-8	19.5-25	5.5	19.40	22.40	14.28	15.83	19.58	18.37	16.38	19.06	15.55	17.07	14.95	16.69	14.74
PS-9	20-25	5	19.65	22.65	13.72	15.74	19.27	18.21	15.78	18.54	14.95	16.23	14.15	16.5	13.15
PS-21	19.5-23	3.5	19.60	20.60	13.3	15.41	18.99	18	15.46	18.51	14.59	16.79	13.83	16.29	12.63
PS-17	18-22	4	18.46	21.46	13.46	15.66	19.23	18.39	15.68	18.52	14.64	16.92	13.99	16.52	12.64
PS-18	20.5-24	3.5	21.40	23.40	13.64	15.88	19.13	7	15.52	19.03	14.53	16.53	13.83	16.49	12.04
S-10	13.5-18	4.5	13.13	15.13	8.52	10.75	14.44	15.04	10.81	**15.74**	9.87	12.61	9.03	11.95	7.35
S-8	11.5-16.5	5	11.40	15.40	9.33	10.92	14.14	12.62	11.18	**dry**	10.28	12.44	9.66	12.05	8.16
S-6	10.5-15	4.5	10.40	14.40	11.54	12.41	14.29	13.53	12.42	**dry**	12.26	13.49	11.99	13.12	10.45
S-3	15-19	4	14.50	16.50	14.07	14.28	15.06	13.96	14.08	**18.38**	14.1	14.26	14.25	14.13	12.56
S-9	10.5-14	3.5	10.40	13.40	10.34	12.15	**14.53**	**13.94**	11.85	**dry**	10.8	**13.74**	NM	**13.49**	8.67
S-2	15-19	4	11.10	18.10	13.43	14.24	15.64	7.21	13.86	16.68	13.48	14.01	13.29	13.9	11.91
S-4/O-17	2.5-7	4.5	10.40	14.40	11.76	**dry**	12.13	**dry**	**dry**	**dry**	**dry**	12.14	11.84	**dry**	10.86
S-5	11.5-15	3.5	9.40	16.90	13.66	14.02	14.65	14.33	13.84	15.03	13.95	14.33	13.8	14.08	11.7
S-7	9.5-17	7.5	10.40	15.40	10.2	11.29	13.63	13.16	11.33	14.86	10.53	12.6	15.03	12.24	9.44
PS-14	18.5-24	5.5	18.90	23.40	12.65	14.85	18.21	17.88	14.68	18.24	13.77	16.14	12.77	15.71	11.35
PS-23	18-21	3	NA	NA	14.78	14.87	17.41	16.04	14.97	15.76	16.09	15.85	15.23	15.15	14.62
PS-22	18.5-25	6.5	19.40	24.40	15.25	15.25	17.8	16.42	15.32	16.15	16.62	16.49	15.62	15.42	14.88
PS-7	18.5-26	7.5	18.40	23.40	14.88	16.47	19.26	18.4	16.62	18.49	15.55	17.73	10.39	17	13.97
PS-10	16-22	6	15.40	18.40	13.24	15.25	17.7	16.69	14.84	17.47	14.34	17.01	13.42	15.19	11.66
PS-3	11.5-18	6.5	11.40	17.40	11.17	12.96	14.34	13.51	11.78	14	12.61	14.68	11.84	12.57	10.15
O-8D**	11.5-17.5	6	19.40	23.40	13.49	15.72	18.73	18.53	15.24	18.88	14.29	16.91	13.39	15.39	12.09
O-10D	11-16	5	NA	NA	11.19	13.36	16.56	16.42	13.02	16.71	12.09	14.7	11.7	13.79	9.82
O-13D***	11.5-16	4.5	16.90	17.40	9.52	11.71	14.96	15.1	11.35	15.65	10.43	13.06	9.5	12.12	8.12

Notes:

Ft — feet
Bgs — below ground surface
BOLD — water level has dropped below saprolite-bedrock interface
* — depths include riser elevations
** — soil boring for O-8D stops at 22 ft bgs with no indication of bedrock, assumed bedrock starting at 22 feet bgs
*** — soil boring for O-13D stops at 16 ft bgs with no indication of bedrock, assumed bedrock starting at 16 feet bgs

Table 7-5
Historical MPE Drop Tube Depth

MPE Well ID	Screened Interval (ft bgs)	Screen Length (ft)	Top of Saprolite (ft)*	Top of Bedrock (ft)*	5/13/2004 (ft bgs)	5/14/2004 (ft bgs)	5/17/2004 (ft bgs)	5/19/2004 (ft bgs)	5/25/2004 (ft bgs)	5/27/2004 (ft bgs)	6/7/2004 (ft bgs)	8/2/2004 (ft bgs)	5/13/2005 (ft bgs)	5/3/2006 (ft bgs)	7/31/2006 (ft bgs)	8/28/2006 (ft bgs)	9/13/2006 (ft bgs)
PS-1	12.5-21	8.5	11.40	17.40													
PS-2	16-25	9	16.40	20.40													
PS-4	12-20	8	15.40	18.40	13.8	13.8	13.8	13.8	13.8	**19.8**	**19.8**	17					
PS-24	20-25	5	20.40	21.40	17.1	17.1	17.1	17.1	19.1	19.1	19.1	**22**	**24.5**	19.1	19.1	15.7	15.7
PS-6	17.5-25	7.5	18.90	23.40	17.3	17.3	17.3	18.3	19.3	19.3	19.3	22	**25**				
PS-5	12.5-22	9.5	12.40	20.40													
PS-13	20-24	4	20.50	21.50	16.5	16.5	16.5	18.5	18.5	18.5	18.5	21	**27**	19.9	19.9	19.2	19.2
PS-12	17.5-21	3.5	18.75	21.75									20.5	20	20	19.4	19.4
PS-11	15.5-22	6.5	15.40	18.40													
PS-16	14.5-20	5.5	13.60	18.60									**19.5**	**20.5**	**20.5**	**19.7**	**19.7**
PS-15	20.5-28	7.5	19.25	28.25	16.3	16.3	16.3	16.3	18.3	18.3	18.3	23.5					
PS-8	19.5-25	5.5	19.40	22.40	17.1	17.1	17.1	17.1	19.1	19.1	19.1	22					
PS-9	20-25	5	19.65	22.65	16.5	16.5	16.5	17.5	17.5	17.5	17.5	21	21				
PS-21	19.5-23	3.5	19.60	20.60	16.1	16.1	16.1	17.1	19.1	19.1	19.1	20	**21.5**	19.4	19.4	19.4	19.4
PS-17	18-22	4	18.46	21.46	16.3	16.3	16.3	16.3	16.3	16.3	16.3	19	**21.5**	19.7	19.7	19.1	19.1
PS-18	20.5-24	3.5	21.40	23.40									23	19.6	19.6	18.7	18.7
S-10	13.5-18	4.5	13.13	15.13										15	15	15	15
S-8	11.5-16.5	5	11.40	15.40										15.1	15.1	14.2	14.2
S-6	10.5-15	4.5	10.40	14.40	13.3	13.3	13.3	**14.8**	**14.9**	**14.9**	**14.9**	**14.5**					
S-3	15-19	4	14.50	16.50									**17.5**	15.5	15.5	12.9	12.9
S-9	10.5-14	3.5	10.40	13.40													
S-2	15-19	4	11.10	18.10										15.5	15.5	15.5	15.5
S-4/O-17	2.5-7	4.5	10.40	14.40													

Table 7-5 (continued)
Historical MPE Drop Tube Depth

MPE Well ID	Screened Interval (ft bgs)	Screen Length (ft)	Top of Saprolite (ft)*	Top of Bedrock (ft)*	4/24/2007 (ft bgs)	8/27/2007 (ft bgs)	9/21/2007 (ft bgs)	5/6/2008 (ft bgs)	6/2/2008 (ft bgs)	7/28/2008 (ft bgs)	8/26/2008 (ft bgs)	9/22/2008 (ft bgs)	10/21/2008 (ft bgs)	3/24/2009 (ft bgs)	5/18/2009 (ft bgs)	6/29/2009 (ft bgs)	8/26/2009 (ft bgs)
PS-1	12.5-21	8.5	11.40	17.40													
PS-2	16-25	9	16.40	20.40													
PS-4	12-20	8	15.40	18.40				14	14.6	16.5	15.72	15.42	15.6	13.8			
PS-24	20-25	5	20.40	21.40				17	17.3	18.2	19.03	18.4	17.3	16.9	18.05	18.39	18.75
PS-6	17.5-25	7.5	18.90	23.40				17.5	16.4	19.5	19.4	18.9	18.6	16.8	16.51	19.56	19.5
PS-5	12.5-22	9.5	12.40	20.40										15.5			
PS-13	20-24	4	20.50	21.50	14.4	18.46	20.45	15.75	15.8	19.4	19.99	19.5	18.4	16.2	18.76	19.73	19.3
PS-12	17.5-21	3.5	18.75	21.75	14.3	18.49	20.85	15.7	15.7	19.7	20.08	19.7	18.6	16.2	19.07	19.88	19.3
PS-11	15.5-22	6.5	15.40	18.40				15.4	16	**19.1**	**18.91**	**18.9**	18.4	16.1			
PS-16	14.5-20	5.5	13.60	18.60	14.6	**18.78**	**18.78**	16	16.1	**19.5**	**20.1**	**20**	**19**	16.5			
PS-15	20.5-28	7.5	19.25	28.25	15.2	18.3	19										
PS-8	19.5-25	5.5	19.40	22.40				16.5	16.5	19.5	19.88	18.8	18	18	18.04	18.41	18.73
PS-9	20-25	5	19.65	22.65	14.6	18.45	20	15.9	16.9	19.2	19.74	19	17.9	16.2	18.37	18.96	19.23
PS-21	19.5-23	3.5	19.60	20.60	14.2	18.13	19.79	15.5	15.5	19.1	19.78	19.2	17.8	15.9	18.78	19.34	19.1
PS-17	18-22	4	18.46	21.46	14.2	18.26	20.21	15.6	16.5	19.4	20.05	19.6	17.9	16.1	18.85	19.76	19.4
PS-18	20.5-24	3.5	21.40	23.40				15.4	15.4	19.4	20.04	19.6	17.5	16.1			
S-10	13.5-18	4.5	13.13	15.13	9.3	13.35	**16.01**								14.35	**15.95**	14
S-8	11.5-16.5	5	11.40	15.40													
S-6	10.5-15	4.5	10.40	14.40													
S-3	15-19	4	14.50	16.50	14.8	15.35	15.6	15.1	15.1	15.3	15.13	15.44	15.2	15.1	14.48	13.4	15.5
S-9	10.5-14	3.5	10.40	13.40													
S-2	15-19	4	11.10	18.10	13.8	15.47	14.85										
S-4/O-17	2.5-7	4.5	10.40	14.40													

Table 7-5 (continued)
Historical MPE Drop Tube Depth

MPE Well ID	Screened Interval (ft bgs)	Screen Length (ft)	Top of Saprolite (ft)*	Top of Bedrock (ft)*	9/11/2009 (ft bgs)	9/21/2009 (ft bgs)	10/5/2009 (ft bgs)	10/19/2009 (ft bgs)	11/2/2009 (ft bgs)	5/6/2010 (ft bgs)
PS-1	12.5-21	8.5	11.40	17.40						
PS-2	16-25	9	16.40	20.40						
PS-4	12-20	8	15.40	18.40						14.96
PS-24	20-25	5	20.40	21.40	18.75	19.22	19.4	17.8	17.57	
PS-6	17.5-25	7.5	18.90	23.40	20.3	19.66	19.86	18.1	17.76	17.68
PS-5	12.5-22	9.5	12.40	20.40						17.18
PS-13	20-24	4	20.50	21.50	19.3	19.96	20.64	17.9	17.6	17.07
PS-12	17.5-21	3.5	18.75	21.75	19.6	20.27	21.46	18	17.25	17.16
PS-11	15.5-22	6.5	15.40	18.40						17.41
PS-16	14.5-20	5.5	13.60	18.60						
PS-15	20.5-28	7.5	19.25	28.25						
PS-8	19.5-25	5.5	19.40	22.40	19.21	19.6	19.96	18.2	17.9	17.5
PS-9	20-25	5	19.65	22.65	20.2	20.2	20	17.8	17.3	17.07
PS-21	19.5-23	3.5	19.60	20.60	20.5	19.61	20.48	16.5	17.24	
PS-17	18-22	4	18.46	21.46	19.9	19.99	21	16.8	17.46	16.95
PS-18	20.5-24	3.5	21.40	23.40						
S-10	13.5-18	4.5	13.13	15.13	**15.5**	**15.54**	**15.75**	13.5	12.69	
S-8	11.5-16.5	5	11.40	15.40						
S-6	10.5-15	4.5	10.40	14.40						
S-3	15-19	4	14.50	16.50	**17.4**	16	16	16	15.22	15.22
S-9	10.5-14	3.5	10.40	13.40						
S-2	15-19	4	11.10	18.10						
S-4/O-17	2.5-7	4.5	10.40	14.40						

Notes:
ft — feet
bgs — below ground surface
BOLD — drop tube depth has dropped below saprolite-bedrock interface
* — depths included riser elevations

- Integrate a monitoring program to assess vadose zone and saprolite/shallow bedrock conditions during the interim shutdown

- Evaluate GWTS operations/controls to determine whether modifications are required over the long term to remove SVE/MPE inputs/alarms/conditions

- Monitor SMW and MW-10 influent to gauge changes in flow and/or miss loading based on cessation of MPE system operation

- Evaluate mass contributions and air emissions control requirements to determine whether continued operation of the VTS is required

While the original design was altered with the MPE system modifications, the remedy's intent of protection of groundwater was met and the SVE/MPE systems were effective. The ROD required that soil above the water table comply with the ROD goal of 195 µg/kg TCE; however, current operations target saprolite zones beneath the water table that are not included in the ROD goal. As recommended above, MPE mass removal efforts have been successful and have met the intent of the remedial design. Continued operation of the MPE system will not achieve further significant mass reductions from the saprolite/weathered bedrock matrix. Continued operation of the GWE, however, will maintain remedy protectiveness.

Kayser-Roth will proceed with operational recommendations made in this five-year review. Results will be presented back to USEPA and RIDEM in routine monthly, quarterly, and annual reports, as required.

Long-Term Monitoring

Long-term monitoring, as described in the *Phase III Groundwater Monitoring Work Plan (Revision 2)*, is ongoing. The protocol devised and implemented in this work plan provides for various stages of groundwater monitoring so that additional wells can be integrated into the program as plume conditions improve. This monitoring program clearly identifies its objectives as:

- Monitoring the progress toward achieving groundwater cleanup standards as established in the ROD

- Determining when to initiate Phase II groundwater extraction activities (e.g., deep zone pumping in MW-10) onsite

The monitoring wells selected for Stage 1 monitoring offsite (A-175, I-12, I-37, and MW-17) were selected to monitor conditions along the north and west edges of the contaminant plume. Supplemental monitoring wells selected for Stage 2 monitoring offsite incorporate those residential wells closer to the TCE spill area. The protocol requires that Stage 2 wells be added to the program once cleanup standards are achieved at Stage 1 offsite wells.

Conditions onsite are monitored in MW-10, SMW, B-3, and MW-2. Groundwater concentrations in these wells fluctuate approximately an order of magnitude periodically, and have declined over time. Concentrations onsite still range generally from less than 500 µg/L to more than 1,000 µg/L, suggesting that residual source material is still present within the shallow bedrock aquifer. Once sustained decreases in these zones are observed, initiation of Phase II groundwater extraction activities will be evaluated.

The long-term monitoring program has been effective in tracking groundwater concentrations.

Institutional Controls

The ROD initially contemplated institutional controls only to prevent disturbance of the physical integrity of the remedy's components (i.e., controls prohibiting disturbance of the landfill cap). All institutional controls must be coordinated with the property's current owner, Sedona Associates.

Initial remedial actions performed in the 1980s focused on providing potable water to residents north of the Site who had been adversely impacted by the TCE plume. Since the 2005 Five-Year Review, the Town of North Smithfield has implemented an ordinance prohibiting private well use within an area defined as the Stamina Mills Remediation District. The ordinance requires notification to USEPA and RIDEM of modification of the ordinance (if any), as well as an annual report of the number and nature of violations of the ordinance (if any). USEPA is seeking that the town ordinance is also recorded on the Stamina Mills property as an added layer of control.

The North Smithfield Remediation District ordinance is effective at prohibiting offsite groundwater use.

System Operations/O&M

Operating procedures currently include the following elements:

- Routine system checks/inspections once every two weeks
- Alarm response checks

- GWTS effluent sampling in accordance with the sewer discharge permit monthly
- GWE influent sampling quarterly
- VTS influent and effluent sampling semi-annually
- Phase III groundwater monitoring every 9 months
- MPE groundwater sample collection annually (in April prior to MPE startup)
- MPE vapor sample collection in April and October
- SVE vapor sample collection in April and October

System procedures require the O&M subcontractor to conduct routine Site visits (documented on appropriate Site forms), which are submitted to the Performing Party's supervising contractor, EnSafe. Site operations are reviewed by the subcontractor and EnSafe personnel at least monthly, and operational data are submitted to USEPA and RIDEM monthly to document alarm conditions and hours of operation. The review and reporting cycle requires frequent review of system operations, and allows the subcontractor and EnSafe to anticipate and schedule maintenance activities appropriately to minimize system downtime.

Maintenance of the system can occur as unplanned or planned maintenance activities. Unplanned maintenance activities are typically short-duration (1- to 2-day events) required to respond to an alarm call. Longer duration unplanned events occur when diagnostics, troubleshooting, and equipment replacement are required. When they occur, longer-term shutdown events are also used to perform preventive maintenance tasks which otherwise would have required a scheduled shutdown of the system.

Causes of cost variances noted since system startup have been identified and corrective measures implemented, resulting in overall improvement in system uptime and reduction in operating costs. Primary variances in O&M costs are associated with larger capital expenditures (e.g., equipment replacement and associated labor costs), such as may be required with a component repair/replacement. The annual O&M budget includes routine maintenance activities, as well as limited scope for minor alarm response. Maintenance activities are discussed real-time (as alarm conditions occur) as well as projected quarterly and annually during the budget development process.

Opportunities for Optimization

Extensive optimization of the vapor treatment system occurred in 2003, and annual review of MPE data is required prior to selecting which MPE wells will be operated each season. A review of MPE data, described above, suggests that continued operation of the MPE system will not achieve significant reductions in mass from the two wells exhibiting maximum concentrations

(PS-06 and S-03), as they appear to be screened in weathered bedrock zones. The GWE/GWTS provides equal protectiveness of the aquifer through ongoing containment of shallow bedrock contamination. In this case, shutdown of the MPE system and continued operation of the GWE system is the most efficient operational approach for the site. Required site optimization activities to be implemented in 2011 include:

- Temporarily suspend MPE operations at the end of the 2010 operating season for evaluation of long-term shutdown of all vapor-phase removal systems
- Integrate a monitoring program to assess vadose zone and saprolite/shallow bedrock conditions during the interim shutdown
- Evaluate GWTS operations/controls to determine whether modifications are required over the long term to remove SVE/MPE inputs/alarms/conditions
- Monitor SMW and MW-10 influent to gauge changes in flow and/or mass loading based on cessation of MPE system operation
- Evaluate mass contributions and air emissions control requirements to determine whether continued operation of the VTS is required

While some short-term costs will be incurred during the recommended 2011 MPE shutdown/decommissioning process, long term O&M costs will be reduced, as labor requirements for operating the MPE system (including pre-startup sampling, manifold maintenance, drop-tube adjustments, sediment-related alarm calls, etc.) and associated MPE impacts on the GWTS (e.g., increases in bag filter alarms, contributions to flow imbalances) will be eliminated. Estimated cost reductions may be on the order of $40,000 to $50,000 per year. Removal of SVE/MPE piping will also facilitate property redevelopment options, opening up the TCE spill area for re-use.[10]

Operation of the GWE and GWTS has not been modified since startup, as the containment system is integral to the Site remedy. Optimization has been applied to monitoring and reporting procedures, minimizing sampling where possible and consolidating reporting of GWE system data quarterly instead of monthly. The *2004 Annual Summary Report* proposed review of the SMW extraction well to determine whether operations in this well can be suspended, or whether its operation is critical to mass removal activities in the saprolite/shallow bedrock zone.

[10] GWE piping is below grade.

Concentration data suggest mass removal effectiveness from this well is decreasing, but its benefits with respect to hydraulic control may be significant. Review of system operations will continue, particularly in light of MPE shutdown.

No opportunities for optimization are apparent with respect to long-term groundwater monitoring procedures.

Early Indicators of Potential Issues

Review of Site data occurs frequently during normal operations. Data do not suggest potential issues with respect to remedy effectiveness.

Implementation of Institutional Controls and Other Measures

Access to the Stamina Mills Site is restricted by a chain-link fence around the majority of the property perimeter; the Site's status as a hazardous waste Site is indicated on a sign on the front gate. The property is accessible along the Branch River both along Forestdale Pond and downstream near the U.S. Geological Survey gauging station and there is anecdotal evidence of fishing along the waterbody. Access is not anticipated to be a concern, as there is no surface expression of contaminants; aboveground components of the treatment system have not been tampered with.

Groundwater use both on- and offsite is prohibited by North Smithfield Ordinance 8-81, the Stamina Mills Remediation Area ordinance. The ordinance requires annual notification of USEPA and RIDEM of any violations. There have not been any violations of the ordinance since its passage.

No institutional controls besides the town ordinance have been implemented for the Stamina Mills property as of this writing. However, the property was purchased at auction in August 2005, and USEPA is working with the new property owner (Sedona Associates) regarding adding the ordinance to site-specific institutional controls as an added layer of institutional controls.

Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

No: This section reevaluates the risk-based assumptions developed for the Stamina Mills Site in accordance with the USEPA's *Comprehensive Five-Year Review Guidance*. Findings are summarized in Table 7-6, and discussed in more detail in subsequent sections.

Table 7-6
Summary of Findings: Question B

Changes in Standards and To Be Considered (TBC) Criteria	
Revisions to Standards	Cleanup standards are based on MCLs. No revisions to primary contaminants (TCE and its degradation products) have occurred. Revisions have occurred for chromium and dieldrin since ROD issuance, but monitoring had been discontinued for both compounds in 2000 because concentrations had remained below ROD goals during the Phase II monitoring program. Dieldrin concentrations, at the time sampling was terminated, ranged from non-detect to maximum concentrations of 0.3 µg/L. These concentrations are still within the range of promulgated dieldrin advisories. Chromium standards have been revised upwards to an MCL of 100 µg/L; all concentrations during Phase II sampling were less than 50 µg/L.
Newly Promulgated Standards	No new standards have been promulgated.
Changes in TBCs	No changes in TBCs have impacted site RGs.
Changes in Exposure Pathways	
Land-Use	No land-use changes have occurred; the site is adjacent to residential and light commercial properties.
New Exposure Pathways	In 2002, USEPA issued guidance regarding migration of volatile organics such as TCE in the vapor phase. The original ROD did not contemplate vapor migration as an exposure pathway. The *Soil Vapor Assessment,* completed as an action item from the 2005 five-year review, has demonstrated that soil vapor does not pose risks to the residential neighborhoods surrounding the Stamina Mills Site.
New Contaminants	No new or additional sources of VOC contamination have been identified. USEPA has inquired whether the solvent stabilizer 1,4-dioxane was used onsite. Typically used in 1,1,1-trichloroethane, not TCE, 1,4-dioxane is unlikely to have been present onsite. 1,4-dioxane is reviewed in more detail below.
Unanticipated Toxic Byproducts	No unanticipated toxic byproducts have been identified at the site.
Changes at the Site	No changes have occurred at the site that could alter the protectiveness of the site remedy.
Changes in Toxicity and Other Contaminant Characteristics	
Toxicity Factors	TCE toxicity data are currently being evaluated by USEPA and various state agencies. Revisions to TCE's toxicological profile are not complete, but were reviewed during the *Soil Vapor Assessment*. However, the TCE MCL remains the same; the Site remedy is based on MCL compliance.
Contaminant Characteristic Changes	USEPA guidance for TCE (which now assesses vapor migration) was assessed in the *Soil Vapor Assessment.*
Changes in Risk Assessment Methods	
Methodology Changes	No major changes in risk assessment methods, aside from consideration of vapor intrusion, have occurred since ROD issuance.
Expected Progress Toward Meeting RAOs	
Groundwater Restoration	Groundwater containment activities have resulted in contraction of the TCE plume toward the Site's Compliance Boundary. The plume will be monitored as outlined in the *Phase III Groundwater Monitoring Work Plan (Revision 2)*.
Direct Contact	The remedy has eliminated potential for the public to come into direct contact with contaminated soil and sediment. Solid wastes have been removed from the site.

Table 7-6
Summary of Findings: Question B

Contaminant Migration	The soil remedy and cleanup goals were reviewed in 2002 and 2003, and have been modified to maximize source removal and minimize contaminant migration into groundwater. An evaluation of MPE efforts during the 2003 through 2009 period suggests that, though mass removal has continued, the bulk of residual mass remains in saturated saprolite or shallow fractured bedrock. This document recommends suspending MPE operations with monitoring for rebound and continuing saprolite/weathered bedrock containment with the GWE system.
Migration to Surface Water	Source area wastes contaminating surface water were removed in conjunction with landfill removal actions and sealing of raceways.
Physical Hazards	Physical hazards were removed from the site during the early 1990s.

Evaluation of Standards and To Be Considered Criteria

Cleanup criteria for the Site, and the basis for these criteria, are shown in Table 7-7.

Table 7-7
Cleanup Levels — Stamina Mills Site

Matrix	Contaminant	1990 Goal	1990 Basis	2005 Goals	2005 Basis	2010 Goals	2010 Basis
Groundwater	TCE	5 µg/L	MCL	5 µg/L	MCL	5 µg/L	MCL
	PCE	5 µg/L	MCL[1]	5 µg/L	MCL	5 µg/L	MCL
	1,1-DCE	7 µg/L	MCL	7 µg/L	MCL	7 µg/L	MCL
	Vinyl Chloride	2 µg/L	MCL	2 µg/L	MCL	2 µg/L	MCL
	1,2-DCE	70 µg/L	MCL[1]	70 µg/L	MCL	70 µg/L	MCL
	Dieldrin	2 µg/L	Health Advisory	Variable [2]		Variable [2]	
	Chromium	50 µg/L	National Interim Primary Drinking Water Regulation	100 µg/L	MCL	100 µg/L	MCL
Soil	TCE	195 µg/kg	Summers Model — based on MCL	No change based on MCL		No change based on MCL	
	PCE	66 µg/kg	Summers Model — based on MCL*	No change based on MCL		No change based on MCL	
	1,1-DCE	17 µg/kg	Summers Model — based on MCL	No change based on MCL		No change based on MCL	
	1,2-DCE	151 µg/kg	Summers Model — based on MCL*	No change based on MCL		No change based on MCL	

Notes:
Taken from Superfund Record of Decision, Stamina Mills, RI, First Remedial Action — Final, (USEPA, 1990)
MCL — Maximum contaminant level
µg/L — micrograms per liter
µg/kg — micrograms per kilogram
[1] — At the time of listing, this MCL was proposed, not final
[2] — See text below for more detail on dieldrin remediation goals

Groundwater Standards

The groundwater remedy at the Site focuses on VOCs by implementing extraction and treatment (i.e., air stripping/aeration) system to remove volatiles from groundwater. The groundwater cleanup goals for this remedy are the MCL for each specific VOC. VOC goals established in 1990 are still consistent with promulgated MCLs in 2010.

Chromium and dieldrin were also listed in the cleanup goals for groundwater, as they were detected onsite. Dieldrin and chromium were associated with the fabric wastes in the landfill, which was removed in 1998/1999. These constituents were detected in landfill seeps and in groundwater, primarily beneath the landfill; the ROD associated contamination with vertical migration of landfill leachate. Because the landfill has been removed, the source for these constituents is no longer present onsite.

Sampling for dieldrin and chromium was terminated at the end of Phase II groundwater monitoring in 2000; rationale for changing the monitoring protocol for the Phase III monitoring program was documented in the *Phase III Groundwater Monitoring Work Plan*. Table 7-8 presents excerpts of this rationale specific to dieldrin and chromium.

- During the entire Phase II monitoring period, dieldrin detections did not exceed the 2 µg/L ROD goal. As noted in the Table 7-8, the maximum detections were only on the order of 0.2 to 0.3 ug/L. Dieldrin's health advisories were withdrawn by USEPA in 1997, and current cleanup goals for dieldrin vary from state to state, ranging from 0.002 to 2 µg/L. Concentrations generally ranged from below detection limits (0.1 µg/L) up to infrequent detections up to 0.3 µg/L. The dieldren concentrations present onsite when Phase II monitoring was terminated were roughly 10% of the ROD goal and were determined to be protective of human health. With removal of the source area, it is expected that these concentrations will have attenuated further.

- Similarly, during the Phase II monitoring program, chromium concentrations were generally below the ROD goal of 50 µg/L. For the last five years of the Phase II monitoring program (1997-2001), the majority of site wells ranged from non-detect (0.5 µg/L) up to 5 µg/L, with infrequent detections above this. Chromium's final MCL was established as 100 µg/L following the issuance of the 1990 ROD. Chromium concentrations in all wells monitored for chromium during Phase I and Phase II had decreased to less than 50 µg/L by 2001, and monitoring for chromium was discontinued due to compliance with ROD goals.

Table 7-8
Summary of Phase III Groundwater Monitoring Work Plan for Onsite Wells
Dieldrin and Chromium Recommendations/Findings (Section 5)

Well	Dieldrin (ROD Goal — 2 µg/L)	Chromium (ROD Goal — 50 µg/L)
MW-2	Maximum detection 0.34 µg/L (1999)	All detections less than 50 µg/L
MW-5	Maximum detection 0.031 µg/L (1993)	All detections less than 50 µg/L
MW-15	Not detected	All detections less than 50 µg/L
SMW (26')	Maximum detection 0.24 µg/L (1994) in SMW when sampled using the 3 well volume approach; not detected in the 26' interval	All detections less than 50 µg/L
SMW (95')	Maximum detection 0.24 µg/L (1994) in SMW when sampled using the 3 well volume approach; not detected in the 95' interval	All detections less than 50 µg/L
MW-10 (26')	Maximum concentration 0.18 µg/L at 44' (2000)	All detections less than 50 µg/L
MW-10 (95')	Maximum concentration 0.1 µg/L (1997)	All detections less than 50 µg/L

Notes:
SMW — Stamina Mills Wells
ROD — Record of Decision
µg/L — microgram per liter

Modifications to the drinking water standards for dieldrin are not expected to have any impact on the Stamina Mills Site's remedy, but will be reviewed further in subsequent five-year reviews, if necessary.

Soil Standards

Migration from soil to groundwater was modeled to calculate the 1990 soil cleanup goal that would be protective of groundwater based on the MCLs for various VOCs. The soil cleanup goals have been met and therefore soil does not pose risk to groundwater from leaching.

In addition to the ROD goals, USEPA defined a soil standard of 200 µg/kg for dieldrin during landfill removal activities. Residual soil at the base of the landfill was required to exhibit concentrations less than 200 µg/kg, or it was excavated to the top of bedrock. USEPA's current Industrial Regional Screening Level (RSL) for dieldrin is 110 µg/kg, representing a 1E-06 risk threshold.[11] Use of the 200 µg/kg criterion during the landfill removal action is still considered protective of human health and the environment given the following:

- Assuming exposure assumptions used to calculate industrial PRGs are comparable to the Site's exposure scenario, even residual soil contamination at 200 µg/kg would only slightly

[11] RSL Summary Table, May 2010

exceed USEPA's baseline risk threshold of 1E-06 (1.8E-06) for an industrial exposure scenario.

- Soil within the landfill excavation area was excavated to bedrock, leaving no residual that exceeded the 200 µg/kg criterion.

- Likely exposure scenarios in the future are recreational, without prolonged exposures to contaminated soil characteristic of an industrial exposure (e.g., daily for 250 days/year, for 25 years), particularly given the limited areal extent of potential dieldrin exposures (e.g., less than half the property).

- Regrading may be required in the former landfill area to allow constructive reuse (e.g., fill to construct a level ballfield). Any residual dieldrin between the 110 µg/kg and 200 µg/kg thresholds is likely to be covered by fill material.

As a result, changes in toxicological calculations for dieldrin are not considered significant enough to make a difference in the overall protectiveness of the landfill removal remedy.

Progress Toward Meeting RAOs

The following RAOs are inherent to the Stamina Mills Site ROD:

- Restore the groundwater to federal and state drinking water standards (or criteria when drinking water standards are not available) as quickly as possible because the aquifer is a drinking water source

- Prevent the public from direct contact with contaminated soils, sediments, and solid wastes, which may present health risks

- Eliminate or minimize the migration of contaminants from the soil into the groundwater

- Prevent the offsite migration of contaminants to the surface water above levels protective of public health and the environment

- Reduce risks to human health associated with the physical hazards while implementing remedial actions at the Site

Compliance with Groundwater Restoration RAO

As described in the ROD, groundwater cleanup levels must be met at the completion of the remedial action through an area extending from the compliance boundary (the northern perimeter of the Site along School Street) north through the former TCE plume area.

The ROD notes that groundwater within the waste management area (defined as those areas of the Site where wastes will be contained in place, including former raceways, debris piles, and building structures) will not necessarily meet ROD groundwater cleanup goals. Therefore, onsite wells (MW-10, SMW, and MW-2) are evaluated only to gauge effectiveness of the overall remedy in reducing contaminant mass and minimizing impacts to the aquifer.

The *Phase III Groundwater Monitoring Work Plan (Revision 2)* established a staged protocol for monitoring on- and offsite wells, as outlined below:

- Stage 1 — Offsite wells I-12, I-37, A-175, and MW-17
- Stage 2 — All Stage 1 wells and offsite wells I-7, I-20, I-24, I-28, and I-31[12]
- Waste Management Area Wells — MW-10, SMW, B-3, and MW-2

Contaminant trends in Stage 1 wells are to be monitored until concentrations are less than the ROD cleanup standards. Once goals are achieved in these wells, monitoring will be initiated in Stage 2 wells, which are closer to the compliance boundary.

Stage 1 monitoring has been ongoing since 2001. Contaminant concentration trends in these wells (including historical data) were shown in Section VI. Concentrations in these wells have decreased significantly since initiation of remedial actions:

- In I-12, decreasing from a maximum of 170 µg/L in 1994 to a low of 1.0 µg/L in 2007.
- In I-37, decreasing from a maximum of 190 µg/L in 1993 to a low of 2.3 µg/L in 2010.
- In A-175, TCE concentrations have been below detection levels since 1993.

Select Stage 2 wells were sampled in May 2010 to augment Stage 1 data:

- In I-20, of the three intervals sampled, only one (300 to 302 feet bgs) exhibited TCE concentrations (1.6 µg/L)

[12] I-28 and I-31 are inaccessible due to paving/redevelopment activities by the property owners. Alternative well locations (e.g., I-30) have been introduced into the Stage 2 program based on historical data as supplemental locations.

- In I-24, all three intervals were non-detect for TCE at a detection limit of 0.5 µg/L

- In I-30, all three intervals were non-detect for TCE at a detection limit of 0.5 µg/L

Figure 7-3, included in Appendix A, shows a comparison of the TCE concentrations in 1993, 2004, and 2010, showing a clear retraction of the plume toward the compliance boundary. A RI figure showing 1979 TCE concentrations in offsite wells can be found in Appendix B. Continued monitoring of Stage 1 and 2 wells is likely to indicate stabilization at or near ROD clean-up goals.

Overall, the remedy, as implemented, has been successful in working toward the groundwater restoration RAO.

Compliance with Elimination of Direct Contact RAO

The remedy implemented at the Site has eliminated potential for the public to come into direct contact with contaminated soil and sediment and has removed solid wastes from the Site.

Building demolition and subsequent restoration activities removed physical hazards associated with deteriorating mill ruins and raceways, as well as the former septic system used onsite. Removal of the landfill in 1998 and 1999 eliminated the potential for contact with solid wastes and any contaminants present in landfill materials and sediments at the toe of the landfill. Other than these physical and landfill-related hazards, surface soil was not determined to be a risk to human health and the environment during the RI.

Compliance with Minimizing Contaminant Migration RAO

Soil treatment goals were developed to minimize the migration of contaminants from the soil into groundwater. As discussed in the ROD, these goals must be met throughout the contaminated soil in the TCE spill area located above the bedrock aquifer.

During remedial design the extent of the TCE spill area was found to be larger than expected, and supplemental investigations indicated that the majority of TCE mass was present at the bedrock-overburden interface. Therefore, both high (MPE) and low (SVE) vacuum elements were included in the design. As discussed previously, the *2002 Annual Report* discussed Site operations in terms of USEPA's guidance document *Development of Recommendations and Methods to Support Assessment of Soil Venting Performance and Closure* (EPA/600/R-01/070), noting that SVE closure assesses soil in three distinct zones: Zone 1 (consistently unsaturated media, typically 0 to 15 feet bgs, addressed by the SVE system); Zone 2 (periodically unsaturated or saturated media associated with water table fluctuations, generally 10 to 16 feet bgs, addressed by both SVE and MPE wells); and Zone 3 (saturated media, typically deeper than 16 to 18 feet bgs).

In 2003, system operations were reconfigured to concentrate mass removal on Zone 2 and Zone 3 soil: operations in Zone 1 soil (e.g., the SVE system) were suspended; the MPE drop tube system was employed to improve dewatering but still allow vapor extraction during low water table conditions; and drop tubes were lowered into selected MPE wells, within Zone 3 and typically 17 to 23 feet bgs, comparable to the primary TCE-contaminated fractures identified in MW-10 and SMW.

Continuous optimization of the MPE system from 2003 through 2009 has resulted in additional mass removal from Zone 3, but aqueous phase data collected annually prior to startup continues to indicate the presence of residual TCE mass. The highest concentrations, noted in PS-06 and S-03, are in wells which penetrate into weathered bedrock to elevations of approximately 185 feet msl, roughly the same elevation of the DNAPL-laden fracture in MW-10. These data suggest the residual contamination is likely collocated with shallow bedrock and/or relict saprolite fracture features similar to those noted in MW-10 during predesign.

Residual mass in Zone 3, saturated saprolite/weathered bedrock, will likely continue to diffuse TCE to groundwater over the long term. Concentrations in PS-06 and S-03 exceed 1% of TCE's solubility in water, and therefore suggest the potential for residual DNAPL, but this assessment may be biased by the concentrating effects of fracture flow. Contaminants are expected to continue to diffuse from residual DNAPL and out of the saprolite/weathered bedrock matrix over the long term. The SVE and MPE systems have successfully removed mass from the TCE spill area, to the point where today, mass flux through continued operation is very low (and is likely diffusion limited). Continued operation of the MPE system is not expected to shorten the operational life of the GWE/GWTS, given the residual mass (and potential DNAPL) present in the saprolite/weathered bedrock in the TCE spill area. The GWE/GWTS is expected to contain the contaminants within the saprolite/weathered bedrock zone, as it is designed to act on some of the same subsurface volumes.

As designed, continuous pumping of shallow bedrock zones (MW-10 and SMW) is expected to induce vertical hydraulic gradients within the bedrock and therefore minimize further downward migration of contaminants into the bedrock aquifer. This shallow hydraulic control approach (termed Phase 1 groundwater extraction), is outlined in the *Basis of Design Memorandum, Installation of Groundwater Recovery System* and the *Remedial Action Report — Soil and Groundwater Remedy*. O&M problems with packers and other down-well equipment required that the deeper portions of SMW and MW-10 be filled during Phase 1 activities; therefore, analytical data are only available from B-3 to assess compliance with the deeper onsite groundwater portion of this RAO, and, as noted previously, concentrations in B-3 have been decreasing.

The deeper portion of MW-10 will be drilled out and resampled once shallow concentrations in MW-10 and SMW show significant decreases in TCE contamination.

Compliance with Prevention of Offsite Migration to Surface Water RAO

The remedy at the Site has met the intent of this RAO through complete removal of landfill wastes and contaminated media located at the toe of the landfill. Surface water is no longer sampled as a part of the routine monitoring program, as the source of surface water contamination has been removed.

Compliance with Elimination of Physical Hazards RAO

The remedy at the Site has met the intent of this RAO through demolition of building foundations, raceways, and other structures, as well as removal of the landfill.

Changes in Land-Use and Exposure Pathways

There have been no documented changes in land-use of the Site or immediate vicinity since the ROD.

In 2002, USEPA issued the draft guidance on vapor intrusion regarding migration of volatile organic compounds such as TCE from the subsurface into overlying buildings. The original ROD did not contemplate vapor migration as an exposure pathway. The *Soil Vapor Assessment,* completed as an action item from the 2005 five-year review, has demonstrated that soil vapor does not pose risks to the residential neighborhoods surrounding the Stamina Mills Site.

New Contaminants and/or Contaminant Sources

No new or additional sources of VOC contamination in soil or groundwater have been suggested by Site data.

USEPA has inquired whether the solvent stabilizer 1,4-dioxane was used onsite. An emerging contaminant, 1,4-dioxane is currently being assessed at former solvent sites to determine its presence/absence. At the Stamina Mills Site, the following approach to assessing 1,4-dioxane has been developed:

- Review historical 1,1,1-trichloroethane (1,1,1-TCA concentrations)
- Assess current 1,1,1-TCA concentrations
- Assess current 1,4-dioxane concentrations from source area (GWE) wells

This methodology for assessing 1,4-dioxane was reviewed with USEPA prior to implementation, as documented in Appendix N. USEPA's risk goal for 1,4-dioxane in groundwater is 6 µg/L.

Background

To improve the material properties of many industrial solvents, chemical additives are mixed into the solvents at relatively low proportions (less than 10% by volume). The emerging contaminant 1,4-dioxane has been identified as a common solvent stabilizer which is recalcitrant in groundwater and, subsequently, mobile in the environment. USEPA has inquired whether this stabilizer is present at the Stamina Mills Site.

1,4-Dioxane typically was used as a stabilizer for the solvent 1,1,1-TCA, which was not identified as a constituent of concern at the Stamina Mills site. 1,4-Dioxane's purpose was to inhibit aluminum corrosion reactions, otherwise the solvent could corrode the metal being cleaned and/or the cleaning equipment itself. Reference documents suggest that stabilizer percentages for 1,1,1-TCA ranged from 2% to 8%.[13] Different stabilizers were typically used in TCE, at much lower ratios (typically less than 1%).

It is unclear what stabilizers, if any, would have been added to the TCE at the Stamina Mills site, as the TCE was used for cleaning fabrics, not for metal degreasing.

Historical 1,1,1-TCA Concentrations

Groundwater data collected from 2000 through 2010 were evaluated to gauge the presence/absence of 1,1,1-TCA. Data from the following locations were evaluated (Table 7-9):

Table 7-9
1,1,1-TCA Evaluation

Onsite Wells — Bedrock Wells	Onsite Wells — MPE Wells (saprolite wells)		Offsite Wells (bedrock wells)	Offsite Wells (overburden)
MW-10	PS-1	PS-4	I-12	OMW01
B-3	PS-11	PS-5	I-21	OMW02
SMW	PS-12	PS-6	I-30	OMW03
MW-15	PS-13	PS-8	I-37	
MW-17	PS-15	PS-9	A-142 *	

[13] *Solvent Stablizers White Paper*, Mohr, T.K.G., Santa Clara Valley Water District, UST Program — Water Supply Division, 2001. *Emerging Contaminant — 1,4-Dioxane*, USEPA OSWER Fact Sheet, EPA 505-F-09-006, September 2009. *Draft Toxicological Profile for 1,4-Dioxane*, U.S. Department of Health and Human Services, Public Health Service, ATSDR, Public Comment Draft, September 2007.

Table 7-9
1,1,1-TCA Evaluation

Onsite Wells — Bedrock Wells	Onsite Wells — MPE Wells (saprolite wells)		Offsite Wells (bedrock wells)	Offsite Wells (overburden)
MW-18	PS-16	S-10	A-143 *	
MW-2	PS-17	S-2	A-167 *	
	PS-18	S-3	A-173 *	
	PS-2	S-6	A-175 *	
	PS-21	S-8	A-200 *	
	PS-24	S-9	A-203 *	
			A-77 *	

Note:
* These wells were sampled in 2004 as part of the 2005 Five-Year Review

A total of 342 1,1,1-TCA results were evaluated; the analysis is presented in Appendix N. 1,1,1-TCA was detected 35 times (10% of all samples), with detected concentrations ranging from 0.29 to 52 µg/L.

These data do not suggest that 1,1,1-TCA was released at the Stamina Mills Site. Given that stabilizers are a small fraction (less than 8% by volume) of the original solvent, historical data do not suggest that stabilizers will be a significant constituent in groundwater.

May 2010 1,1,1-TCA Concentrations

Phase III groundwater monitoring data from May 2010 were reviewed for 1,1,1-TCA occurrences. 1,1,1-TCA was only detected 3 times, in offsite wells I-24 (0.84 µg/L at 60 to 62 feet bgs, 0.68 µg/L at 85 to 87 feet bgs) and I 30 (0.28 µg/L at 85 to 87 feet bgs). Consistent with historical data, May 2010 data suggest that 1,1,1-TCA was not released at the Stamina Mills Site.

May 2010 Source-Area 1,4-Dioxane Results

To achieve the 6 µg/L aqueous screening value established by USEPA, 1,4-dioxane was analyzed using SW-846 Method 8270 techniques. Samples were collected from the three active recovery wells onsite to achieve sufficient sample volume for the Method 8270 analysis.

1,4-Dioxane was not detected in B-3, MW-10, or SMW during the sampling event.[14]

1,4-Dioxane Conclusions

Given the (a) very few, very low 1,1,1-TCA detections at the Site, and (b) the absence of 1,4-dioxane at concentrations above screening levels, 1,4-dioxane is not considered a risk at the Stamina Mills site. Moreover, because 1,4-dioxane is associated with 1,1,1-TCA and not the

[14] The method detection limit was 2 µg/L.

site's primary contaminant (TCE), 1,4-dioxane is unlikely to have been present onsite. Therefore no further 1,4-dioxane assessments are required to assess this emerging contaminant.

Remedy Degradation and By-Products

TCE degradation products were anticipated during remedy selection, and no new by-products have been discovered during the treatment process. Therefore, the protectiveness of the remedy would not be affected by degradation and/or by-products.

Evaluation of Toxicity Factors and Contaminant Characteristics

As noted above, cleanup goals for primary Site contaminants (TCE and daughter products) were developed primarily using MCLs (or proposed MCLs at time of ROD issuance). MCLs for these compounds have not changed since ROD signature.

However, since 1990 both toxicological information and the environmental industry's understanding of contaminant fate and transport has changed:

- TCE toxicity data is currently being evaluated by USEPA and various state agencies. Calculations performed in support of the *Soil Vapor Assessment* during 2008/2009 generated a target groundwater concentration of 2.89 µg/L for TCE corresponding to a target indoor air inhalation cancer risk of 1E-06. This target groundwater concentration was used as a screening level and is within the same order-of-magnitude of the current MCL, 5 µg/L. Using this screening level, the current MCL represents a risk value of 1.63E-06, well within USEPA's acceptable risk range of 1E-06 to 1E-04. The TCE MCL has not been changed since ROD issuance. Since the TCE MCL is the basis for the Site cleanup goals and the MCL has not changed, the protectiveness of the remedy is not currently affected.

- In 2002, USEPA issued the draft vapor intrusion guidance regarding migration of volatile organics such as TCE in the vapor phase. The original ROD did not contemplate vapor migration as an exposure pathway. The *Soil Vapor Assessment,* completed as an action item from the 2005 five-year review, has demonstrated that soil vapor does not pose risks to the residential neighborhoods surrounding the Stamina Mills Site. The protectiveness of the remedy is therefore not affected by vapor migration.

Neither of these factors impacts the protectiveness of the site remedy.

Risk Recalculation/Reassessment

Because there have been no changes to the underlying standards used to develop cleanup goals at the Site, there is no need for risk recalculation/reassessment during this five-year review.

Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. Five-year review guidance requires evaluation of any new information or changes in Site conditions that could call into question the overall protectiveness of the remedy. Table 7-10 summarizes findings of the five-year review; details are provided in subsequent sections.

Table 7-10
Summary of Findings: Question C
Other Information

Ecological Risks	No newly identified ecological risks have been found
Natural Disasters	No impacts from natural disasters have occurred
Other Information	No other information has come to light that could affect the protectiveness of the remedy

Newly Identified Ecological Risks

None identified.

Impacts from Natural Disasters

No impacts from natural disasters have affected the Site and changed the remedy.

Additional Information

No other information has come to light that could affect the protectiveness of the selected remedy.

VIII. ISSUES

No issues were identified during the five-year review process that would affect the protectiveness of the remedy or the future protectiveness of the remedy.

IX. NEXT STEPS, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions were generated as part of this five-year review. A copy of the Administrative Record will be placed at the North Smithfield Public Library for public viewing. This follow-up action will not affect the current or future protectiveness of the remedy.

X. PROTECTIVENESS STATEMENT

Because the remedial actions at the Stamina Mills Site are protective, the site is protective of human health and the environment.

XI. NEXT REVIEW

The next statutory review for the Stamina Mills Site will be required in 2015, five years from the completion date (e.g., signature date) of this five-year review report.

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2008 Annual Report, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe, April 2009).

Technical Memorandum — First Quarter 2009 Operations and Analytical Summary, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe Inc.; June 2009).

Soil Vapor Assessment, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe Inc.; July 2009).

Soil Vapor Assessment, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0, Errata Pages (EnSafe Inc.; September 2009).

Technical Memorandum — Second Quarter 2009 Operations and Analytical Summary, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe Inc.; October 2009).

Technical Memorandum — Third Quarter 2009 Operations and Analytical Summary, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe Inc.; November 2009).

Technical Memorandum — Fourth Quarter 2009 Operations and Analytical Summary, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe Inc.; April 2010).

2009 Annual Report, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe, April 2010).

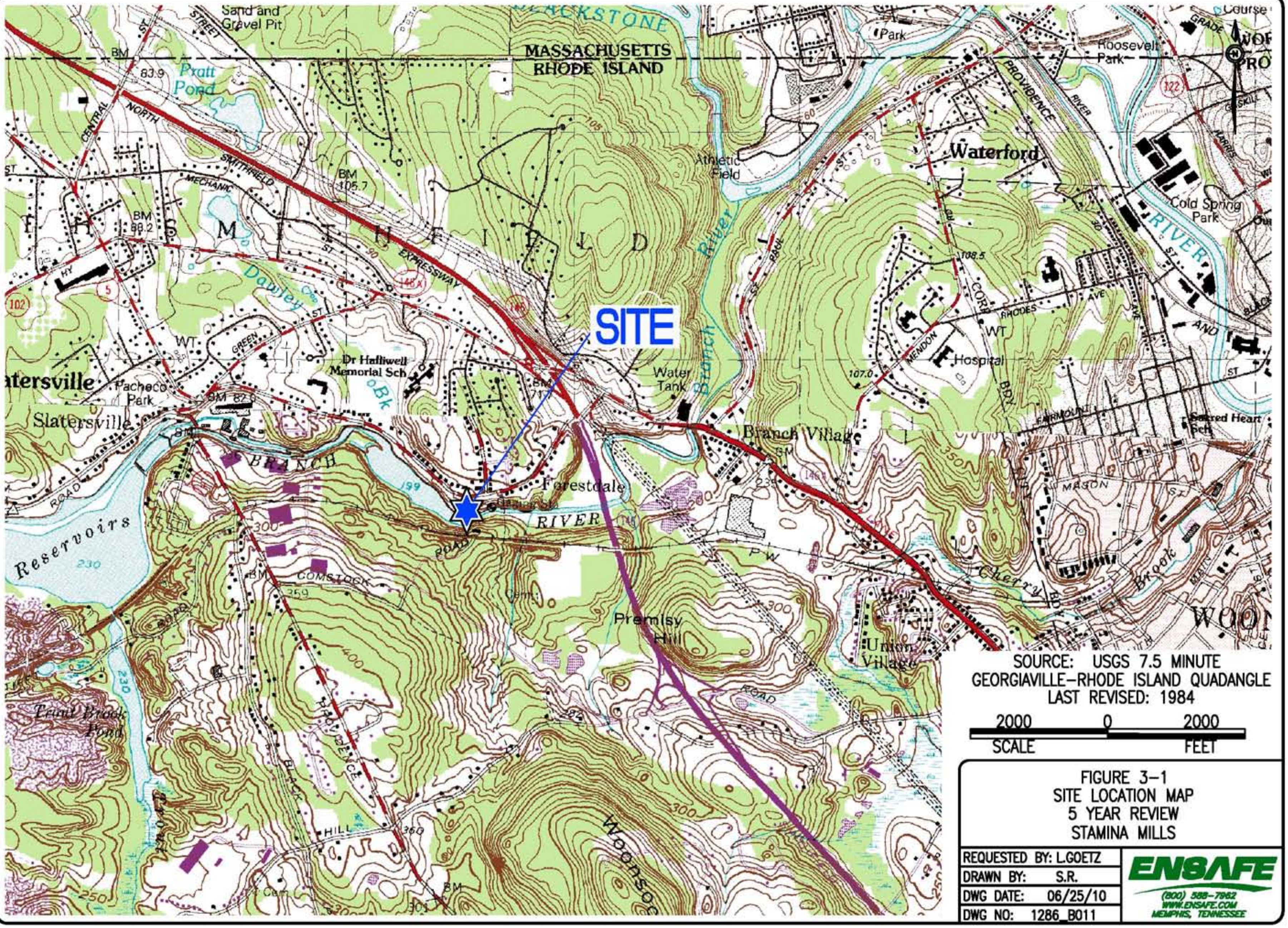
Technical Memorandum — First Quarter 2010 Operations and Analytical Summary, Stamina Mills Superfund Site, North Smithfield, Rhode Island, USEPA Docket No. I-91-1070, Revision 0 (EnSafe Inc.; June 2010).

FIVE-YEAR REVIEW REPORT
2010 FIVE-YEAR REVIEW REPORT
STAMINA MILLS SUPERFUND SITE
TOWN OF NORTH SMITHFIELD — PROVIDENCE COUNTY, RHODE ISLAND
SEPTEMBER 2010

FIVE-YEAR REVIEW REPORT
2010 FIVE-YEAR REVIEW REPORT
STAMINA MILLS SUPERFUND SITE
TOWN OF NORTH SMITHFIELD — PROVIDENCE COUNTY, RHODE ISLAND
SEPTEMBER 2010

FIVE-YEAR REVIEW REPORT
2010 FIVE-YEAR REVIEW REPORT
STAMINA MILLS SUPERFUND SITE
TOWN OF NORTH SMITHFIELD — PROVIDENCE COUNTY, RHODE ISLAND
SEPTEMBER 2010

Appendix A
Figures



SOURCE: USGS 7.5 MINUTE
GEORGIAVILLE–RHODE ISLAND QUADANGLE
LAST REVISED: 1984

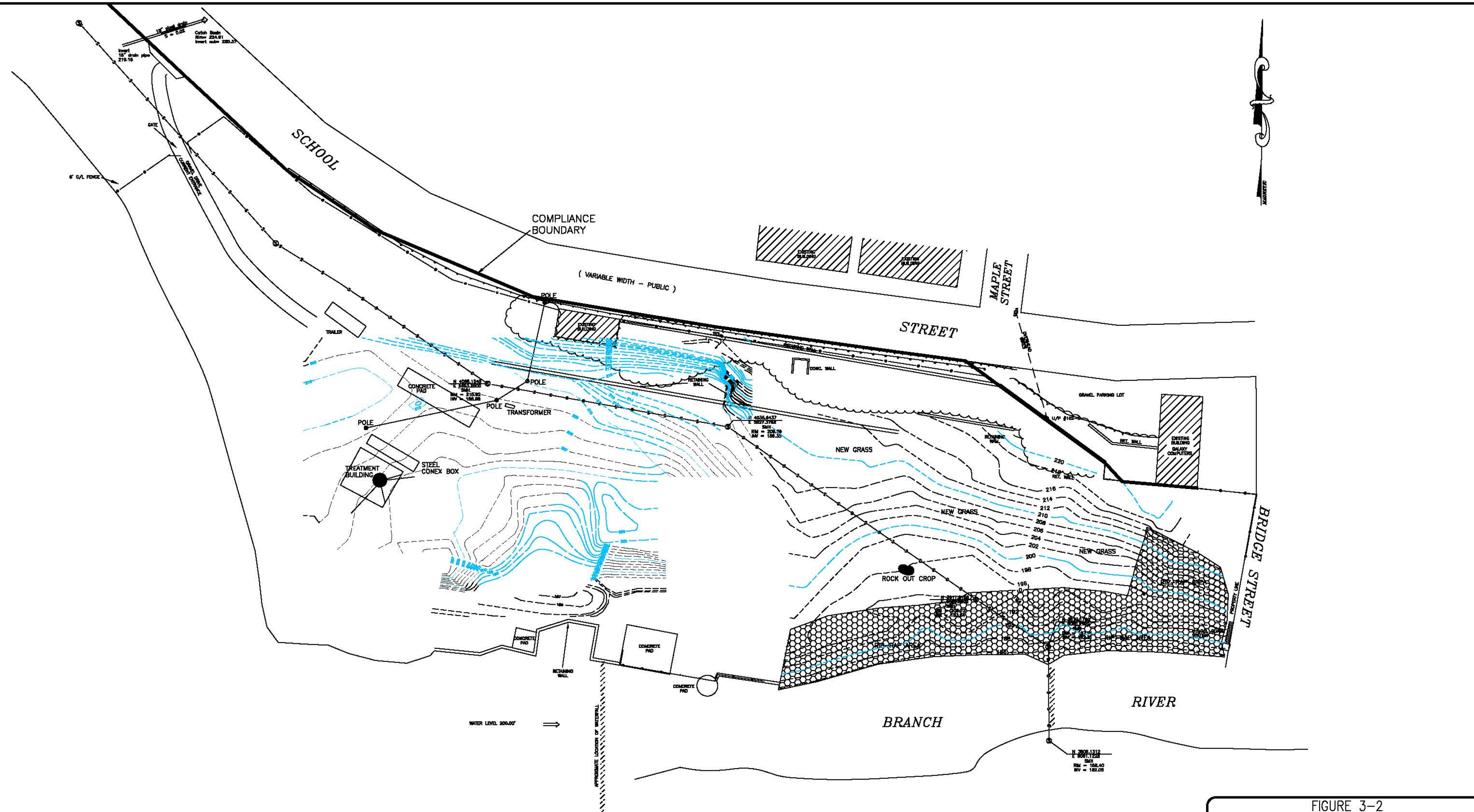
2000 0 2000
SCALE FEET

FIGURE 3–1
SITE LOCATION MAP
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY:	L.GOETZ
DRAWN BY:	S.R.
DWG DATE:	06/25/10
DWG NO:	1286_B011

ENSAFE
(800) 588-7962
WWW.ENSAFE.COM
MEMPHIS, TENNESSEE

I:\PROJECTS\4001\4001-025\4001025V016_SITE_LOCATION_MAP.dwg 6/20/2005 2:40:54 PM CST



LOCATION OF EXISTING UTILITIES SHOWN, ARE FROM GATE LOCATION AND EXISTING DOCUMENTATION AND MAY NOT BE ACCURATE. EXACT LOCATION TO BE DONE BY THE APPROPRIATE UTILITY COMPANY OR MUNICIPALITY PRIOR TO ANY EXCAVATION. CALL *DIGSAFE* AT *1-800-225-4977*

GRAPHIC SCALE

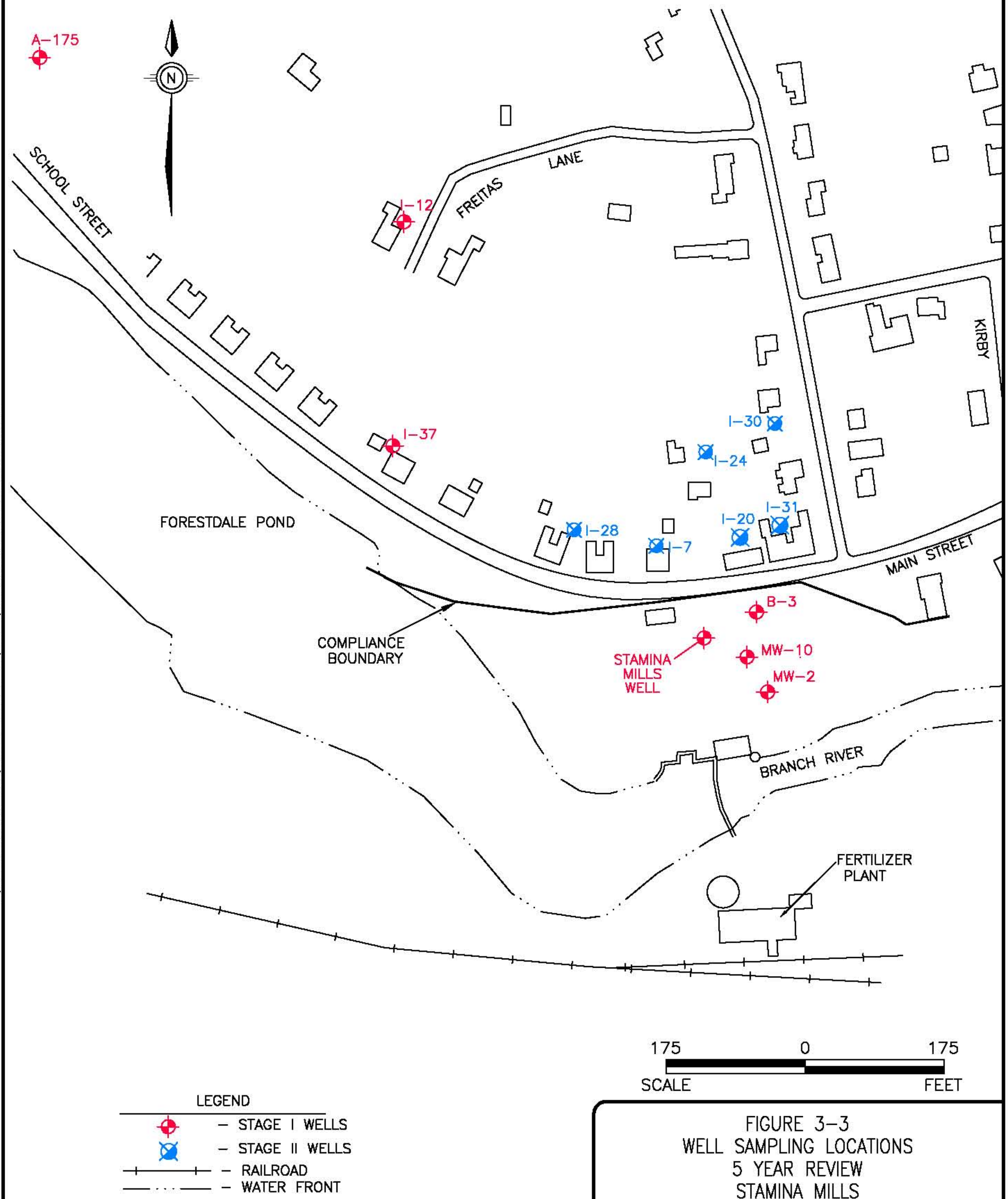
(IN FEET)
1 inch = 30 ft.

NOTE:
SURVEY DATA PROVIDED BY NATIONAL SURVEYORS–DEVELOPERS INC.

FIGURE 3–2
SITE CONDITIONS AND TOPOGRAPHY
AFTER 1999 LANDFILL REMOVAL
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY:	RYAN A
DRAWN BY:	BRONSON
DWG DATE:	09/02/10
DWG NO:	1286_B007

ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE

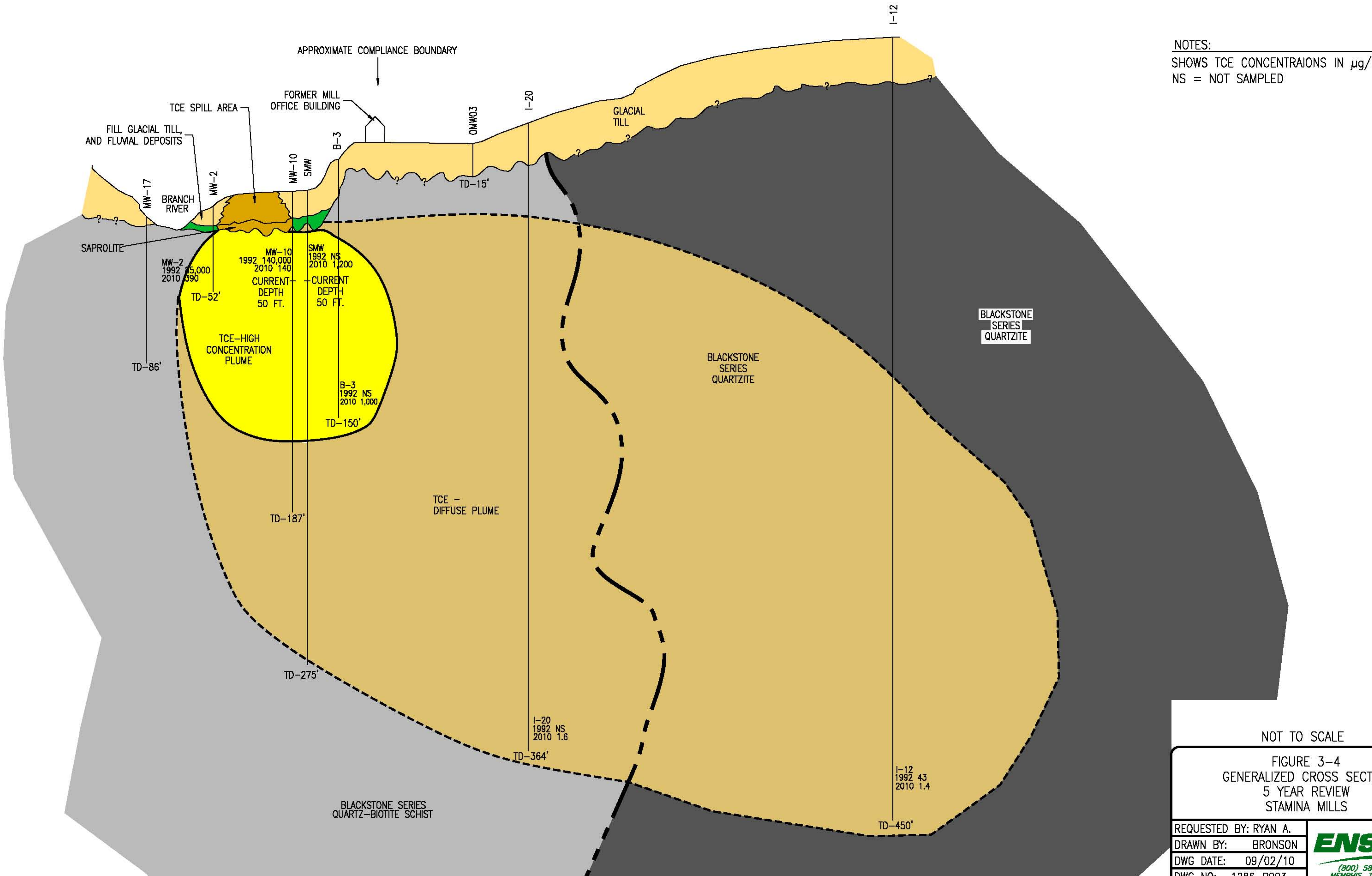


NOTE:
STAGE II WELLS WILL BE ADDED TO THE MONITORING PROGRAM ONCE IT HAS BEEN DETERMINED THAT CLEANUP STANDARDS HAVE BEEN ATTAINED AT STAGE I OFF SITE MONITORING WELLS.
BOUNDARIES ARE APPROXIMATE.

FIGURE 3-3
WELL SAMPLING LOCATIONS
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY: RYAN A	ENSAFE
DRAWN BY: BRONSON	(800) 588-7962
DWG DATE: 09/02/10	MEMPHIS, TENNESSEE
DWG NO: 1286_B013	

I:\2010 PROJECTS-BST\1286 STAMINA MILLS\PLANS\1286_B013_WELL_STAMINA MILLS.DWG



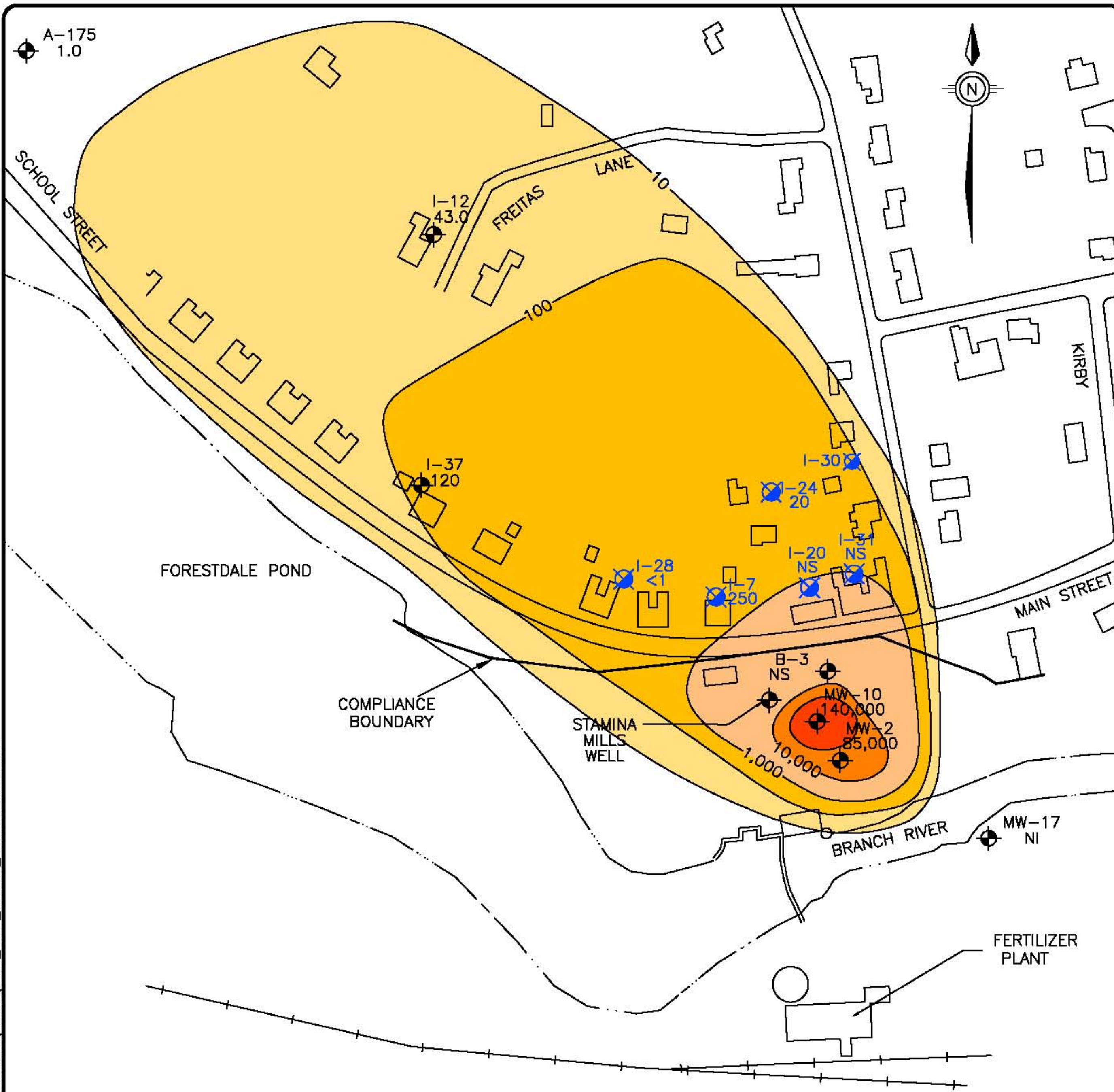
NOT TO SCALE

FIGURE 3-4
GENERALIZED CROSS SECTION
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY:	RYAN A.
DRAWN BY:	BRONSON
DWG DATE:	09/02/10
DWG NO:	1286_B003

ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE

I:\2010 PROJECTS-BST\1286 STAMINA MILLS\Plans\1286_B003_CROSS SEC_STAMINA MILLS.dwg



LEGEND

- STAGE 1 WELLS
- STAGE II WELLS
- RAILROAD
- WATER FRONT
- 100 — CONTAMINANT ISOCON
- NS — NOT SAMPLED
- NI — NOT INSTALLED

ALL UNITS MICROGRAMS PER LITER (μg/L)

NOTE:
STAGE II WELLS WILL BE ADDED TO THE MONITORING PROGRAM ONCE IT HAS BEEN DETERMINED THAT CLEANUP STANDARDS HAVE BEEN ATTAINED AT STAGE I OFFSITE MONITORING WELLS.

FIGURE 3-5
TCE PLUME – NOVEMBER 1992
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY: RYAN A	ENSAFE (800) 588-7962 MEMPHIS, TENNESSEE
DRAWN BY: BRONSON	
DWG DATE: 09/02/10	
DWG NO: 1286_B006	

I:\2010 PROJECTS-BST\1286 STAMINA MILLS\PLANS\1286_B006_OFFSITE_STAMINA MILLS.DWG

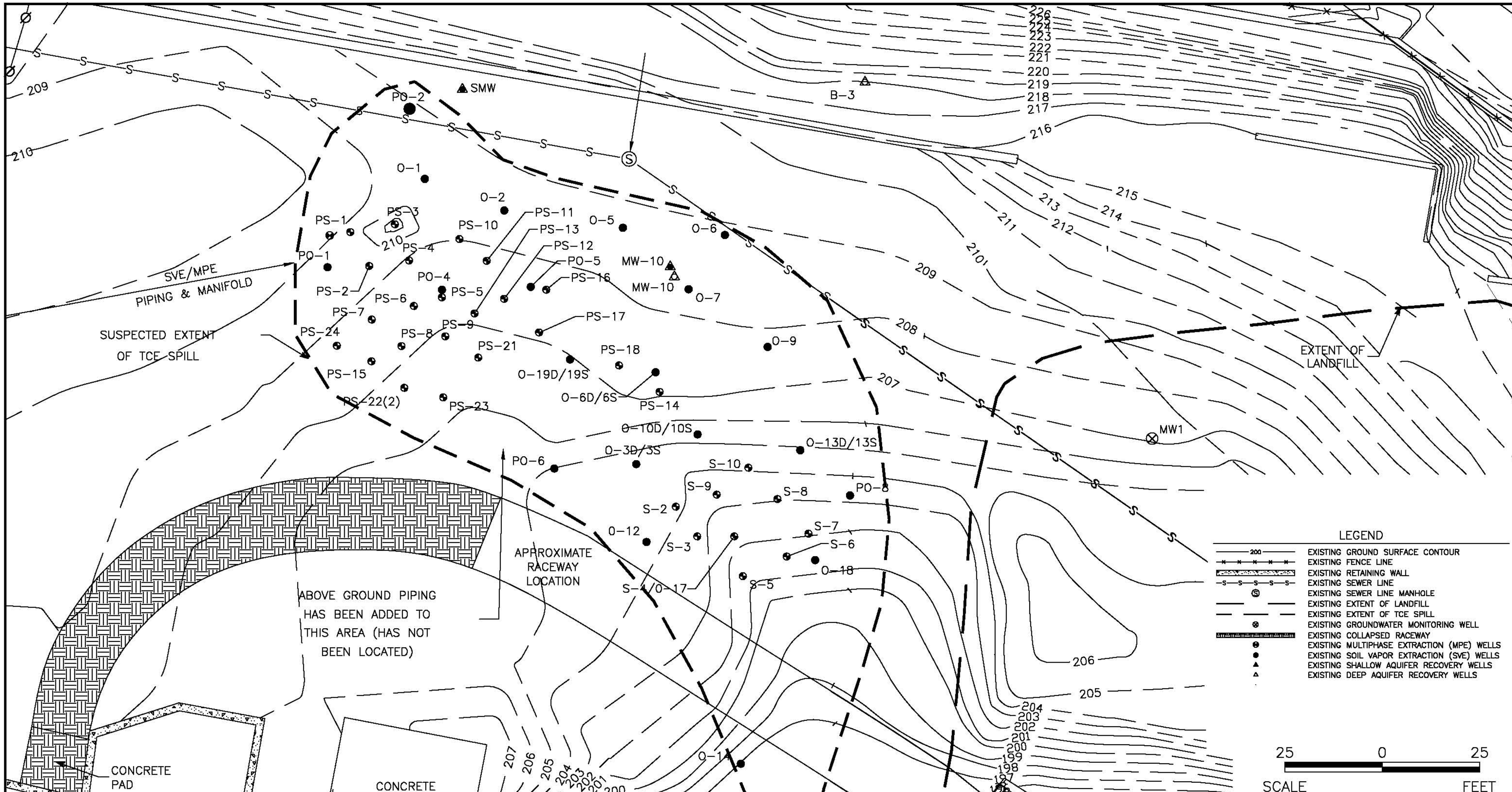
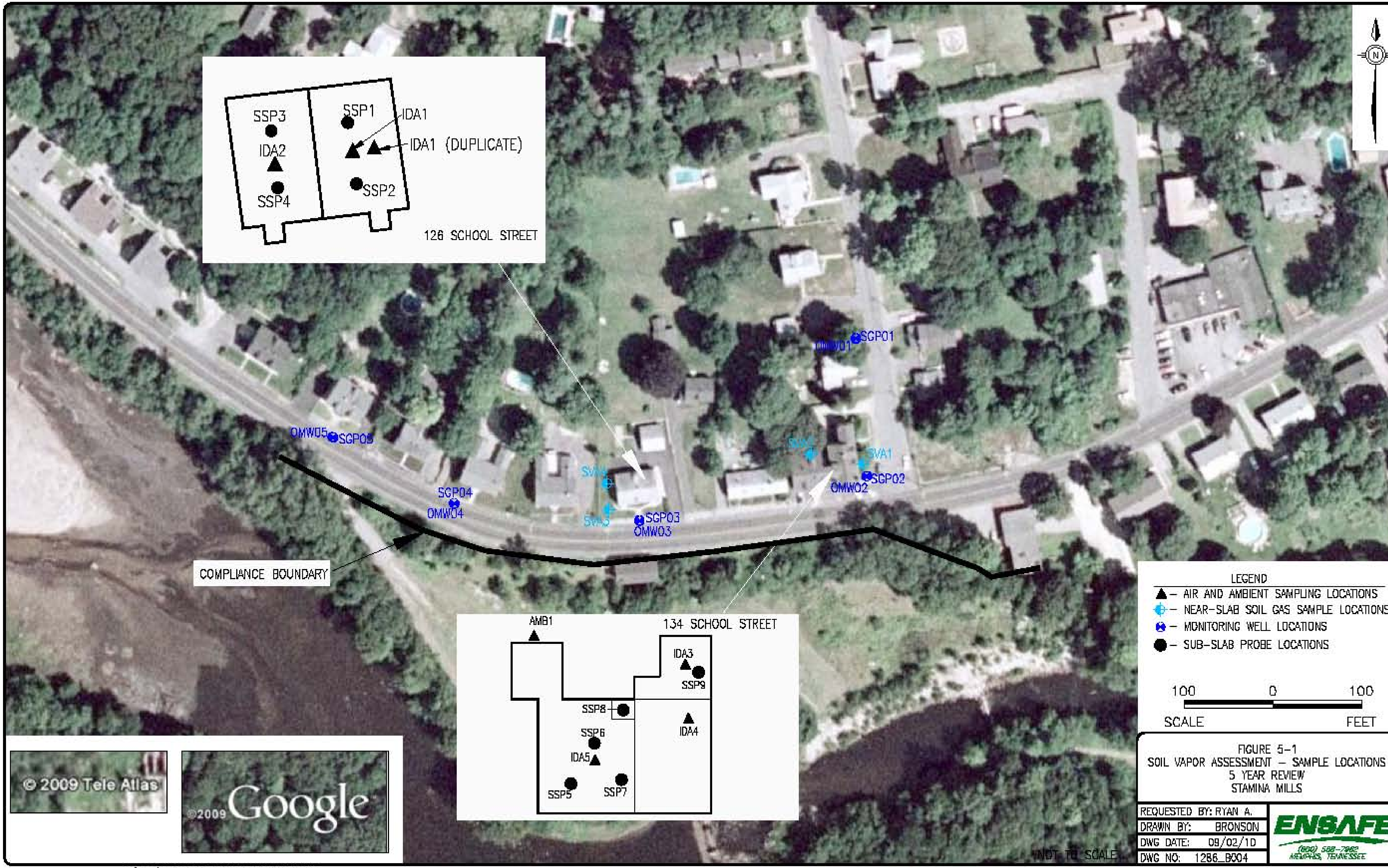


FIGURE 4-1
APPROXIMATE BOUNDARY OF TCE SPILL AREA AND SVE/MPE WELL LAYOUT
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY: RYAN A	ENSAFE
DRAWN BY: BRONSON	(800) 588-7962
DWG DATE: 06/23/10	MEMPHIS, TENNESSEE
DWG NO: 1286_B008	



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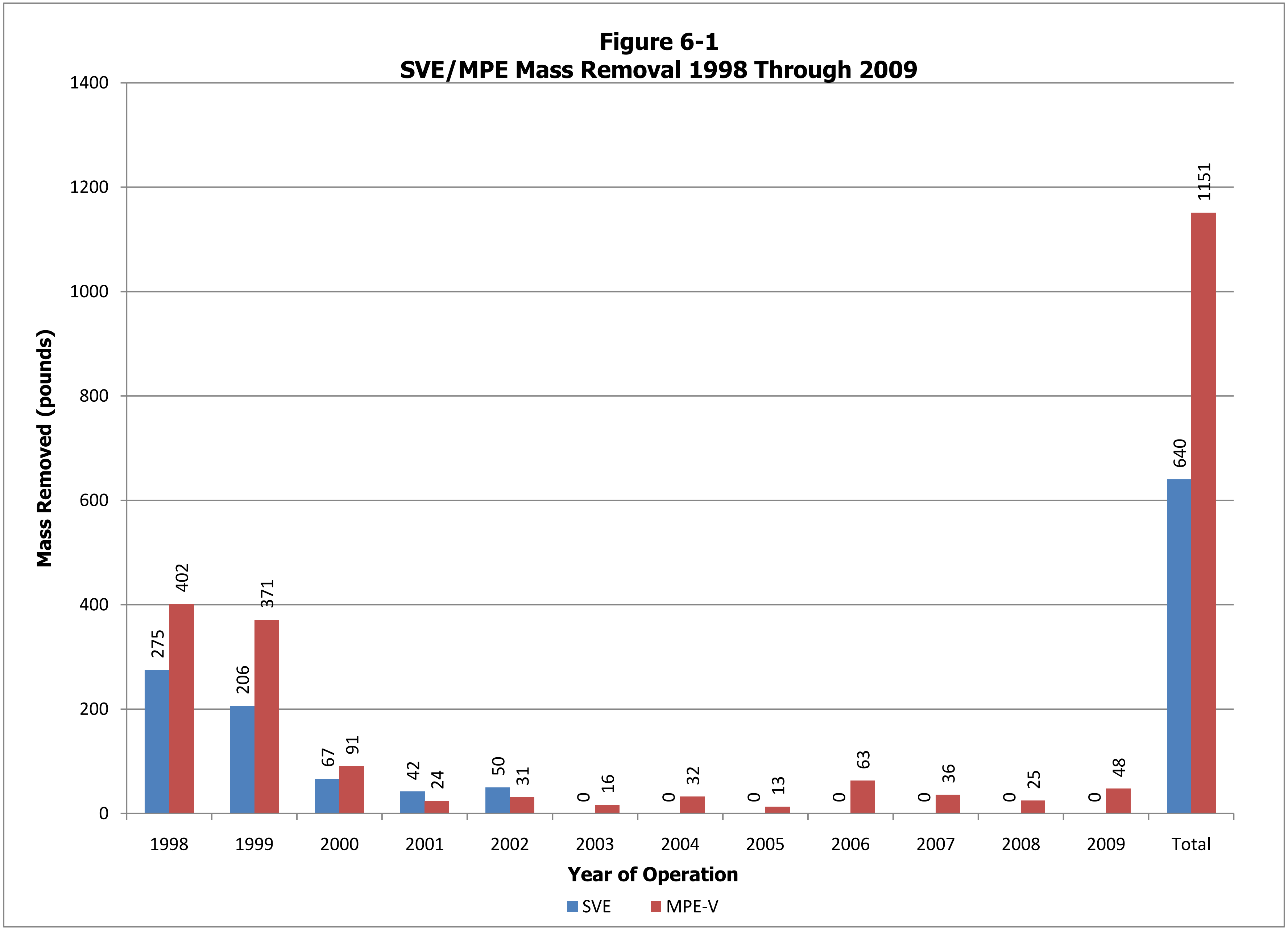
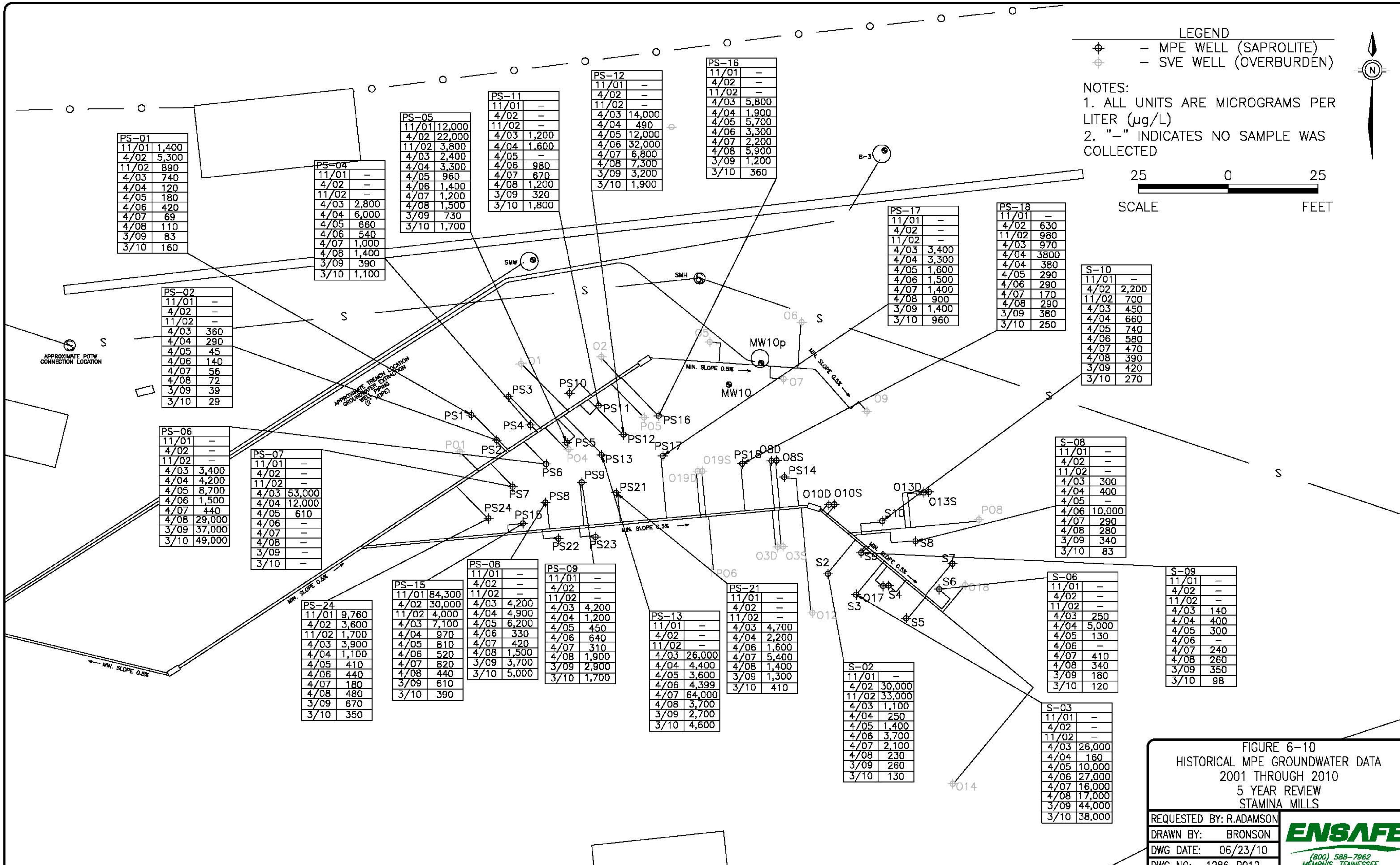


Figure 6-1
SVE/MPE Mass Removal 1998 Through 2009
Mass Removed (pounds)
1400
1200
1000
800
600
400
200
0
275
402
206
371
67
91
42
24
50
31
0
16
0
32
0
13
0
63
0
36
0
25
0
48
640
1151
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Total
Year of Operation
SVE
MPE-V



PS-01	
11/01	1,400
4/02	5,300
11/02	890
4/03	740
4/04	120
4/05	180
4/06	420
4/07	69
4/08	110
3/09	83
3/10	160

PS-02	
11/01	–
4/02	–
11/02	–
4/03	360
4/04	290
4/05	45
4/06	140
4/07	56
4/08	72
3/09	39
3/10	29

PS-04	
11/01	–
4/02	–
11/02	–
4/03	2,800
4/04	6,000
4/05	660
4/06	540
4/07	1,000
4/08	1,400
3/09	390
3/10	1,100

PS-05	
11/01	12,000
4/02	22,000
11/02	3,800
4/03	2,400
4/04	3,300
4/05	960
4/06	1,400
4/07	1,200
4/08	1,500
3/09	730
3/10	1,700

PS-11	
11/01	–
4/02	–
11/02	–
4/03	1,200
4/04	1,600
4/05	–
4/06	980
4/07	670
4/08	1,200
3/09	320
3/10	1,800

PS-12	
11/01	–
4/02	–
11/02	–
4/03	14,000
4/04	490
4/05	12,000
4/06	32,000
4/07	6,800
4/08	7,300
3/09	3,200
3/10	1,900

PS-16	
11/01	–
4/02	–
11/02	–
4/03	5,800
4/04	1,900
4/05	5,700
4/06	3,300
4/07	2,200
4/08	5,900
3/09	1,200
3/10	360

PS-17	
11/01	–
4/02	–
11/02	–
4/03	3,400
4/04	3,300
4/05	1,600
4/06	1,500
4/07	1,400
4/08	900
3/09	1,400
3/10	960

PS-18	
11/01	–
4/02	630
11/02	980
4/03	970
4/04	3800
4/04	380
4/05	290
4/06	290
4/07	170
4/08	290
3/09	380
3/10	250

S-10	
11/01	–
4/02	2,200
11/02	700
4/03	450
4/04	660
4/05	740
4/06	580
4/07	470
4/08	390
3/09	420
3/10	270

PS-06	
11/01	–
4/02	–
11/02	–
4/03	3,400
4/04	4,200
4/05	8,700
4/06	1,500
4/07	440
4/08	29,000
3/09	37,000
3/10	49,000

PS-07	
11/01	–
4/02	–
11/02	–
4/03	53,000
4/04	12,000
4/05	610
4/06	–
4/07	–
4/08	–
3/09	–
3/10	–

S-08	
11/01	–
4/02	–
11/02	–
4/03	300
4/04	400
4/05	–
4/06	10,000
4/07	290
4/08	280
3/09	340
3/10	83

PS-24	
11/01	9,760
4/02	3,600
11/02	1,700
4/03	3,900
4/04	1,100
4/05	410
4/06	440
4/07	180
4/08	480
3/09	670
3/10	350

PS-15	
11/01	84,300
4/02	30,000
11/02	4,000
4/03	7,100
4/04	970
4/05	810
4/06	520
4/07	820
4/08	440
3/09	610
3/10	390

PS-08	
11/01	–
4/02	–
11/02	–
4/03	4,200
4/04	4,900
4/05	6,200
4/06	330
4/07	420
4/08	1,500
3/09	3,700
3/10	5,000

PS-09	
11/01	–
4/02	–
11/02	–
4/03	4,200
4/04	1,200
4/05	450
4/06	640
4/07	310
4/08	1,900
3/09	2,900
3/10	1,700

PS-13	
11/01	–
4/02	–
11/02	–
4/03	26,000
4/04	4,400
4/05	3,600
4/06	4,399
4/07	64,000
4/08	3,700
3/09	2,700
3/10	4,600

PS-21	
11/01	–
4/02	–
11/02	–
4/03	4,700
4/04	2,200
4/06	1,600
4/07	5,400
4/08	1,400
3/09	1,300
3/10	410

S-02	
11/01	–
4/02	30,000
11/02	33,000
4/03	1,100
4/04	250
4/05	1,400
4/06	3,700
4/07	2,100
4/08	230
3/09	260
3/10	130

S-06	
11/01	–
4/02	–
11/02	–
4/03	250
4/04	5,000
4/05	130
4/06	–
4/07	410
4/08	340
3/09	180
3/10	120

S-09	
11/01	–
4/02	–
11/02	–
4/03	140
4/04	400
4/05	300
4/06	–
4/07	240
4/08	260
3/09	350
3/10	98

S-03	
11/01	–
4/02	–
11/02	–
4/03	26,000
4/04	160
4/05	10,000
4/06	27,000
4/07	16,000
4/08	17,000
3/09	44,000
3/10	38,000

FIGURE 6-10
HISTORICAL MPE GROUNDWATER DATA
2001 THROUGH 2010
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY:	R.ADAMSON
DRAWN BY:	BRONSON
DWG DATE:	06/23/10
DWG NO:	1286_B012

ENSAFE (800) 588-7962 MEMPHIS, TENNESSEE

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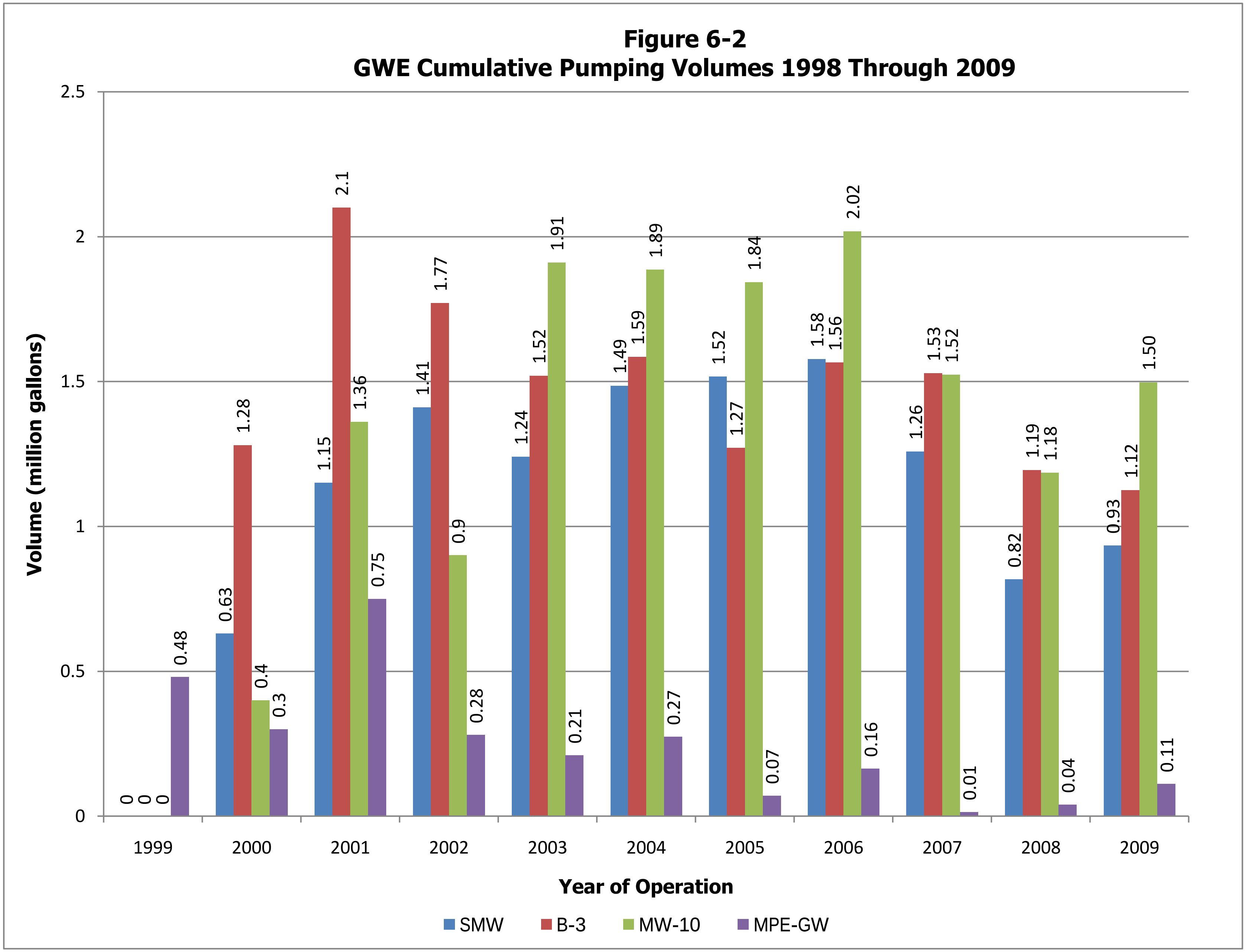


Figure 6-2
GWE Cumulative Pumping Volumes 1998 Through 2009
Volume (million gallons)
2.5
2
1.5
1
0.5
0
0 0 0 0.48
0.63 1.28 0.4 0.3
1.15 2.1 1.36 0.75
1.41 1.77 0.9 0.28
1.24 1.52 1.91 0.21
1.49 1.59 1.89 0.27
1.52 1.27 1.84 0.07
1.58 1.56 2.02 0.16
1.26 1.53 1.52 0.01
0.82 1.19 1.18 0.04
0.93 1.12 1.50 0.11
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year of Operation
SMW
B-3
MW-10
MPE-GW

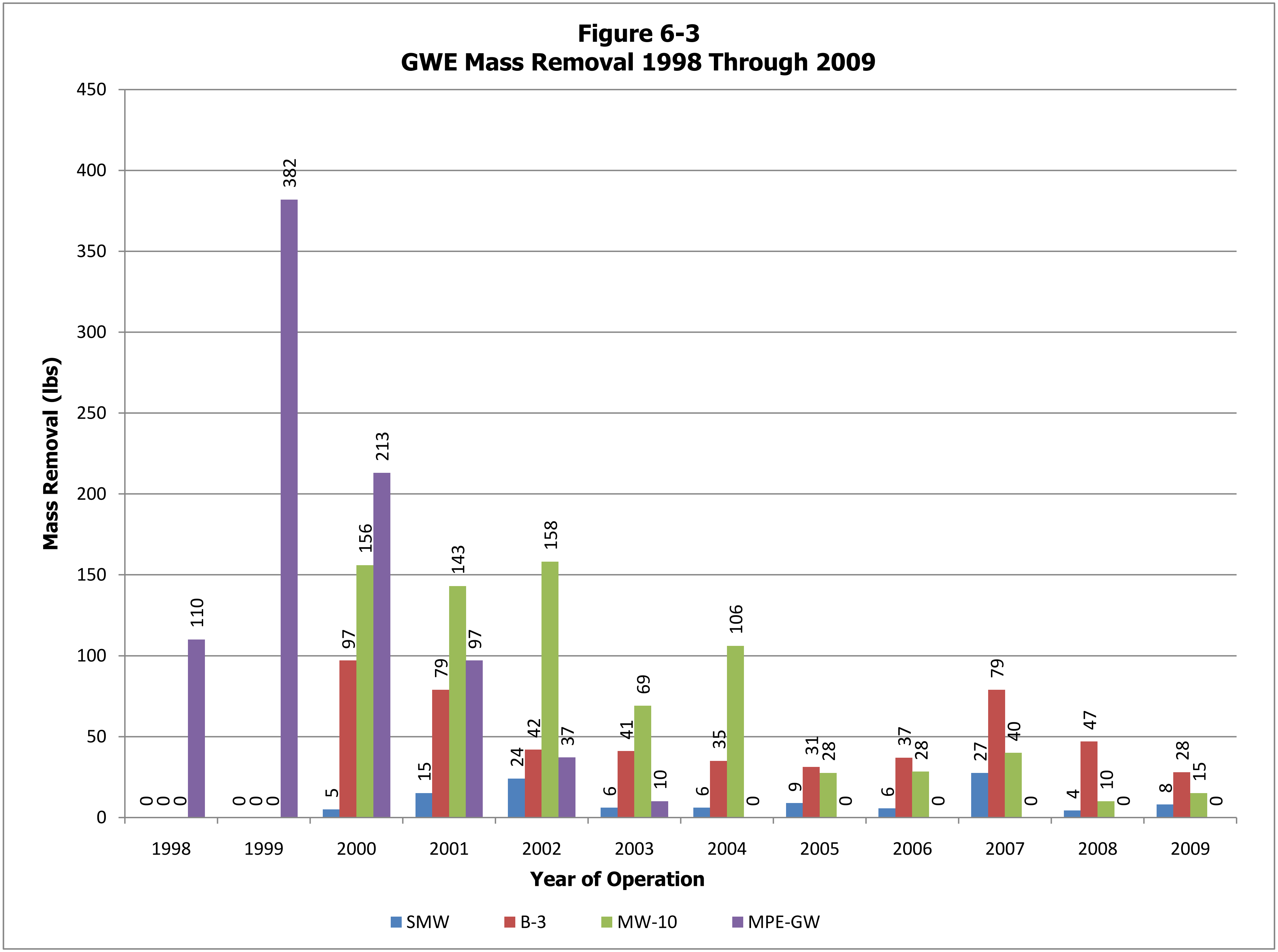
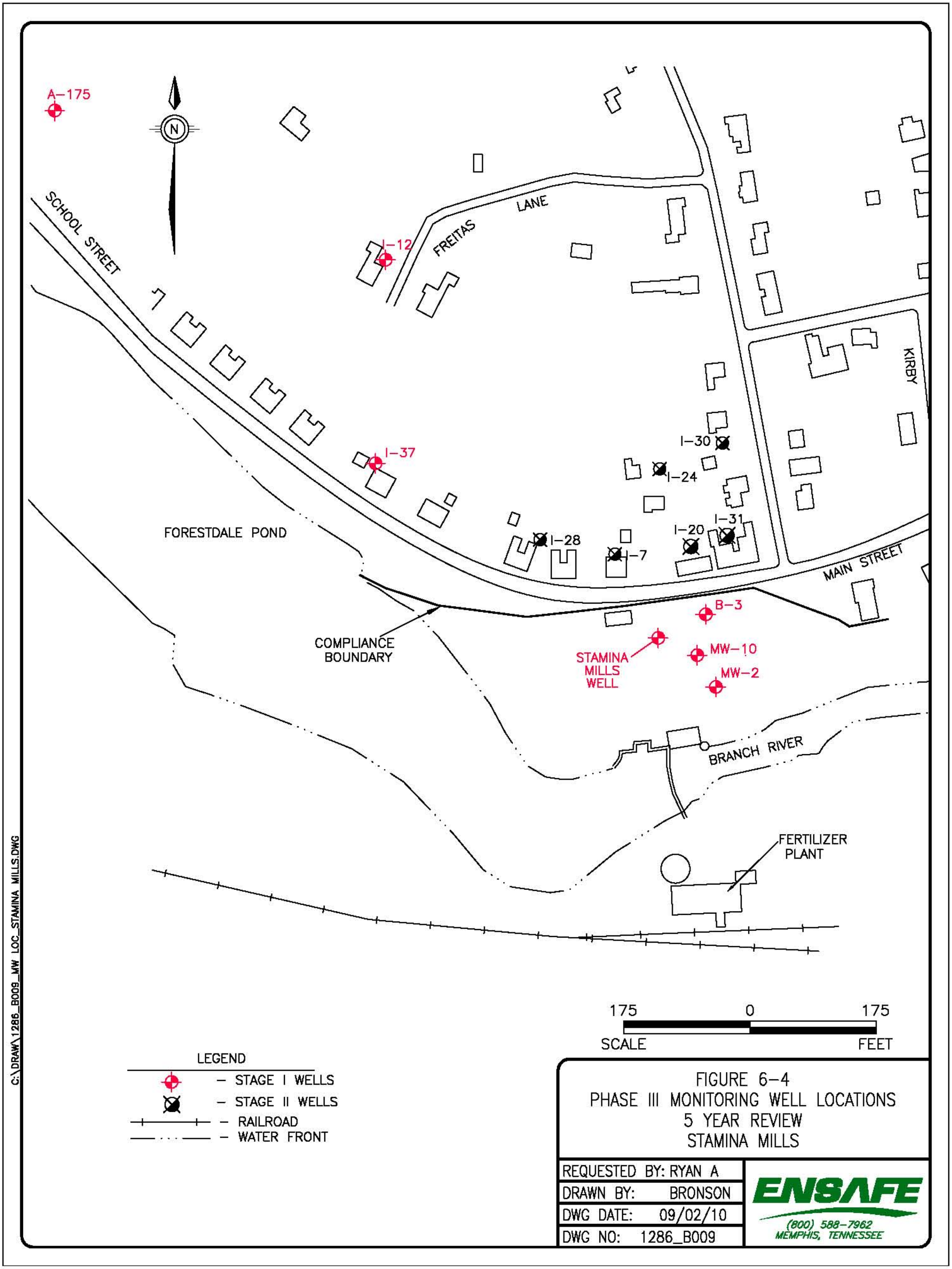


Figure 6-3
GWE Mass Removal 1998 Through 2009
Mass Removal (lbs)
450
400
350
300
250
200
150
100
50
0
0
0
0
110
0
0
0
382
5
97
156
213
15
79
143
97
24
42
158
37
6
41
69
10
6
35
106
0
9
31
28
0
6
37
28
0
27
79
40
0
4
47
10
0
8
28
15
0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year of Operation
SMW
B-3
MW-10
MPE-GW



A-175
N
SCHOOL STREET
FREITAS LANE
I-12
I-37
I-30
I-24
I-20
I-31
I-28
I-7
KIRBY
MAIN STREET
FORESTDALE POND
B-3
COMPLIANCE BOUNDARY
STAMINA MILLS WELL
MW-10
MW-2
BRANCH RIVER
FERTILIZER PLANT
175 0 175
SCALE FEET
LEGEND
- STAGE I WELLS
- STAGE II WELLS
- RAILROAD
- WATER FRONT
C:\DRAW\1286_B009_MW LOC_STAMINA MILLS.DWG
FIGURE 6-4
PHASE III MONITORING WELL LOCATIONS
5 YEAR REVIEW
STAMINA MILLS
REQUESTED BY: RYAN A
DRAWN BY: BRONSON
DWG DATE: 09/02/10
DWG NO: 1286_B009
ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE

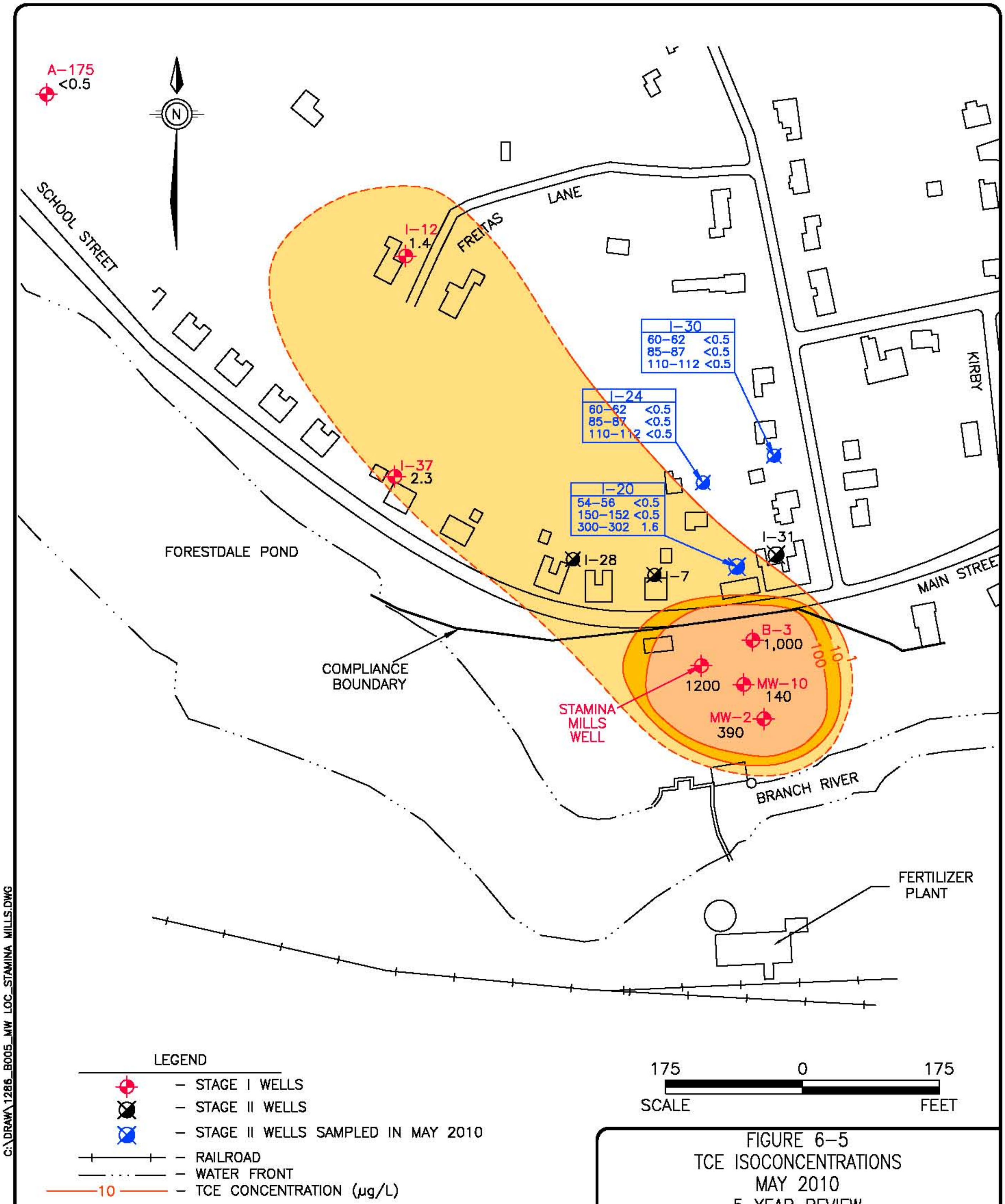
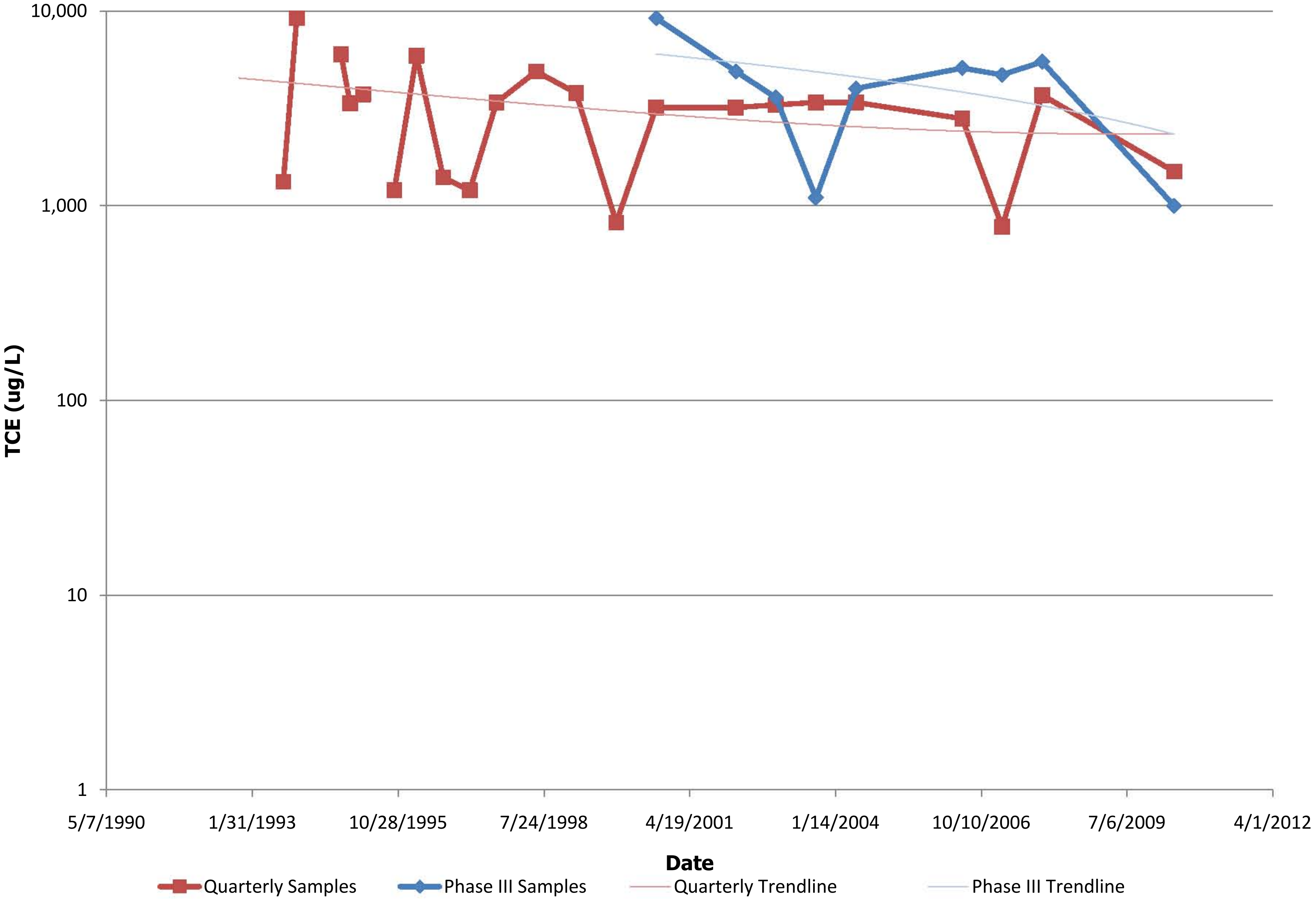


FIGURE 6-5
TCE ISOCONCENTRATIONS
MAY 2010
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY: L.GOETZ	ENSAFE (800) 588-7962 MEMPHIS, TENNESSEE
DRAWN BY: BRONSON	
DWG DATE: 09/02/10	
DWG NO: 1286_B005	

Figure 6-6
B-3 Historical TCE Concentrations



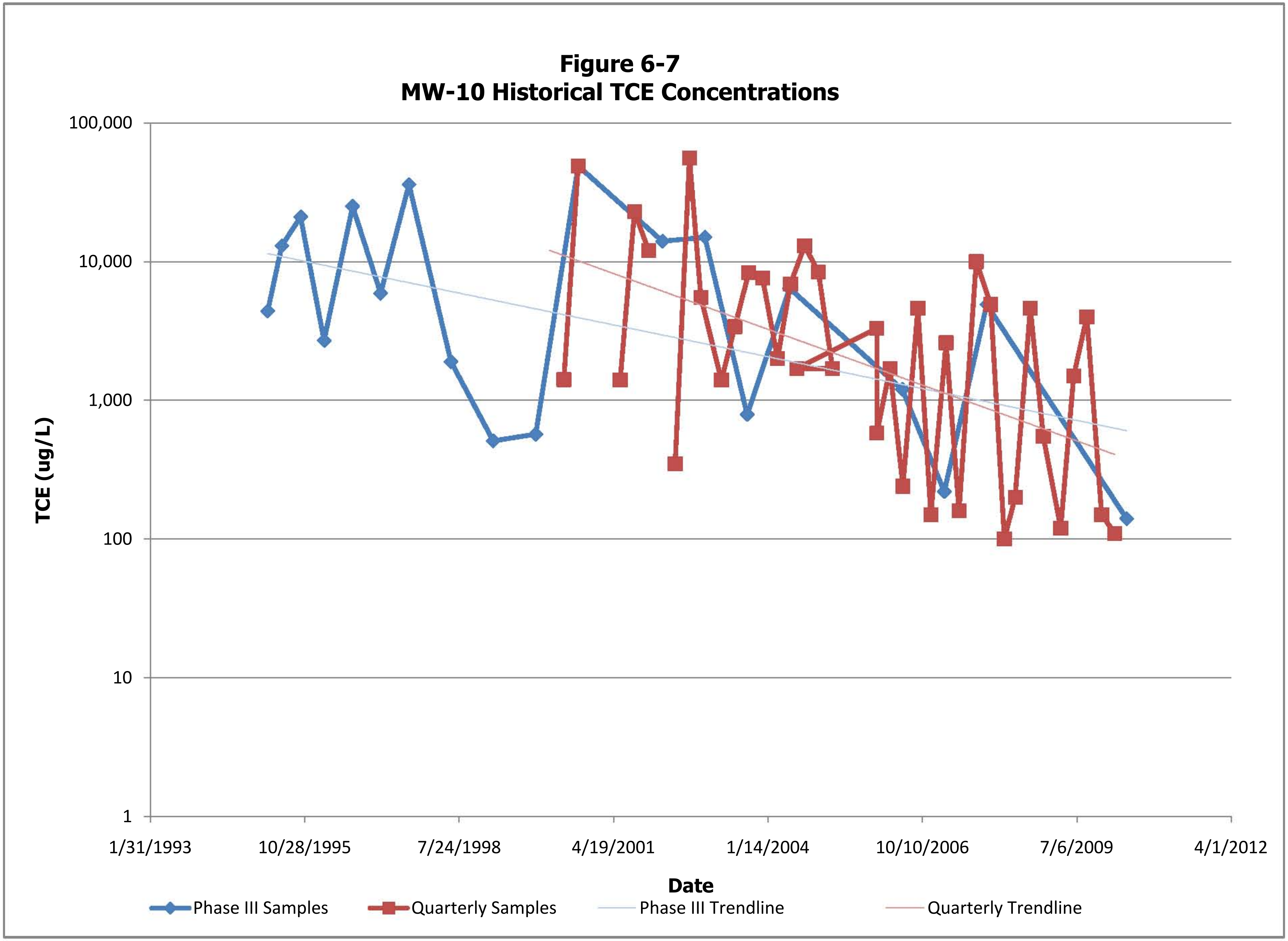


Figure 6-7
MW-10 Historical TCE Concentrations
100,000
10,000
1,000
100
10
1
TCE (ug/L)
1/31/1993
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Date
Phase III Samples
Quarterly Samples
Phase III Trendline
Quarterly Trendline

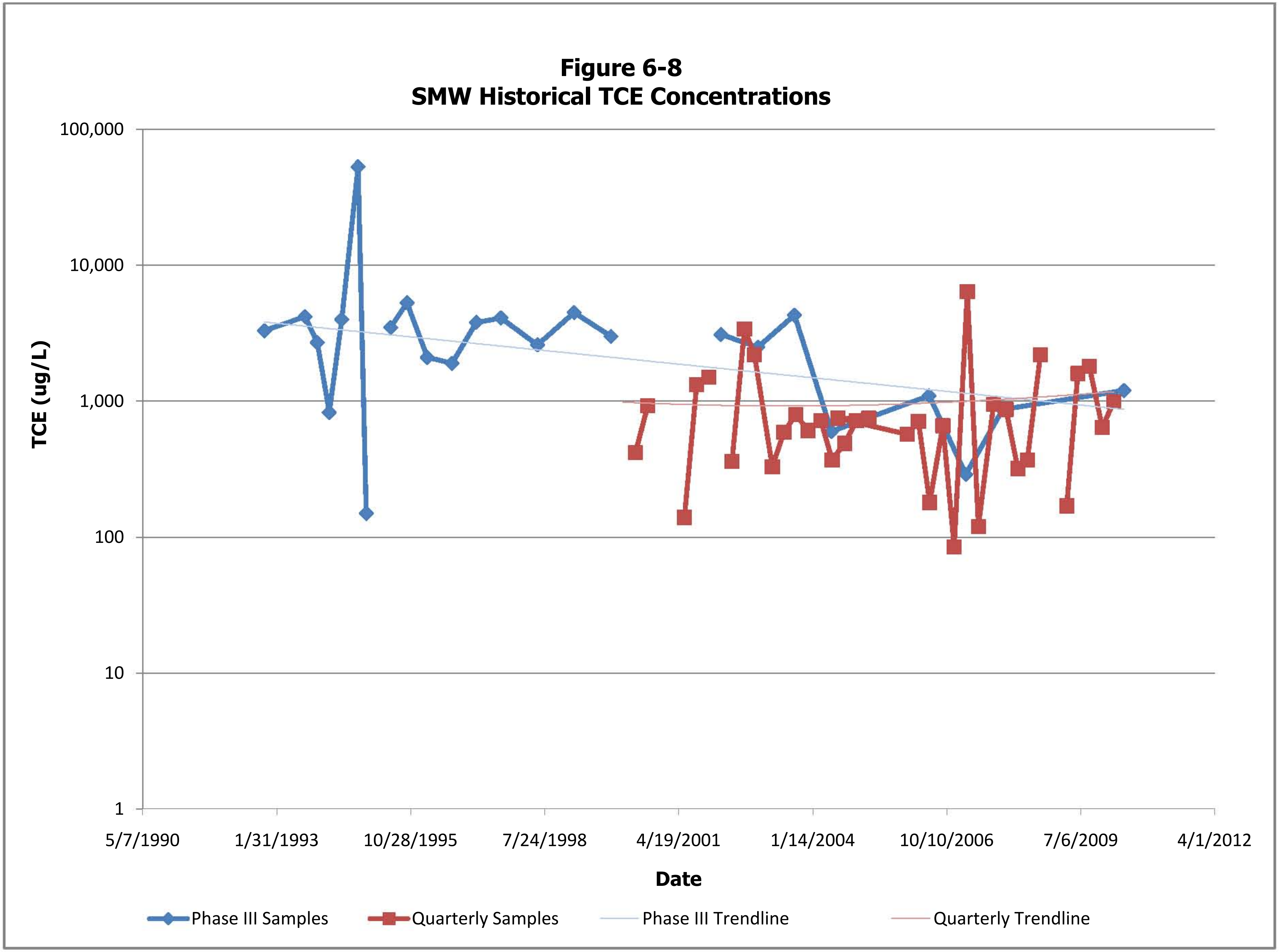


Figure 6-8
SMW Historical TCE Concentrations
100,000
10,000
1,000
100
10
1
TCE (ug/L)
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Date
Phase III Samples
Quarterly Samples
Phase III Trendline
Quarterly Trendline

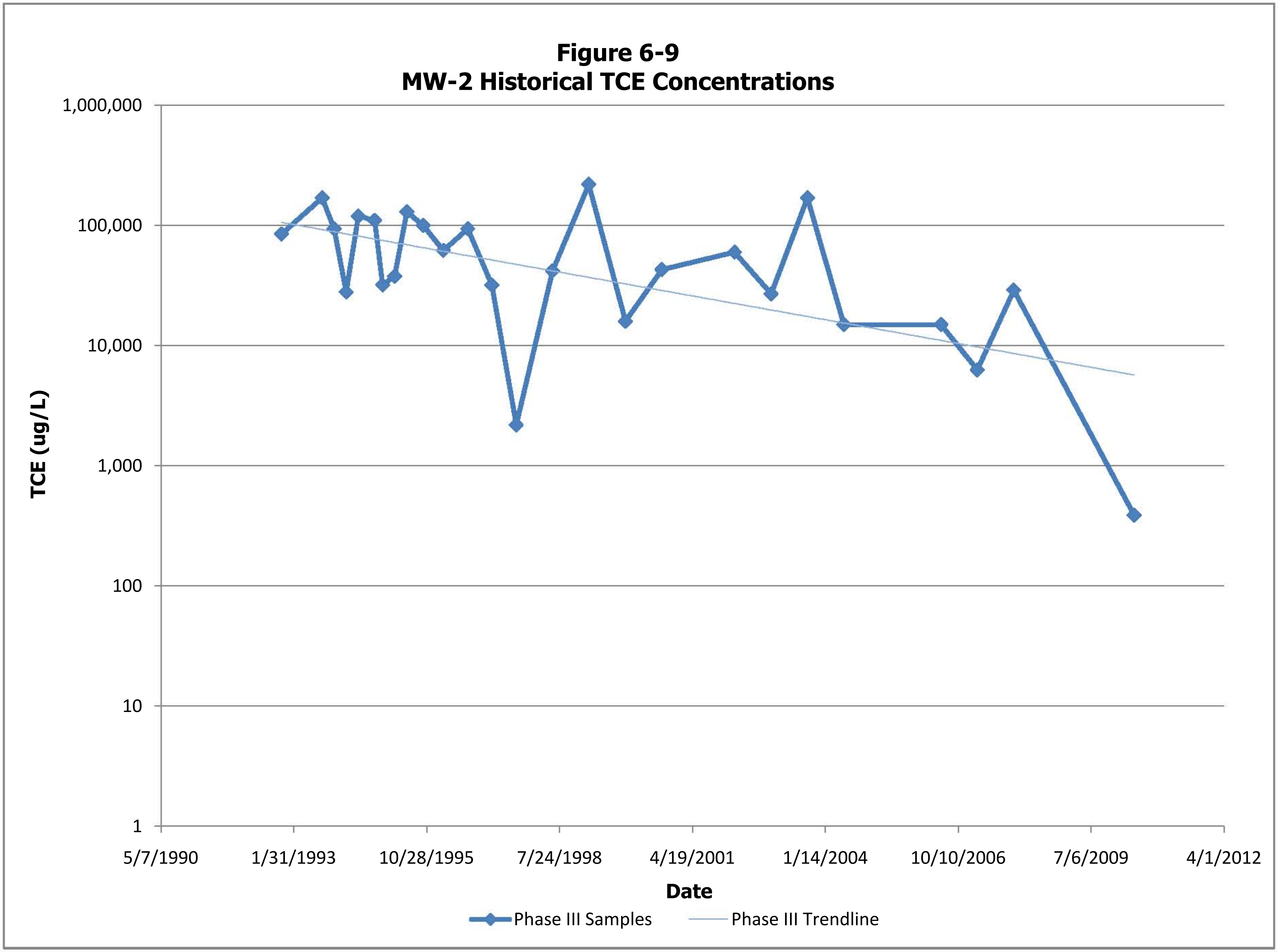
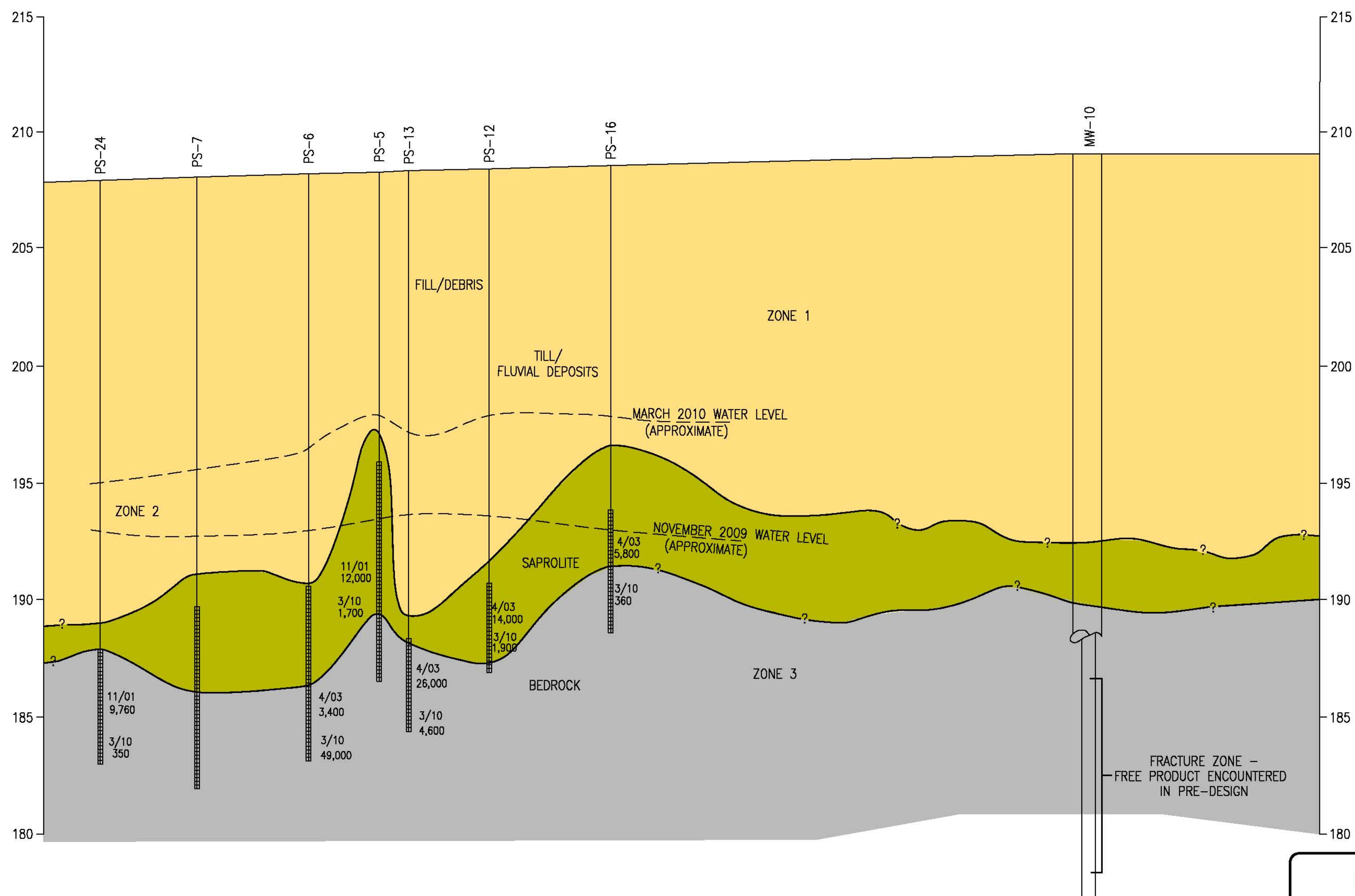


Figure 6-9
MW-2 Historical TCE Concentrations
1,000,000
100,000
10,000
1,000
100
10
1
TCE (ug/L)
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Date
Phase III Samples
Phase III Trendline



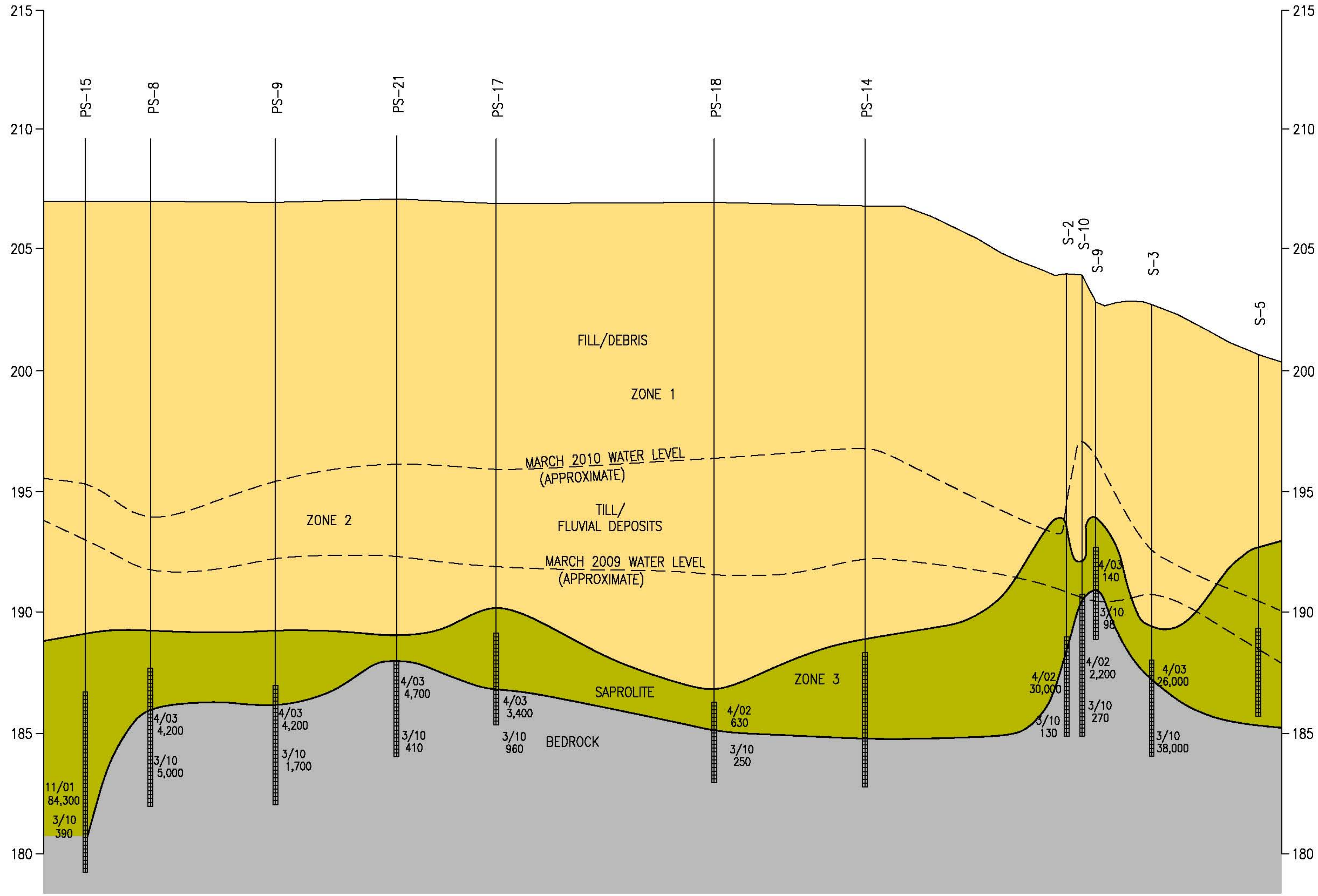
NOT TO SCALE

NOTES:
SOFT BEDROCK, SCHIST, MICA, AND CLAYED SILT WAS CLASSIFIED AS SAPROLITE.
SAND AND SILTY-SAND WAS CLASSIFIED AS FILL.
NOVEMBER 2009 AND MARCH 2010 WATER LEVELS WERE ADJUSTED TO ACCOUNT FOR RISERS ABOVE GRADE.
UNKNOWN RISER ELEVATIONS WERE DETERMINED USING THE AVERAGE OF MEASURED RISER ELEVATIONS OF PS-13, PS-12, PS-16, PS-15, PS-9, PS-21, PS-17, S-10, S-3 AND S-2.

FIGURE 7-1
CROSS SECTIONS – NORTH
MPE MANIFOLD
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY: RYAN A.	ENSAFE
DRAWN BY: BRONSON	(800) 588-7962
DWG DATE: 06/25/10	MEMPHIS, TENNESSEE
DWG NO: 1286_B001	

I:\2010 PROJECTS-BST\1286 STAMINA MILLS\Plans\1286_B001_CROSS SEC_STAMINA MILLS.dwg



NOT TO SCALE

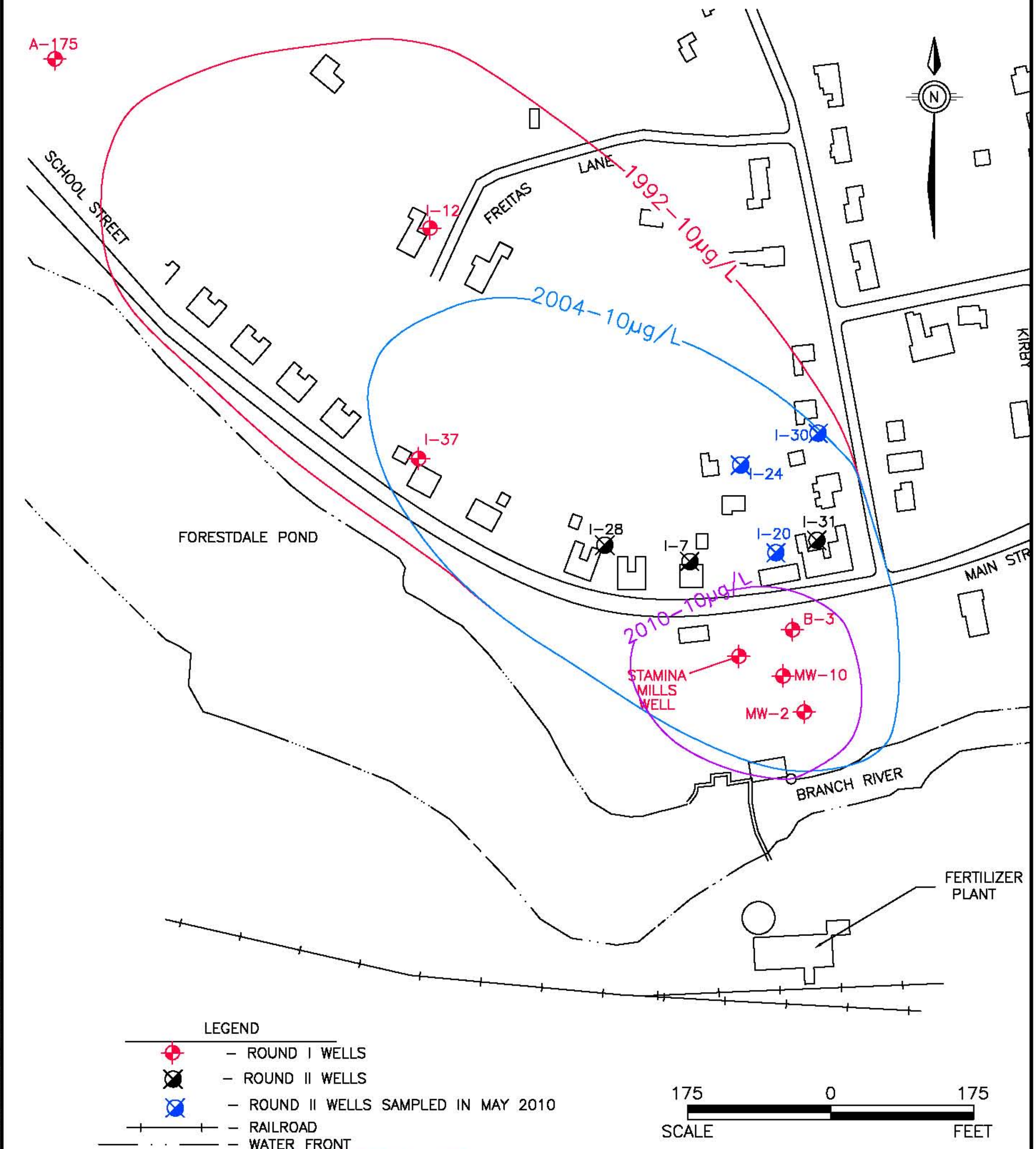
NOTES:
SOFT BEDROCK, SCHIST, MICA, AND CLAYED SILT WAS CLASSIFIED AS SAPROLITE.
SAND AND SILTY-SAND WAS CLASSIFIED AS FILL.
NOVEMBER 2009 AND MARCH 2010 WATER LEVELS WERE ADJUSTED TO ACCOUNT FOR RISERS ABOVE GRADE.
UNKNOWN RISER ELEVATIONS WERE DETERMINED USING THE AVERAGE OF MEASURED RISER ELEVATIONS OF PS-13, PS-12, PS-16, PS-15, PS-9, PS-21, PS-17, S-10, S-3 AND S-2.

FIGURE 7-2
CROSS SECTION – SOUTH
MPE MANIFOLD
5 YEAR REVIEW
STAMINA MILLS

REQUESTED BY:	RYAN A.
DRAWN BY:	BRONSON
DWG DATE:	06/23/10
DWG NO:	1286_B002

ENSAFE
(800) 588-7962
MEMPHIS, TENNESSEE

I:\2010 PROJECTS-BST\1286 STAMINA MILLS\Plans\1286_B002_CROSS SEC_STAMINA MILLS.dwg



LEGEND

- ROUND I WELLS
- ROUND II WELLS
- ROUND II WELLS SAMPLED IN MAY 2010
- RAILROAD
- WATER FRONT
- 10µg/L TCE ISOCON – 1992
- 10µg/L TCE ISOCON – 2004
- 10µg/L TCE ISOCON – 2010

NOTE:
ROUND 2 WELLS WILL BE ADDED TO THE MONITORING PROGRAM ONCE IT HAS BEEN DETERMINED THAT CLEANUP STANDARDS HAVE BEEN ATTAINED AT ROUND 1 OFFSITE MONITORING WELLS.

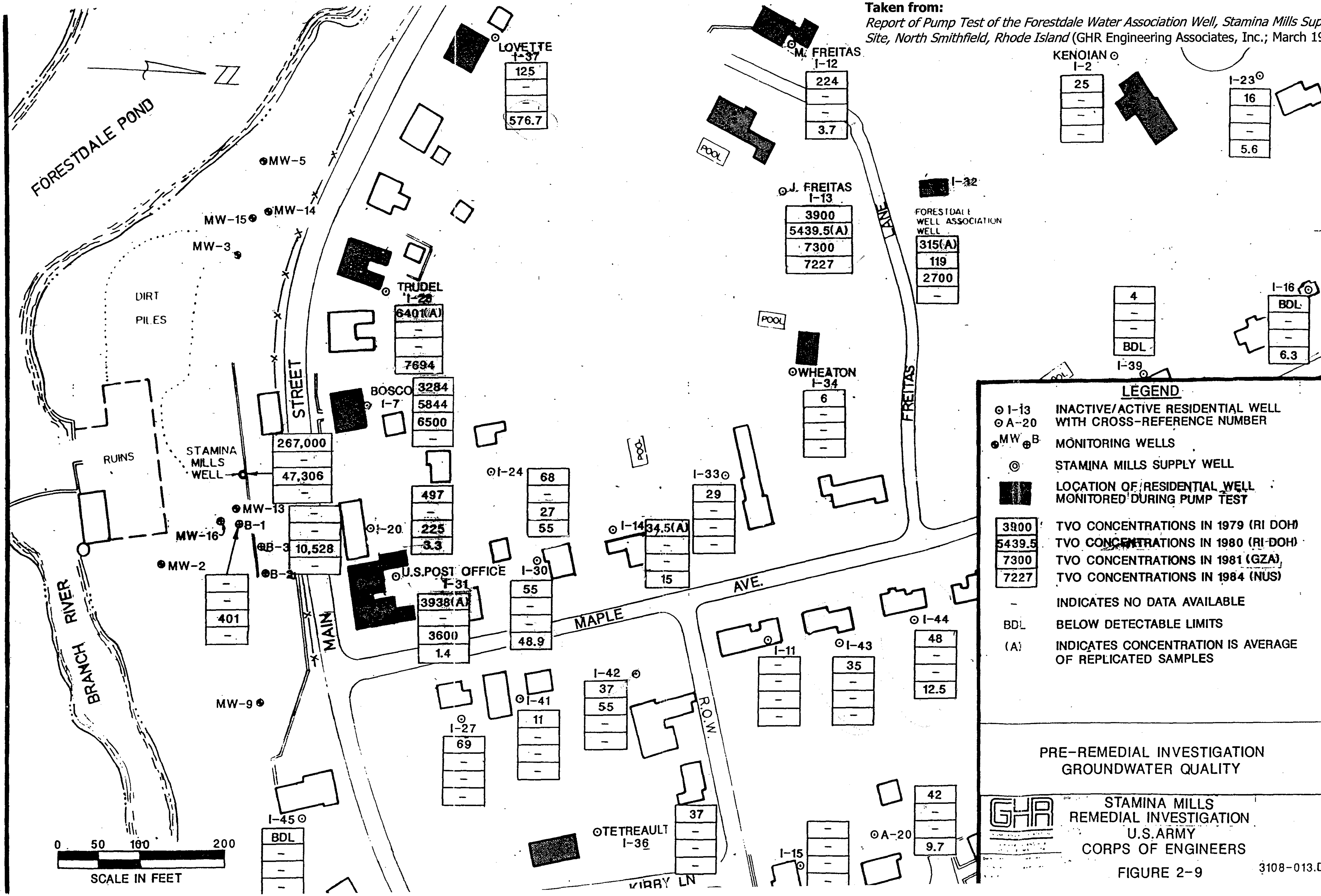
FIGURE 7-3
COMPARISON OF TCE CONCENTRATIONS
1993, 2004, AND 2010
5 YEAR REVIEW
STAMINA MILLS

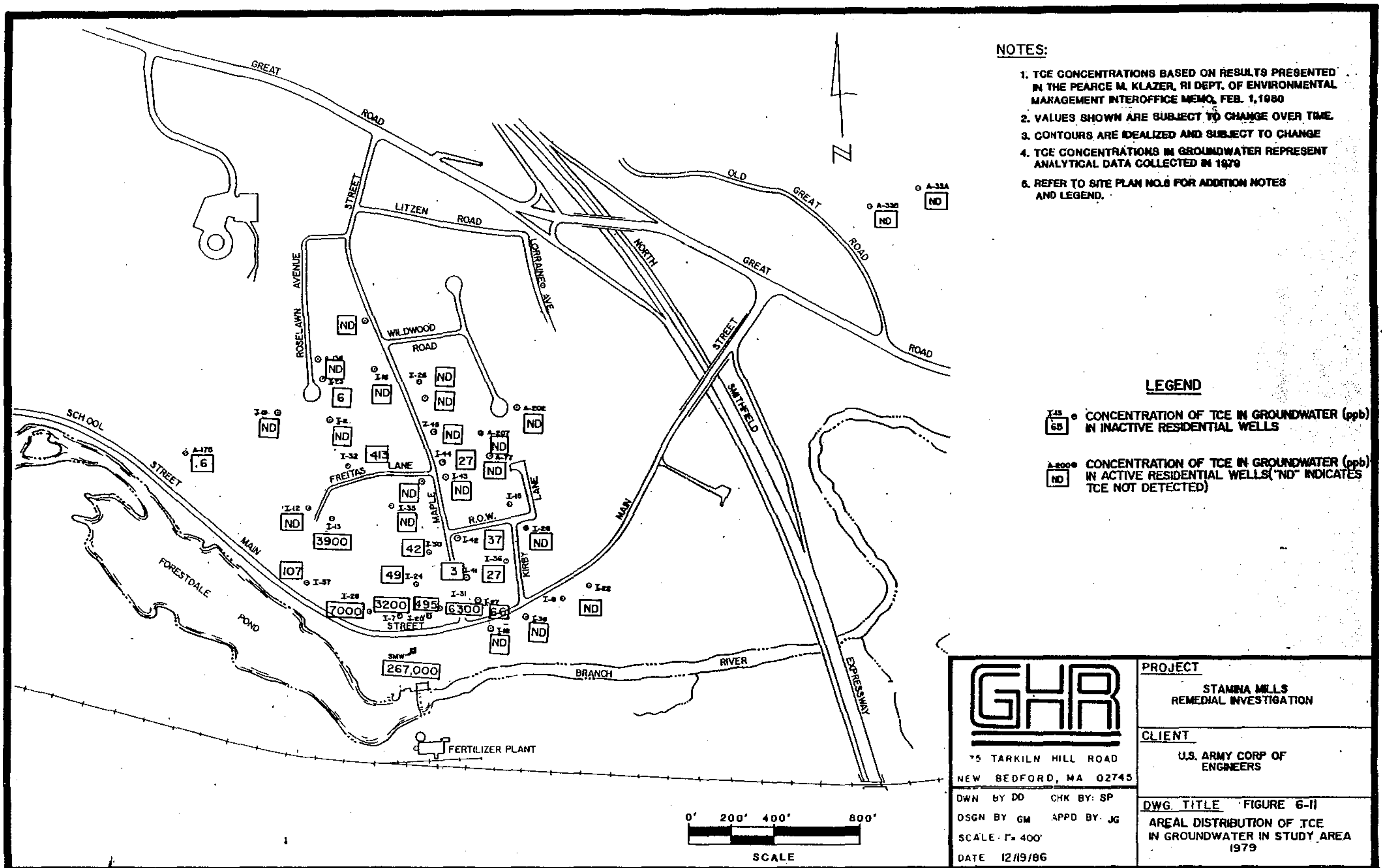
REQUESTED BY: RYAN A	ENSAFE (800) 588-7962 MEMPHIS, TENNESSEE
DRAWN BY: BRONSON	
DWG DATE: 06/25/10	
DWG NO: 1286_B010	

I:\2010 PROJECTS-BST\1286 STAMINA MILLS\PLANS\1286_B010_TCE CONC_STAMINA MILLS.DWG

Appendix B
Historical Diagrams and Figures

Taken from:
Report of Pump Test of the Forestdale Water Association Well, Stamina Mills Superfund Site, North Smithfield, Rhode Island (GHR Engineering Associates, Inc.; March 1989).





Taken from:
Remedial Investigation Report, Stamina Mills Site, North Smithfield, Rhode Island (GHR Engineering Associates, Inc.; January 1990).

Site Plan No. 4
(Map Pocket)
Taken from:
***Remedial Investigation Report, Stamina Mills Site, North Smithfield, Rhode Island* (GHR Engineering Associates, Inc.; January 1990).**

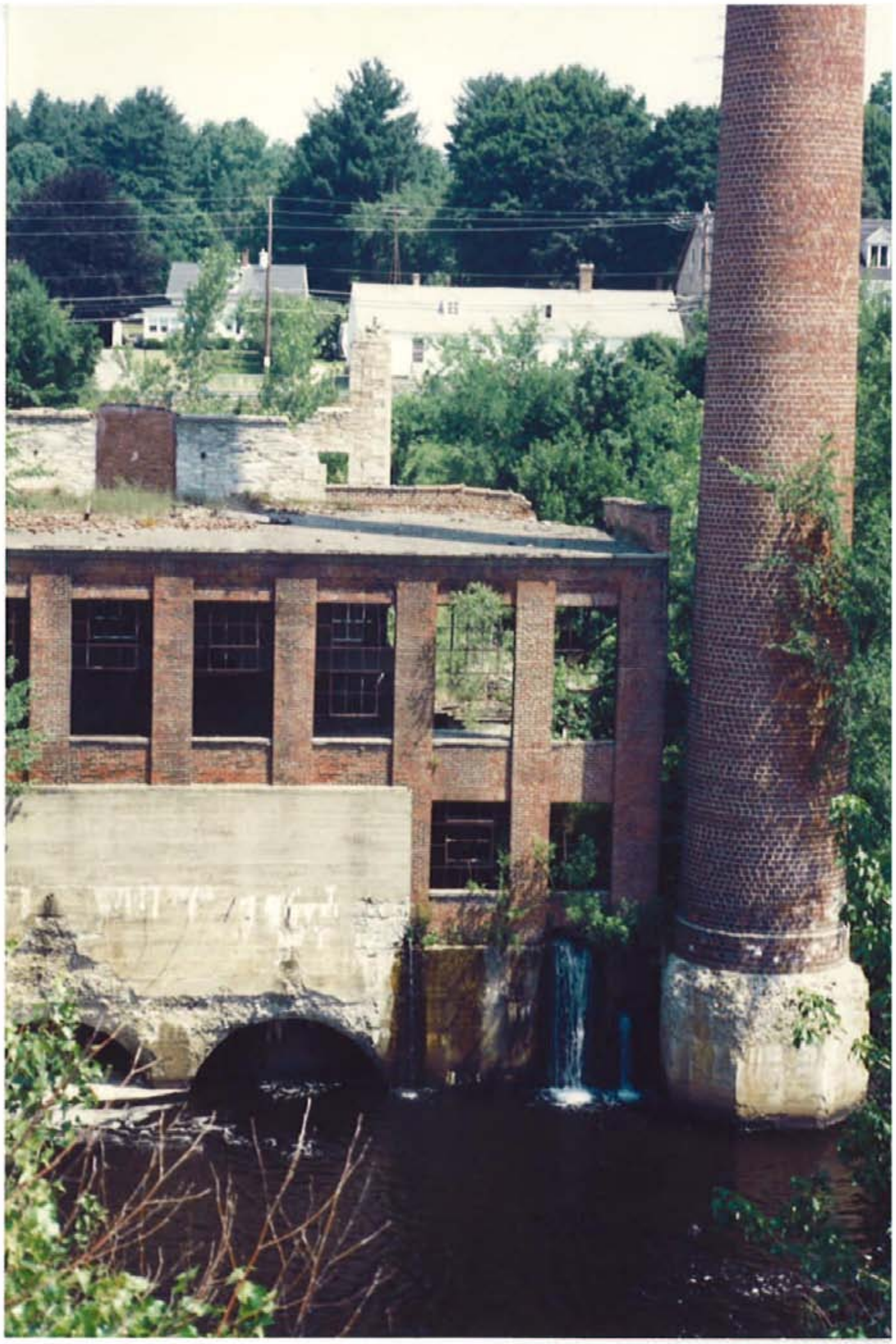

FORESTDALE POND
BRANCH RIVER
MAIN STREET
ROSELAWN AVENUE
MAPLE STREET
FREITAS LANE
WILDWOOD ROAD
LITZEN ROAD
KIRBY LANE
ROW
LORRAINE AVENUE
BRIDGE STREET
GREAT ROAD
NORTH SMITHFIELD EXPRESSWAY
UNDER CONSTRUCTION
PARKING
TENNIS COURT
POOL
U.S. POST OFFICE
FORESTDALE WELL ASSOCIATION WELL
STAMINA MILLS WELL
M. FREITAS
J. FREITAS
LOVETTE
TRUDEL
BOSCO
TETRAULT
NOTES
1. REFER TO SITE PLAN SP-3 FOR NOTES AND LEGEND
2. LOT NUMBERS SHOWN IN ELLIPSES ARE BASED ON TOWN OF N. SMITHFIELD ASSESSORS PLATS 2 AND 5; LOT LINES ARE APPROXIMATE ONLY
0 50 100 200 300
SCALE IN FEET
$$ — THINK VALUE ENGINEERING — $$
Revisions
Symbol | Descriptions | Date | Approved
LOCATION MONITORED DURING PUMP TEST | 9/88
LOCATION SAMPLED DURING RI INVESTIGATION | 9/88
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA
Designed by:
Drawn by:
Checked by:
Reviewed by:
Submitted by:
STAMINA MILLS
REMEDIAL INVESTIGATION
Scale: As Shown
Spec. No: DACA 45
Contract No: DACA 45
Sheet reference number:
Date
Drawing Code
SITE PLAN NO. 4

7100-028

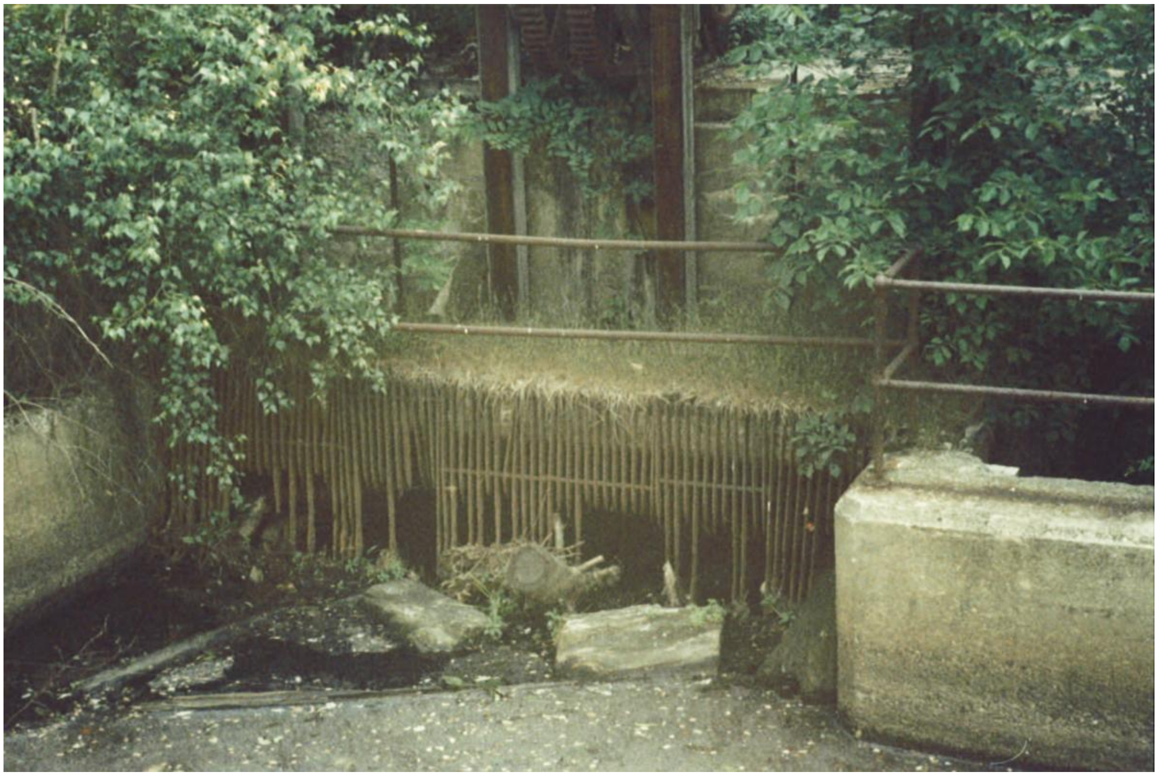
Appendix C
Select Historical Photographs

The Stamina Mills Site (date unknown). View is to the north, taken from the south side of the Branch River.

Stamina Mills fire, 1977. View is from School Street, toward the southeast.



Mill Ruins, view is north, from the south side of the Branch River. Note raceway opening in the foreground.



Mill ruins, view of raceway entrance, Forestdale Pond.

Stamina Mills site following demolition of mill buildings (1992/1993). View is toward northwest.

Stamina Mills site following site restoration (1993/1994). View is to southeast, prior to construction of SVE/MPE and treatment building.

Appendix D

Copy of North Smithfield Well Ordinance

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
THE TOWN OF NORTH SMITHFIELD

AN ORDINANCE OF THE TOWN COUNCIL
REGARDING GROUNWATER WELLS NEAR STAMINA MILL SITE

It is ordained by the Town Council of the Town of North Smithfield as follows:

That the Code of Ordinances shall be amended to add **Chapter 8, Article V**, to read as follows:

SECTION 1. Legislative Findings and Purpose

It is here declared that the public health and safety requires the cessation of well construction and well pumping activity within an area here defined as the Stamina Mill Remediation District. The scope of this district has been delineated by the United States Environmental Protection Agency as that area, due to groundwater patterns and proximity to the Stamina Mill Superfund site on School Street in Forestdale, North Smithfield, whose well pumping activities have the potential capacity to draw contaminants from the groundwater affected by the site. Furthermore, each lot in the delineated area has, for many years, been connected to a primary public water supply.

SECTION 2. No person shall install, construct or connect a groundwater well in any location within the Stamina Mill Groundwater Remediation District as defined on the attached maps, and attached schedule of included lots.

SECTION 3. No person shall use, pump from or in any way operate a groundwater well in any location within the Stamina Mill Groundwater Remediation District as defined on the attached map, and attached schedule of included lots.

SECTION 4. The Building Inspector is authorized to enforce the provisions of this chapter and to institute such proceedings, including proceedings to enjoin the above prohibited activities within the Stamina Mills Groundwater Remediation District, as necessary to effectuate the requirements of this chapter.

SECTION 5. Any person, firm, corporation or other entity who knowingly violates Sections 2 or 3 hereof shall be subject to a fine of not less than two hundred and fifty dollars ($250.00), nor more than five hundred dollars ($500.00). Each and every violation of this ordinance, and each and every day the violation continues or is repeated, shall constitute a separate offense. All such fines shall inure to the benefit of the town.

SECTION 6. The Building Inspector shall give copies of any violations issued pursuant to Section 4 or 5 above to (a) the Project Manager of the Stamina Mill Superfund Site, Office of Waste Management, Rhode Island Department of Environmental Management (RIDEM), 235 Promenade St., Providence, RI 02908, and (b) the Remedial Project Manager for the Stamina Mills Superfund Site, US Environmental Protection Agency (EPA) 1 Congress St., Suite 1100, Boston, MA 02114-2023, and shall provide written notice to the above of the repeal or modification of this ordinance or of any judicial decision that repeals or modifies this ordinance. The Building Inspector shall also provide to RIDEM and EPA an annual report on September 1 of the number and nature of violations in the prior year ending June 30. The Building Inspector may consult with and coordinate with RIDEM and EPA concerning the management of this ordinance.

SECTION 7. This ordinance shall not apply to any investigative monitoring well installed by or at the request or order of any federal, state, or local governmental authority.

SECTION 8. The Town Administrator shall request from the EPA, following the next EPA five-year review, and no later than January 1, 2011 substantiation of the continued necessity of this ordinance.

SECTION 9. This ordinance shall take effect on the date of passage in accordance with the Town Charter. There are two (2) attachments to the ordinance. One is a revised map of what the ordinance will include as well as a list with the involved lots affected by the ordinance.

Approved in form: [signature]
Mark C. Hadden, Town Solicitor

Received by Town Clerk: [signature] Date: April 19, 2006
Debra A. Todd

Posted Date: April 19, 2006

First Reading: May 1, 2006

Second Reading: May 15, 2006

Flaherty yes Thibault yes Yazbak yes Zwolenski yes Lovett recused

Approved by Town Administrator: [signature]
Robert B. Lowe


ENSAFE

PLAT-LOT	LOCATION	Well ID	HOUSE NUMBER	RATIONALE
005-136	MAPLE AVE	I-30	53	Current/previous contamination generally > 10 ug/L
005-137	MAPLE AVE		55	Current/previous contamination generally > 10 ug/L
005-269	MAPLE AVE	I-14	51	Current/previous contamination generally > 10 ug/L
005-135	MAPLE AVE			Current/previous contamination generally > 10 ug/L
005-134	MAPLE AVE	I-33	47	Current/previous contamination generally > 10 ug/L
005-132	MAPLE AVE	I-32		Current/previous contamination generally > 10 ug/L
005-133	MAPLE AVE		43	Current/previous contamination generally > 10 ug/L
005-435	SCHOOL ST	I-31	134	Current/previous contamination generally > 10 ug/L
005-136	SCHOOL ST	I-20	130	Current/previous contamination generally > 10 ug/L
005-139	SCHOOL ST	I-24	128	Current/previous contamination generally > 10 ug/L
005-140	SCHOOL ST	I-7	126	Current/previous contamination generally > 10 ug/L
005-141	SCHOOL ST		124	Current/previous contamination generally > 10 ug/L
005-142	SCHOOL ST	I-28	122	Current/previous contamination generally > 10 ug/L
005-143	SCHOOL ST		120	Current/previous contamination generally > 10 ug/L
005-144	SCHOOL ST		118	Current/previous contamination generally > 10 ug/L
005-145	SCHOOL ST	I-37	116	Current/previous contamination generally > 10 ug/L
005-146	SCHOOL ST		114	Current/previous contamination generally > 10 ug/L
005-147	SCHOOL ST		112	Current/previous contamination generally > 10 ug/L
005-148	SCHOOL ST	A-152	110	Current/previous contamination generally > 10 ug/L
005-149	SCHOOL ST		108	Current/previous contamination generally > 10 ug/L
005-150	SCHOOL ST		104	Current/previous contamination generally > 10 ug/L
005-151	SCHOOL ST			Current/previous contamination generally > 10 ug/L
005-170	SCHOOL ST		100	Current/previous contamination generally > 10 ug/L
005-284	FREITAS LANE	I-13	16	Current/previous contamination generally > 10 ug/L
005-286	FREITAS LANE	I-12	20	Current/previous contamination generally > 10 ug/L
005-277	FREITAS LANE	I-21	19	Current/previous contamination generally > 10 ug/L
005-393	FREITAS LANE	I-34	10	Current/previous contamination generally > 10 ug/L
005-022	FREITAS LANE	I-35		Current/previous contamination generally > 10 ug/L
005-288	SCHOOL ST	I-1	191	Potential pumping influence
005-160	SCHOOL ST		189	Potential pumping influence
005-159	SCHOOL ST	I-17	187	Potential pumping influence
005-158	SCHOOL ST	I-22	183	Potential pumping influence
005-157	SCHOOL ST	I-3	181	Potential pumping influence
005-156	SCHOOL ST	I-8	179	Potential pumping influence
005-155	SCHOOL ST	I-35	177	Potential pumping influence
005-154	SCHOOL ST	I-18	175	Potential pumping influence
005-153	SCHOOL ST		173	Potential pumping influence
005-035	SCHOOL ST	A-167	162	Potential pumping influence
005-257	SCHOOL ST		152	Potential pumping influence
005-346	SCHOOL ST			Potential pumping influence
005-168	SCHOOL ST			Potential pumping influence
005-249	SCHOOL ST			Potential pumping influence
005-130	SCHOOL ST			Potential pumping influence
005-330	KIRBY LANE	I-5	15	Potential pumping influence
005-331	KIRBY LANE	I-6	19	Potential pumping influence
005-332	KIRBY LANE			Potential pumping influence
005-328	KIRBY LANE	I-10	9	Potential pumping influence
005-329	KIRBY LANE	I-25	11	Potential pumping influence
005-368	KIRBY LANE			Potential pumping influence
005-344	KIRBY LANE			Potential pumping influence
005-345	KIRBY LANE	I-36	8	Potential pumping influence
005-309	KIRBY LANE	I-15	14	Potential pumping influence
005-342	KIRBY LANE			Potential pumping influence
005-034	MAPLE AVE		62	Potential pumping influence
005-282	MAPLE AVE	I-11	50	Potential pumping influence
005-286	MAPLE AVE	I-43	46	Potential pumping influence
005-176	MAPLE AVE	I-44	44	Potential pumping influence
005-252	MAPLE AVE	I-45	42	Potential pumping influence
005-243	MAPLE AVE			Potential pumping influence
005-316	MAPLE AVE		32	Potential pumping influence
005-315	MAPLE AVE	I-26	30	Potential pumping influence
005-259	MAPLE AVE	I-27	60	Potential pumping influence
005-265	MAPLE AVE	I-41	58	Potential pumping influence
005-264	MAPLE AVE			Potential pumping influence
005-437	MAPLE AVE	I-42	54	Potential pumping influence
005-199	MAPLE AVE	I-16	29	Potential pumping influence
005-186	MAPLE AVE		31	Potential pumping influence
005-209	MAPLE AVE	I-39	33	Potential pumping influence
005-231	MAPLE AVE	I-40	37	Potential pumping influence
005-230	ROSELAWN AVE	I-23	16	Potential pumping influence
005-412	ROSELAWN AVE	I-2	18	Potential pumping influence
005-409	ROSELAWN AVE	I-19	23	Potential pumping influence
005-446	ROSELAWN AVE	I-9	21	Potential pumping influence
005-289	INDUSTRIAL DRIVE	A-75	120	Potential pumping influence

Appendix E
Residential Well Index

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	LOCATION	Well ID	HOUSENUMBER	OWNER (2010)	ADDRESS/CONTACT INFORMATION		
005-277	FREITAS LANE	I-21	19	LOWE ROBERT B & MARION F	PO BOX 698	FORESTDALE RI 02824-0698	
005-284	FREITAS LANE	I-13	16	SCHMIDT CRAIG & CHERYL T/E	PO BOX 146	FORESTDALE RI 02824-0146	
005-285	FREITAS LANE	I-12	20	SULFARO KIM J	P O BOX 635	FORESTDALE RI 02824	
005-393	FREITAS LANE	I-34	10	WHEATON GUY E JR & DONNA J	PO BOX 73	FORESTDALE RI 02824-0073	
005-309	KIRBY LANE	I-15	14	GRENIER ROBERT P & ANNA T/E	PO BOX 144	FORESTDALE RI 02824-0144	
005-328	KIRBY LANE	I-10	9	GIGUERE LAURA N	PO BOX 621	FORESTDALE RI 02824-0000	
005-329	KIRBY LANE	I-25	11	LAFERRIERE BRIAN & JESSICA	11 KIRBY LANE	NORTH SMITHFIELD RI 02896	
005-330	KIRBY LANE	I-5	15	BARTLETT THERESE R	PO BOX 233	FORESTDALE RI 02824-0233	
005-331	KIRBY LANE	I-15	19	PATO BRIAN A	19 KIRBY LANE	FORESTDALE RI 02824	
005-334	KIRBY LANE	A-79	23	BAKER PATRICIA C	23 KIRBY LANE	FORESTDALE RI 02824	
005-335	KIRBY LANE	A-78	25	FORGET DONNA A	PO BOX 88	FORESTDALE RI 02824-0088	
005-338	KIRBY LANE	A-77	29	DAVIS CAROL I TRUST	PO BOX 252	FORESTDALE RI 02824-0252	
005-340	KIRBY LANE	A-76	16	O'MALLEY THOMAS P & HARRINGTON BONNIE T/	16 KIRBY LANE	PO BOX 125	FORESTDALE RI 02824-0125
005-345	KIRBY LANE	I-36	8	TETREAULT GAIL L	PO BOX 122	FORESTDALE RI 02824-0122	
005-281	LITZEN RD			LIGHTOWLER THERESA	PO BOX 114	FORESTDALE RI 02824-0114	
005-296	LITZEN RD	A-87	37	CLOUGH KEITH A	37 LITZEN RD	FORESTDALE RI 02824	
005-300	LITZEN RD	A-89	22	LIGHTOWLER FRANK E & THERESA C	PO BOX 114	FORESTDALE RI 02824-0114	
005-301	LITZEN RD	A-85	31	GOULD JUDITH D	31 LITZEN RD	NORTH SMITHFIELD RI 02896-7910	
005-303	LITZEN RD	A-90	47	HAFFNER LAMAR L & DOROTHY CO-TRUSTEES	47 LITZEN ROAD	N SMITHFIELD RI 02896-7910	
005-304	LITZEN RD	A-84	28	HAGGAS PAUL C & SARAH J RIENDEAU J/T	28 LITZEN RD	N SMITHFIELD RI 02896-0000	
005-310	LITZEN RD	A-83	44	WATERMAN JAMES H JR & VICTORIA R T/C	44 LITZEN RD	NORTH SMITHFIELD RI 02896-7911	
005-356	LITZEN RD		56	VADENAIS DIANE L & DENNIS J T/E	56 LITZEN ROAD	NORTH SMITHFIELD RI 02896-7911	
005-379	LITZEN RD	A-86	59	ST ONGE DOROTHEA L TRUSTEE	154 PATTON RD	WOONSOCKET RI 02895	
005-391	LITZEN RD	A-88	50	HEROUX ELAINE V	PO BOX 904	SLATERSVILLE RI 02876-0894	
005-041	LORRAINE AVE	A-93	42	MILLER HOWARD I MD & CRESCENT D T/E	42 LORRAINE AVE	NO SMITHFIELD RI 02896	
005-353	LORRAINE AVE	A-91	33	BRODEUR ROBERT C & GAIL L T/E	PO BOX 277	FORESTDALE RI 02824-0277	
005-358	LORRAINE AVE	A-98	23	SCHWEGLER JOHN & JULIE T/E	23 LORRAINE AVE	NORTH SMITHFIELD RI 02896-7912	
005-359	LORRAINE AVE	A-96	25	MCCOOEY THOMAS S & SALLY N T/E	25 LORRAINE AVE	N SMITHFIELD RI 02896-7912	
005-366	LORRAINE AVE		38	TELLIER RICHARD N & DEBORAH T/E	38 LORRAINE AVE	NO SMITHFIELD RI 02896	
005-373	LORRAINE AVE	A-97	26	KIERNAN BERNARD J & JOHNNA M T/E	26 LORRAINE AVE	N SMITHFIELD RI 02896-7913	
005-374	LORRAINE AVE	A-95	27	DUFAULT ANDRE R & DENISE M T/E	27 LORRAINE AVE	NORTH SMITHFIELD RI 02896-7912	
005-456	LORRAINE AVE	A-92	24	ROUSSELLE MARCEL P & PATRICIA A	PO BOX 68	FORESTDALE RI 02824-0068	
005-034	MAPLE AVE		62	TRINQUE DENNIS R & DONNA M	PO BOX 682	FORESTDALE RI 02824-0682	
005-132	MAPLE AVE	I-32		FORESTDALE WATER SYSTEM	TOWN OF NORTH SMITHFIELD	PO BOX 248	SLATERSVILLE RI 02876-0248
005-133	MAPLE AVE		43	AUSTIN DENNIS M JR & JAMIE L T/E	PO BOX 647	FORESTDALE RI 02824-0647	
005-134	MAPLE AVE	I-33	47	LILLEY JOHN S & FIELER ANN Y T/E	PO BOX 113	FORESTDALE RI 02824-0113	
005-136	MAPLE AVE	I-30	53	HARPIN-TUTAJ LISA J	C/O MICHAEL & WANDA J TUTAJ L/E	PO BOX 21	FORESTDALE RI 02824-0021
005-137	MAPLE AVE		55	TOLLIVER SANDRA A & BRIAN BURSELL	PO BOX 116	FORESTDALE RI 02824-0116	
005-171	MAPLE AVE	A-100	16	GIBBS SCOTT A & JANET ELIZABETH T/E	PO BOX 4	FORESTDALE RI 02824	
005-174	MAPLE AVE	A-105	12	VARIO KENNETH & LINDA T/E	12 MAPLE AVE	NO SMITHFIELD RI 02896	
005-178	MAPLE AVE	I-44	44	COURNOYER PAUL R & RACHEL L T/E	PO BOX 193	FORESTDALE RI 02824-0193	
005-181	MAPLE AVE		21	WHITTON ALAN E & STACEY T/E	P.O. BOX 463	SLATERSVILLE RI 02876-0463	
005-183	MAPLE AVE		25	WOJCIK MARY	PO BOX 606	FORESTDALE RI 02824-0606	
005-185	MAPLE AVE	A-103	14	OBRIEN SHARON T	PO BOX 62	FORESTDALE RI 02824-0062	
005-186	MAPLE AVE		31	GLATKI WILLIAM S & GARY W JT	PO BOX 131	FORESTDALE RI 02824-0131	
005-199	MAPLE AVE	I-16	29	CONNELL WILLIAM J & DIANE M T/E	P.O. BOX 698	FORESTDALE RI 02824-0698	
005-201	MAPLE AVE	A-102	22	AUGER RAYMOND P & JANE G T/E	PO BOX 215	FORESTDALE RI 02824-0215	
005-204	MAPLE AVE		27	CHAMPAGNE JAMES M & ANNE MARIE T/E	PO BOX 636	FORESTDALE RI 02824-0636	
005-206	MAPLE AVE	A-111	9	SMITH MICHELLE M	PO BOX 651	FORESTDALE RI 02824-0651	
005-209	MAPLE AVE	I-39	33	OKEEFE SUSAN R & DENNIS J T/E	PO BOX 273	FORESTDALE RI 02824	
005-231	MAPLE AVE	I-40	37	JANELLE M MARGUERITE L/E	REM ROBERTA ANN JANELLE	PO BOX 86	FORESTDALE RI 02824-0086
005-233	MAPLE AVE	A-107	5	GERVAIS LUC RAY A & JACQUELINE R L/E	P O BOX 46	FORESTDALE RI 02824	
005-238	MAPLE AVE		18	BISSONNETTE MARC P & JOAN E T/E	PO BOX 235	FORESTDALE RI 02824-0235	
005-243	MAPLE AVE			JANELLE ROBERT M TRUSTEE	PO BOX 86	FORESTDALE RI 02824-0086	
005-248	MAPLE AVE		26	WINKLEMAN JOHN J JR TRUSTEE	PO BOX 605	FORESTDALE RI 02824-0605	
005-252	MAPLE AVE	I-45	42	ALLGAIR THEODORE F & AMY B T/R	42 MAPLE AVE	NO SMITHFIELD RI 02896	
005-259	MAPLE AVE	I-27	60	TRINQUE DENNIS R & DONNA M	PO BOX 682	FORESTDALE RI 02824-0682	
005-265	MAPLE AVE	I-41	58	BARKER ELIZABETH	PO BOX 242	FORESTDALE RI 02824-0242	
005-269	MAPLE AVE	I-14	51	SAMSON AMELA A & MCCORMICK MICHAEL V J/T	PO BOX 25	FORESTDALE RI 02824	
005-282	MAPLE AVE	I-11	50	DUCHARME ROBERT R & BARBARA M	PO BOX 243	FORESTDALE RI 02824-0243	
005-286	MAPLE AVE	I-43	46	HANSON PATRICIA M	PO BOX 253	FORESTDALE RI 02824-0253	
005-295	MAPLE AVE	A-109	6	HAGAN PAUL J & DONNA M T/E	PO BOX 176	FORESTDALE RI 02824-0176	
005-298	MAPLE AVE	A-99	11	BRYAN THOMAS & CYNTHIA T/E	PO BOX 53	FORESTDALE RI 02824-0053	
005-315	MAPLE AVE	I-26	30	BANNON FREDERICK T & JANET M T/E	30 MAPLE AVE	NO SMITHFIELD RI 02896	
005-316	MAPLE AVE		32	SOLTYS MARTIN J + NANCY T/E	PO BOX 225	FORESTDALE RI 02824-0225	
005-437	MAPLE AVE	I-42	54	BATEMAN JOHN J	PO BOX 694	FORESTDALE RI 02824-0694	
005-020	ROSELAWN AVE	A-138	3	BOUCHER HENRY J & LOUISE T T/E	PO BOX 654	FORESTDALE RI 02824-0654	
005-187	ROSELAWN AVE	A-144	4	BERTHERMAN JAMES E & MARY LOU	PO BOX 123	SLATERSVILLE RI 02876-0123	
005-230	ROSELAWN AVE	I-23	16	SCHMIDT JAMES R & JULIA J	PO BOX 223	FORESTDALE RI 02824-0223	

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	LOCATION	Well ID	HOUSENUMBER	OWNER (2010)	ADDRESS/CONTACT INFORMATION			
005-234	ROSELAWN AVE	A-146	8	MARSHALL DIANE H & CLIFFORD JT	PO BOX 244	FORESTDALE RI 02824-0244		
005-299	ROSELAWN AVE	A-137	1	BOUCHER ELIZABETH E	PO BOX 32	FORESTDALE RI 02824-0032		
005-370	ROSELAWN AVE		15	LHEUREUX LYNN A	PO BOX 279	FORESTDALE RI 02824-0279		
005-388	ROSELAWN AVE	A-136	14	ST VINCENT ROLAND D & CAROLYN J T/E	PO BOX 686	FORESTDALE RI 02824-0686		
005-403	ROSELAWN AVE	A-139	9	ORLANDO FLORENCE T & HUESTIS LINDA S J/T	PO BOX 121	FORESTDALE RI 02824-0121		
005-408	ROSELAWN AVE	A-140	19	KIERNAN PAUL E & SUZANNE T TRUSTEES	PO BOX 623	FORESTDALE RI 02824-0623		
005-409	ROSELAWN AVE	I-19	23	LAFONTAINE CHARLES R & MURIEL L T/E	PO BOX 184	FORESTDALE RI 02824-0184		
005-412	ROSELAWN AVE	I-2	18	KENOIAN CHARLES S & ROBIN M T/E	PO BOX 104	FORESTDALE RI 02824-0104		
005-419	ROSELAWN AVE		11	MCGOVERN ROBERT C JR & PATRICIA N T/E	PO BOX 704	FORESTDALE RI 02824-0704		
005-420	ROSELAWN AVE	A-142	10	TOWNSEND GLENN P & CAROL A T/E	PO BOX 715	FORESTDALE RI 02824-0715		
005-424	ROSELAWN AVE	A-141	12	CABRAL MARK V & SARA PETERSON T/E	PO BOX 136	FORESTDALE RI 02824-0136		
005-444	ROSELAWN AVE	A-143	17	PELLETIER JEFFREY G & LYNNE A T/E	PO BOX 226	FORESTDALE RI 02824-0226		
005-446	ROSELAWN AVE	I-9	21	COTE MARCEL A & MARTHA M	PO BOX 162	FORESTDALE RI 02824-0162		
005-434	ROSELAWN AVE (REAR)			AMERICAN TEL & TEL CO	PPYT TAX DIVISION	PO BOX 7207	BEDMINSTER NJ 07921-7207	
005-001	SCHOOL ST		20	CARCHIA JOSEPH & MARIA T/E	PO BOX 914	SLATERSVILLE RI 02876-0894		
005-004	SCHOOL ST		60	COLONIAL VILLAGE ASSOCIATES LTP	C/O CVA DEVELOPERS LLC	5 CATHEDRAL SQ	PROVIDENCE RI 02903	
005-005	SCHOOL ST			TOWN OF N SMITHFIELD	PO BOX 248	SLATERSVILLE RI 02876-0248		
005-006	SCHOOL ST		30	WIENS RICHARD H & DANIELLE D T/E	PO BOX 311	SLATERSVILLE RI 02876-0311		
005-007	SCHOOL ST		40	VADENAIS NORMAND G & MARGUERITE C	PO BOX 187	SLATERSVILLE RI 02876-0187		
005-008	SCHOOL ST		42	LEITAO JUDITH C	PO BOX 151	SLATERSVILLE RI 02876-0151		
005-009	SCHOOL ST		52	KENOIAN HAROLD H & LILLIAN	PO BOX 436	SLATERSVILLE RI 02876-0436		
005-010	SCHOOL ST		54	SLATERSVILLE CONGREGATL CHURCH	PO BOX 808	SLATERSVILLE RI 02876		
005-011	SCHOOL ST		58	JOLY ANGELIQUE	1380 IRON MINE HILL RD	NO SMITHFIELD RI 02896		
005-012	SCHOOL ST		62	BELL MICHAEL TRUSTEE	PO BOX 652	SLATERSVILLE RI 02876-0652		
005-013	SCHOOL ST		70	HOUDE RUSSELL L JR & MONICA K T/E	PO BOX 1042	SLATERSVILLE RI 02876-0897		
005-014	SCHOOL ST		74	ARPIN JACQUELINE A	P O BOX 398	SLATERSVILLE RI 02876-0398		
005-015	SCHOOL ST		78	BERGERON RONALD R JR	78 SCHOOL ST	SLATERSVILLE RI 02876		
005-017	SCHOOL ST		82	HAMCO LLC	273 GREAT ROAD	NORTH SMITHFIELD RI 02896-7055		
005-033	SCHOOL ST			SEDONA ASSOCIATES LLC /	TOWN OF NO SMITHFIELD	1445 WAMPANOAG TRAIL	SUITE 203	EAST PROVIDENCE RI 02915
005-035	SCHOOL ST	A-167	162	ONEILL JOHN R & SUZANNE JT	PO BOX 92	FORESTDALE RI 02824-0092		
005-038	SCHOOL ST	A-147	166	DAIGNAULT CHERYL A & RALPHAEL JR T/E	PO BOX 695	FORESTDALE RI 02824-0695		
005-039	SCHOOL ST	A-159		ELEANOR HOWARD SCHOOL	n/a	N SMITHFIELD RI 02896		
005-046	SCHOOL ST	A-162	197	KERRIGAN ALICE A	PO BOX 165	FORESTDALE RI 02824-0165		
005-047	SCHOOL ST	A-164	201	HOPPE FREDERICK W SR & BARBARA A T/E	PO BOX 181	FORESTDALE RI 02824-0181		
005-048	SCHOOL ST	A-155	205	HOPPE FREDERICK W SR & BARBARA A T/E	PO BOX 181	FORESTDALE RI 02824-0181		
005-105	SCHOOL ST		53	SZARO JEANNETTE D	PO BOX 498	SLATERSVILLE RI 02876-0498		
005-106	SCHOOL ST	A-156	194	BELLOWS FREDERICK & YUK PING T/E	PO BOX 716	FORESTDALE RI 02824-0716		
005-138	SCHOOL ST	I-20	130	JOHNSON KYLE D & POWERS JAIME L J/T	PO BOX 57	FORESTDALE RI 02824-0057		
005-139	SCHOOL ST	I-24	128	GRAVEL WILLIAM J & SARAH E T/E	P O BOX 74	FORESTDALE RI 02824		
005-140	SCHOOL ST	I-7	126	MARACAYO ROBERT & ALMANZAR MARIBELT J/T	PO BOX 97	FORESTDALE RI 02824-0097		
005-141	SCHOOL ST		124	RUDIS CHRISTIE A & HOLMES WALTER F JT	124 SCHOOL ST	NO SMITHFIELD RI 02896		
005-142	SCHOOL ST	I-28	122	TRUDEL ALAN D & LYNNE M TE	PO BOX 613	FORESTDALE RI 02824-0613		
005-143	SCHOOL ST		120	AUBIN THOMAS W	PO BOX 545	FORESTDALE RI 02824	FORESTDALE RI 02824	
005-144	SCHOOL ST		118	RECORE RICHARD A & CLAUDETTE H T/E	PO BOX 234	FORESTDALE RI 02824-0234		
005-145	SCHOOL ST	I-37	116	LOVETT DAVID A & ET AL	PO BOX 65	FORESTDALE RI 02824		
005-146	SCHOOL ST		114	DIONNE ROBERT P & SARANNE M T/E	PO BOX 342	CHEPACHET RI 02814-0342		
005-147	SCHOOL ST		112	DIONNE ROBERT P & SARANNE M T/E	PO BOX 342	CHEPACHET RI 02814-0342		
005-148	SCHOOL ST	A-152	110	DIONNE ROBERT P & SARANNE M T/E	PO BOX 342	CHEPACHET RI 02814-0342		
005-149	SCHOOL ST		108	DIONNE ROBERT P & SARANNE M T/E	PO BOX 342	CHEPACHET RI 02814-0342		
005-150	SCHOOL ST		104	ANNIS ARTHUR J & YVONNE J/T	PO BOX 83	SLATERSVILLE RI 02876		
005-152	SCHOOL ST	A-168	178	PHANEUF DARYL E & KUCHARSKI JODY L J/T	PO BOX 134	FORESTDALE RI 02824-0134		
005-153-A	SCHOOL ST		173	BYRNES MICHAEL T	PO BOX 88	SLATERSVILLE RI 02876		
005-153-B	SCHOOL ST		173	BUSHNELL JESSE	PO BOX 637	FORESTDALE RI 02824		
005-154	SCHOOL ST	I-18	175	HOPPE FREDERICK W SR & BARBARA A T/E	PO BOX 181	FORESTDALE RI 02824-0181		
005-155	SCHOOL ST	I-38	177	CONTILDES ALFRED J TRUSTEE 1/2 &	CONTILDES ALFRED III & CHRISTINE H T/E	PO BOX 106	FORESTDALE RI 02824-0106	
005-156	SCHOOL ST	I-8	179	CAMARA FRANCIS R & PATRICIA L T/E	PO BOX 8	FORESTDALE RI 02824-0008		
005-157	SCHOOL ST	I-3	181	GALLAGHER KERRY ANN & LOZEAU PAUL G JR	PO BOX 214	FORESTDALE RI 02824-0214		
005-158	SCHOOL ST	I-22	183	MANDEVILLE R ELAINE & THOMAS R TRUSTEES	PO BOX 151	FORESTDALE RI 02824-0151		
005-159	SCHOOL ST	I-17	187	DOHERTY CHARLES B & LISA M T/E	PO BOX 281	FORESTDALE RI 02824-0281		
005-160	SCHOOL ST		189	SALEMI ROBERT E & RICHARD G J/T	PO BOX 152	FORESTDALE RI 02824-0152		
005-168	SCHOOL ST			ONE FIFTY TWO SCHOOL ST RE PARTNERSHIP	PO BOX 129	FORESTDALE RI 02824-0129		
005-170	SCHOOL ST		100	ETHIER JOHN C & ANN MARIE T/E	1075 QUAKER HWY	UXBRIDGE MA 01569-2234		
005-175	SCHOOL ST		94	BRANCHAUD NORMAND L & EVA L T/E	PO BOX 251	FORESTDALE RI 02824-0251		
005-176	SCHOOL ST	A-175, A-176	98	LECLAIR-KOZLIK-LOGAN & BASSETT	VFW POST 6342	PO BOX 96	SLATERSVILLE RI 02876	
005-208	SCHOOL ST		66	INZER RONALD & NANCY JT	PO BOX 339	SLATERSVILLE RI 02876-0339		
005-237	SCHOOL ST		76	HOPPE CAROL A & MARSHALL VAUGHN	PO BOX 366	SLATERSVILLE RI 02876-0366		
005-249	SCHOOL ST			ED CONSTRUCTION INC	515 DOUGLAS PK	NO SMITHFIELD RI 02896		
005-257	SCHOOL ST		152	ONE FIFTY TWO SCHOOL ST RE PARTNERSHIP	PO BOX 129	FORESTDALE RI 02824-0129		
005-271	SCHOOL ST	A-174	174	DESROSIERS ROBERT O & DEBORAH L T/E	PO BOX 667	FORESTDALE RI 02824-0667		

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	LOCATION	Well ID	HOUSENUMBER	OWNER (2010)	ADDRESS/CONTACT INFORMATION		
005-283	SCHOOL ST		84	GOVERNO ERIC S	PO BOX 105	FORESTDALE RI 02824-0105	
005-288	SCHOOL ST	I-1	191	TOUSIGNANT KENNETH L & AMANDA B T/E	191 SCHOOL STREET	FORESTDALE RI 02824	
005-294	SCHOOL ST	A-165	207	ROBINSON RICHARD R & THERESA A T/E	PO BOX 72	FORESTDALE RI 02824-0072	
005-305	SCHOOL ST		22	COURNOYER JEFFREY ETAL	PO BOX 231	SLATERSVILLE RI 02876-0231	
005-346	SCHOOL ST			ONE FIFTY TWO SCHOOL ST RE PARTNERSHIP	PO BOX 129	FORESTDALE RI 02824-0129	
005-355	SCHOOL ST	A-173	193	VANHOUWE LOUISE P TRUSTEE	PO BOX 75	FORESTDALE RI 02824-0075	
005-372	SCHOOL ST		43	TREMBLAY STEPHEN & NICOLE R T/E	43 SCHOOL ST	NORTH SMITHFIELD RI 02896-7921	
005-383	SCHOOL ST		47	POTENZA RICHARD F	PO BOX 512	SLATERSVILLE RI 02876-0512	
005-400	SCHOOL ST		59	HOYLE WAYNE B & GERTRUDE G T/E	PO BOX 687	SLATERSVILLE RI 02876-0687	
005-406	SCHOOL ST		73	PEREZ ERICKSEN	PO BOX 1202	SLATERSVILLE RI 02876	
005-423	SCHOOL ST		90	V-H INC	PO BOX 669	FORESTDALE RI 02824-0669	
005-435	SCHOOL ST	I-31	134	MCGEE THOMAS P IV	125 BLACK PLAIN ROAD	NORTH SMITHFIELD RI 02896-8	
005-476	SCHOOL ST		203	HOPPE FREDERICK W JR & DIANE J TE	PO BOX 203	FORESTDALE RI 02824-0203	
002-009	VICTORY HWY		355	HOULE ROBERT R TRUSTEE	355 VICTORY HWY	NO SMITHFIELD RI 02896-0000	
002-010	VICTORY HWY		333	GUERIN RICHARD A & DOUGHTY LINDA J J/T	333 VICTORY HWY	NORTH SMITHFIELD RI 02896-7741	
002-023	VICTORY HWY		233	CHACE ONEILL BEATRICE J	233 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-024	VICTORY HWY	A-215	261	NERBONNE ANNETTE E	261 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-025	VICTORY HWY		267	RICHARD EDGAR J ETAL	267 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-027	VICTORY HWY		531	SCOTLAND LINDA LEE	PO BOX 474	SLATERSVILLE RI 02876	
002-041	VICTORY HWY		358	DR HARRY L HALLIWELL MEMORIAL SCHOOL	PO BOX 72	SLATERSVILLE RI 02876-0072	
002-043	VICTORY HWY		270	QUIJANO ERIC & RODRIQUES IRMA I T/E	270 VICTORY HWY	N SMITHFIELD RI 02896-7705	
002-046	VICTORY HWY		285	GLAUDE GEORGE H & RITA F T/E	285 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-050	VICTORY HWY		460	LEDGER KRISTIN	460 VICTORY HWY	NORTH SMITHFIELD RI 02896-7740	
002-051	VICTORY HWY		354	HAGAN KIMBERLY J	354 VICTORY HWY	NORTH SMITHFIELD RI 02896-7705	
002-052	VICTORY HWY		305	FREDETTE RONALD & MONIQUE M J/T	305 VICTORY HWY	NORTH SMITHFIELD RI 02896-7741	
002-053	VICTORY HWY		235	COTE CLEMENT J & MARY ANN T/E	235 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-061	VICTORY HWY		219	BEAULIEU MICHAEL D & SUZANNE C T/E	219 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-062	VICTORY HWY		286	MURRAY ANNE E	286 VICTORY HWY	NORTH SMITHFIELD RI 02896-7705	
002-063	VICTORY HWY		302	BAILLARGEON ERIC A & COSTELLO ANN MARIE	302 VICTORY HWY	N SMITHFIELD RI 02896-7705	
002-065	VICTORY HWY		443	RAFFERTY CAITLIN ELIZABETH &	RAFFERTY EDW J III & EILEEN M L/E	PO BOX 164	FORESTDALE RI 02824-0164
002-069	VICTORY HWY		357	WORDELL KENNETH	357 VICTORY HWY	NORTH SMITHFIELD RI 02896-7741	
002-076	VICTORY HWY		293	COUSINEAU PAUL J & LISA E T/E	293 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-081	VICTORY HWY		539	POIRIER KEVIN W & KIMBERLY	539 VICTORY HWY	N SMITHFIELD RI 02896-7713	
002-082	VICTORY HWY		451	KELLY PAUL S & EILEEN B T/E	451 VICTORY HWY	N SMITHFIELD RI 02896-7751	
002-083	VICTORY HWY		503	MARTINEAU BRUCE W & MADELEINE L JT	503 VICTORY HWY	N SMITHFIELD RI 02896-7713	
002-084	VICTORY HWY		473	PERRY WILLIAM C & JOAN L	PO BOX 542	SLATERSVILLE RI 02876-0542	
002-085	VICTORY HWY		489	FORGET ROBERT A & ANTOINETTE J T/E	489 VICTORY HWY	NORTH SMITHFIELD RI 02896-7751	
002-086	VICTORY HWY		445	CHAUSSE ROBERT & SANDRA A JT	445 VICTORY HWY	N SMITHFIELD RI 02896-7751	
002-087	VICTORY HWY		515	BROOKS MILES S	PO BOX 805	SLATERSVILLE RI 02876-0899	
002-090	VICTORY HWY		405	GLAUDE JOSEPH M & TAMMY L T/E	405 VICTORY HWY	NORTH SMITHFIELD RI 02896-7742	
002-091	VICTORY HWY		383	ROY RONALD J & CONSTANCE C TE	383 VICTORY HWY	N SMITHFIELD RI 02896-7741	
002-102	VICTORY HWY		295	MORRIS AMEY L	295 VICTORY HWY	NORTH SMITHFIELD RI 02896-7709	
002-104	VICTORY HWY		275	GERMAIN ALBERT & RITA R T/E	275 VICTORY HWY	N SMITHFIELD RI 02896-7709	
002-113	VICTORY HWY		431	KOZIOL KAREN M	431 VICTORY HWY	NO SMITHFIELD RI 02896	
002-116	VICTORY HWY		557	DUGAS DOUGLAS & ERIN G	557 VICTORY HWY	NORTH SMITHFIELD RI 02896-7713	
002-124	VICTORY HWY	A-216	356	BABINEAU JOHN M & JANE M	356 VICTORY HWY	N SMITHFIELD RI 02896-7705	
002-136	VICTORY HWY		536	CUTITAR MARLENE TRUSTEE OF	THE MARLENE CUTITAR TRUST	123 OAK TREE AVE	WARWICK RI 02886
002-140	VICTORY HWY	A-214	323	BAZINET JOHN R & KAREN T/E	323 VICTORY HWY	NORTH SMITHFIELD RI 02896-7741	
002-143	VICTORY HWY		544	HAVUNEN KIM M	18 MARIA ST	LINCOLN RI 02865-1416	
002-159	VICTORY HWY		490	WIGGINS EDWARD J & HELEN A TE	PO BOX 1454	PROVIDENCE RI 02901-1454	
002-167	VICTORY HWY		484	WIGGINS EDWARD J & HELEN A TE	PO BOX 1454	PROVIDENCE RI 02901-1454	
002-218	VICTORY HWY			AMERICAN TEL & TEL CO	PPYT TAX DIVISION	PO BOX 7207	BEDMINSTER NJ 07921-7207
002-221	VICTORY HWY		502	WIGGINS EDWARD J & HELEN A TE	PO BOX 1454	PROVIDENCE RI 02901-1454	
002-300	VICTORY HWY		570	GAUTHIER THOMAS J & JEANNINE E T/E	PO BOX 691	SLATERSVILLE RI 02876-0691	
002-301	VICTORY HWY		554	NIEDZWIADEK DANUTA	554 VICTORY HWY	N SMITHFIELD RI 02896-7740	
005-240	VICTORY HWY		246	GOODWIN SCOTT A & LISA M	246 VICTORY HWY	N SMITHFIELD RI 02896-7705	
005-245	VICTORY HWY	A-106	250	MARKS LINDA L TRUSTEE	250 VICTORY HWY	NORTH SMITHFIELD RI 02896-7705	
005-468	VICTORY HWY			GOODWIN SCOTT A & LISA M	246 VICTORY HWY	N SMITHFIELD RI 02896-7705	
005-040	WILDWOOD RD	A-196	12	PUCCETTI JONATHAN C & STACIE J T/E	PO BOX 204	FORESTDALE RI 02824	
005-235	WILDWOOD RD	A-200	2	HUTCHINS PHYLIS H	PO BOX 94	FORESTDALE RI 02824-0094	
005-313	WILDWOOD RD	A-210	3	HARNOIS PHILIP A	PO BOX 178	WOONSOCKET RI 02895-0780	
005-314	WILDWOOD RD	A-205	1	JALOWY JOSEPH J & GLORIA B TRUSTEES	PO BOX 262	FORESTDALE RI 02824-0262	
005-317	WILDWOOD RD	A-201	5	JAMES CHERYL-ANN	5 WILDWOOD RD	N SMITHFIELD RI 02896	
005-318	WILDWOOD RD	A-203	7	RIDGE ETHELWYNNE A TRUST	PO BOX 697	FORESTDALE RI 02824-0697	
005-319	WILDWOOD RD		9	MCCOOEY THOMAS S & MARGARET M	PO BOX 182	FORESTDALE RI 02824-0182	
005-320	WILDWOOD RD	A-202	11	ZONIN MATTHEW J & GLORIA V T/E	11 WILDWOOD ROAD	NO SMITHFIELD RI 02896	
005-322	WILDWOOD RD		17	HANKINS JONATHAN M & BRENDA R T/E	PO BOX 17	FORESTDALE RI 02824-0017	
005-323	WILDWOOD RD	A-208	19	MCCOOEY SALLY N &NORTH LOIS R L/E	25 LORRAINE AVE	NORTH SMITHFIELD RI 02896-7912	
005-324	WILDWOOD RD			MCCOOEY SALLY N &NORTH LOIS R L/E	25 LORRAINE AVE	NORTH SMITHFIELD RI 02896-7912	

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	LOCATION	Well ID	HOUSENUMBER	OWNER (2010)	ADDRESS/CONTACT INFORMATION		
005-325	WILDWOOD RD		16	DYS GEORGE D & PRETE DIANE M J/T	PO BOX 247	FORESTDALE RI 02824-0247	
005-326	WILDWOOD RD	A-206	6	ROLLINS NELLIE M TRUSTEE	PO BOX 206	FORESTDALE RI 02824-0206	
005-327	WILDWOOD RD		8	HOLMES PETER K & JOANNE S T/E	PO BOX 673	FORESTDALE RI 02824-0673	
005-387	WILDWOOD RD	A-199	14	ALLISON MARIE M	PO BOX 213	FORESTDALE RI 02824-0213	
005-401	WILDWOOD RD	A-209	10	OBRIEN JAMES J & MARILYN L	PO BOX 103	FORESTDALE RI 02824-0103	
002-042	not found in 2010 rolls			MURRAY EUGENE F & ANNE E	286 VICTORY HWY	NORTH SMITHFIELD RI 02896	
002-054	not found in 2010 rolls			BEAULIEU MICHAEL D & SUZANNE C T/E	219 VICTORY HWY	N SMITHFIELD RI 02896-0000	
005-022				WHEATON GUY E JR & DONNA J	PO BOX 73	FORESTDALE RI 02824-0073	
005-032	not found in 2010 rolls			SLATERSVILLE RIVER PROPERTIES INC	PO BOX 158	SLATERSVILLE RI 02876	
005-131				WHITTON ALAN E & STACEY T/E	P.O. BOX 463	SLATERSVILLE RI 02876-0463	
005-151	not found in 2010 rolls			ANNIS ARTHUR J & YVONNE J/T	PO BOX 83	SLATERSVILLE RI 02876	
005-177	not found in 2010 rolls			BAILLARGEON ERIC A & COSTELLO ANN MARIE	302 VICTORY HWY	N SMITHFIELD RI 02896-0000	
005-264	not found in 2010 rolls			BATEMAN JOHN J	54 MAPLE AVE PO BOX 694	FORESTDALE RI 02824-0000	
005-321	not found in 2010 rolls			GERUSO ROBERT M & SUZANNE M T/E	11 WILDWOOD RD POB 632	FORESTDALE RI 02824-0000	
005-332	not found in 2010 rolls			THE BELISLE FAMILY LIVING TRUST	C/O FLORENCE BELISLE	P O BOX 163	FORESTDALE RI 02824-0000
005-333				BAKER PATRICIA C	23 KIRBY LANE	FORESTDALE RI 02824	
005-336	not found in 2010 rolls			FORGET DONNA A	25 KIRBY LANE PO BOX 88	FORESTDALE RI 02824-0000	
005-339	not found in 2010 rolls			DAVIS HAROLD W & CAROL I T/E	29 KIRBY LANE PO BOX 252	FORESTDALE RI 02824-0000	
005-341				O'MALLEY THOMAS P & HARRINGTON BONNIE T/	16 KIRBY LANE	PO BOX 125	FORESTDALE RI 02824-0125
005-342				O'MALLEY THOMAS P & HARRINGTON BONNIE T/	16 KIRBY LANE	PO BOX 125	FORESTDALE RI 02824-0125
005-344	not found in 2010 rolls			BATEMAN JOHN J	54 MAPLE AVE PO BOX 694	FORESTDALE RI 02824-0000	
005-365				OBRIEN SHARON T	PO BOX 62	FORESTDALE RI 02824-0062	
005-367				ORLANDO FLORENCE T & HUESTIS LINDA S J/T	PO BOX 121	FORESTDALE RI 02824-0121	
005-368	not found in 2010 rolls			GRENIER ROBERT P & ANNA T/E	14 KIRBY LANE	FORESTDALE RI 02824	
005-394				WHEATON GUY E JR & DONNA J	PO BOX 73	FORESTDALE RI 02824-0073	

Appendix F
Plat-Lot and Well Cross-Index

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	HOUSENUMBER	LOCATION	Well ID
005-277	19	FREITAS LANE	I-21
005-284	16	FREITAS LANE	I-13
005-285	20	FREITAS LANE	I-12
005-393	10	FREITAS LANE	I-34
005-309	14	KIRBY LANE	I-15
005-328	9	KIRBY LANE	I-10
005-329	11	KIRBY LANE	I-25
005-330	15	KIRBY LANE	I-5
005-331	19	KIRBY LANE	I-15
005-334	23	KIRBY LANE	A-79
005-335	25	KIRBY LANE	A-78
005-338	29	KIRBY LANE	A-77
005-340	16	KIRBY LANE	A-76
005-345	8	KIRBY LANE	I-36
005-281		LITZEN RD	
005-296	37	LITZEN RD	A-87
005-300	22	LITZEN RD	A-89
005-301	31	LITZEN RD	A-85
005-303	47	LITZEN RD	A-90
005-304	28	LITZEN RD	A-84
005-310	44	LITZEN RD	A-83
005-356	56	LITZEN RD	
005-379	59	LITZEN RD	A-86
005-391	50	LITZEN RD	A-88
005-041	42	LORRAINE AVE	A-93
005-353	33	LORRAINE AVE	A-91
005-358	23	LORRAINE AVE	A-98
005-359	25	LORRAINE AVE	A-96
005-366	38	LORRAINE AVE	
005-373	26	LORRAINE AVE	A-97
005-374	27	LORRAINE AVE	A-95
005-456	24	LORRAINE AVE	A-92
005-034	62	MAPLE AVE	
005-132		MAPLE AVE	I-32
005-133	43	MAPLE AVE	
005-134	47	MAPLE AVE	I-33
005-136	53	MAPLE AVE	I-30
005-137	55	MAPLE AVE	
005-171	16	MAPLE AVE	A-100
005-174	12	MAPLE AVE	A-105
005-178	44	MAPLE AVE	I-44
005-181	21	MAPLE AVE	
005-183	25	MAPLE AVE	

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	HOUSENUMBER	LOCATION	Well ID
005-185	14	MAPLE AVE	A-103
005-186	31	MAPLE AVE	
005-199	29	MAPLE AVE	I-16
005-201	22	MAPLE AVE	A-102
005-204	27	MAPLE AVE	
005-206	9	MAPLE AVE	A-111
005-209	33	MAPLE AVE	I-39
005-231	37	MAPLE AVE	I-40
005-233	5	MAPLE AVE	A-107
005-238	18	MAPLE AVE	
005-243		MAPLE AVE	
005-248	26	MAPLE AVE	
005-252	42	MAPLE AVE	I-45
005-259	60	MAPLE AVE	I-27
005-265	58	MAPLE AVE	I-41
005-269	51	MAPLE AVE	I-14
005-282	50	MAPLE AVE	I-11
005-286	46	MAPLE AVE	I-43
005-295	6	MAPLE AVE	A-109
005-298	11	MAPLE AVE	A-99
005-315	30	MAPLE AVE	I-26
005-316	32	MAPLE AVE	
005-437	54	MAPLE AVE	I-42
005-020	3	ROSELAWN AVE	A-138
005-187	4	ROSELAWN AVE	A-144
005-230	16	ROSELAWN AVE	I-23
005-234	8	ROSELAWN AVE	A-146
005-299	1	ROSELAWN AVE	A-137
005-370	15	ROSELAWN AVE	
005-388	14	ROSELAWN AVE	A-136
005-403	9	ROSELAWN AVE	A-139
005-408	19	ROSELAWN AVE	A-140
005-409	23	ROSELAWN AVE	I-19
005-412	18	ROSELAWN AVE	I-2
005-419	11	ROSELAWN AVE	
005-420	10	ROSELAWN AVE	A-142
005-424	12	ROSELAWN AVE	A-141
005-444	17	ROSELAWN AVE	A-143
005-446	21	ROSELAWN AVE	I-9
005-434		ROSELAWN AVE (REAR)	
005-001	20	SCHOOL ST	
005-004	60	SCHOOL ST	
005-005		SCHOOL ST	

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	HOUSENUMBER	LOCATION	Well ID
005-006	30	SCHOOL ST	
005-007	40	SCHOOL ST	
005-008	42	SCHOOL ST	
005-009	52	SCHOOL ST	
005-010	54	SCHOOL ST	
005-011	58	SCHOOL ST	
005-012	62	SCHOOL ST	
005-013	70	SCHOOL ST	
005-014	74	SCHOOL ST	
005-015	78	SCHOOL ST	
005-017	82	SCHOOL ST	
005-033		SCHOOL ST	
005-035	162	SCHOOL ST	A-167
005-038	166	SCHOOL ST	A-147
005-039		SCHOOL ST	A-159
005-046	197	SCHOOL ST	A-162
005-047	201	SCHOOL ST	A-164
005-048	205	SCHOOL ST	A-155
005-105	53	SCHOOL ST	
005-106	194	SCHOOL ST	A-156
005-138	130	SCHOOL ST	I-20
005-139	128	SCHOOL ST	I-24
005-140	126	SCHOOL ST	I-7
005-141	124	SCHOOL ST	
005-142	122	SCHOOL ST	I-28
005-143	120	SCHOOL ST	
005-144	118	SCHOOL ST	
005-145	116	SCHOOL ST	I-37
005-146	114	SCHOOL ST	
005-147	112	SCHOOL ST	
005-148	110	SCHOOL ST	A-152
005-149	108	SCHOOL ST	
005-150	104	SCHOOL ST	
005-152	178	SCHOOL ST	A-168
005-153-A	173	SCHOOL ST	
005-153-B	173	SCHOOL ST	
005-154	175	SCHOOL ST	I-18
005-155	177	SCHOOL ST	I-38
005-156	179	SCHOOL ST	I-8
005-157	181	SCHOOL ST	I-3
005-158	183	SCHOOL ST	I-22
005-159	187	SCHOOL ST	I-17
005-160	189	SCHOOL ST	

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	HOUSENUMBER	LOCATION	Well ID
005-168		SCHOOL ST	
005-170	100	SCHOOL ST	
005-175	94	SCHOOL ST	
005-176	98	SCHOOL ST	A-175, A-176
005-208	66	SCHOOL ST	
005-237	76	SCHOOL ST	
005-249		SCHOOL ST	
005-257	152	SCHOOL ST	
005-271	174	SCHOOL ST	A-174
005-283	84	SCHOOL ST	
005-288	191	SCHOOL ST	I-1
005-294	207	SCHOOL ST	A-165
005-305	22	SCHOOL ST	
005-346		SCHOOL ST	
005-355	193	SCHOOL ST	A-173
005-372	43	SCHOOL ST	
005-383	47	SCHOOL ST	
005-400	59	SCHOOL ST	
005-406	73	SCHOOL ST	
005-423	90	SCHOOL ST	
005-435	134	SCHOOL ST	I-31
005-476	203	SCHOOL ST	
002-009	355	VICTORY HWY	
002-010	333	VICTORY HWY	
002-023	233	VICTORY HWY	
002-024	261	VICTORY HWY	A-215
002-025	267	VICTORY HWY	
002-027	531	VICTORY HWY	
002-041	358	VICTORY HWY	
002-043	270	VICTORY HWY	
002-046	285	VICTORY HWY	
002-050	460	VICTORY HWY	
002-051	354	VICTORY HWY	
002-052	305	VICTORY HWY	
002-053	235	VICTORY HWY	
002-061	219	VICTORY HWY	
002-062	286	VICTORY HWY	
002-063	302	VICTORY HWY	
002-065	443	VICTORY HWY	
002-069	357	VICTORY HWY	
002-076	293	VICTORY HWY	
002-081	539	VICTORY HWY	
002-082	451	VICTORY HWY	

2010 PRIVATE WELL INDEX BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005			
PLAT-LOT	**HOUSENUMBER**	**LOCATION**	**Well ID**
002-083	503	VICTORY HWY	
002-084	473	VICTORY HWY	
002-085	489	VICTORY HWY	
002-086	445	VICTORY HWY	
002-087	515	VICTORY HWY	
002-090	405	VICTORY HWY	
002-091	383	VICTORY HWY	
002-102	295	VICTORY HWY	
002-104	275	VICTORY HWY	
002-113	431	VICTORY HWY	
002-116	557	VICTORY HWY	
002-124	356	VICTORY HWY	A-216
002-136	536	VICTORY HWY	
002-140	323	VICTORY HWY	A-214
002-143	544	VICTORY HWY	
002-159	490	VICTORY HWY	
002-167	484	VICTORY HWY	
002-218		VICTORY HWY	
002-221	502	VICTORY HWY	
002-300	570	VICTORY HWY	
002-301	554	VICTORY HWY	
005-240	246	VICTORY HWY	
005-245	250	VICTORY HWY	A-106
005-468		VICTORY HWY	
005-040	12	WILDWOOD RD	A-196
005-235	2	WILDWOOD RD	A-200
005-313	3	WILDWOOD RD	A-210
005-314	1	WILDWOOD RD	A-205
005-317	5	WILDWOOD RD	A-201
005-318	7	WILDWOOD RD	A-203
005-319	9	WILDWOOD RD	
005-320	11	WILDWOOD RD	A-202
005-322	17	WILDWOOD RD	
005-323	19	WILDWOOD RD	A-208
005-324		WILDWOOD RD	
005-325	16	WILDWOOD RD	
005-326	6	WILDWOOD RD	A-206
005-327	8	WILDWOOD RD	
005-387	14	WILDWOOD RD	A-199
005-401	10	WILDWOOD RD	A-209
002-042		not found in 2010 rolls	
002-054		not found in 2010 rolls	
005-022			

2010 PRIVATE WELL INDEX
BASED ON NORTH SMITHFIELD TAX PLATS 002 AND 005

PLAT-LOT	HOUSENUMBER	LOCATION	Well ID
005-032		not found in 2010 rolls	
005-131			
005-151		not found in 2010 rolls	
005-177		not found in 2010 rolls	
005-264		not found in 2010 rolls	
005-321		not found in 2010 rolls	
005-332		not found in 2010 rolls	
005-333			
005-336		not found in 2010 rolls	
005-339		not found in 2010 rolls	
005-341			
005-342			
005-344		not found in 2010 rolls	
005-365			
005-367			
005-368		not found in 2010 rolls	
005-394			

Appendix G
Public Notice

THE VALLEY Breeze

Garcia's surprise move leaves

or mail your item. Receipt does not guarantee publication. Event marketing by for-profit businesses requires paid advertising.

DO YOU HAVE SOMETHING TO CELEBRATE?
Share the good news of your births, engagements, weddings and anniversaries. This is a free service. Pictures will be returned upon request.
• **Get forms:** Visit www.valleybreeze.com, click on "Celebrations" at left, and select a form; or call 401-334-9555; or stop by the office during business hours.

OBITUARIES
Obituaries cost $70–$100. They are posted online immediately, and placed in the first available paper. Check with your funeral director for details.

ARE YOU LOOKING FOR A PREVIOUSLY PUBLISHED STORY?
All current stories remain free online for one week after print publication. Older stories are now archived online back to July 2001. We're sorry, but we have few back issues of papers in our offices and cannot provide free library services.
• **Online:** Visit www.valleybreeze.com, and click on "Search The Breeze Archive." Use keywords to find old stories. Single stories cost $2.95 through our Newsbank partners. Multi-story packages, which provide lower costs per story, are also available.

BUY OUR PHOTOS
We now offer e-mail delivery of Breeze news and sports photos as jpeg files for your personal use for $20.
• **By mail:** Send $20 to Photos, The Valley Breeze, 2190 Mendon Road, Suite #1, Cumberland, RI 02864. (Add $3 if you need the file on CD and mailed to you.) You MUST fully describe the photo, the names of the people in it, the photographer's name, and which edition and date it appeared, and tell us your name, address, phone and e-mail information.
• **Call or visit** our office with complete information to place your order. We accept cash, check or major credit cards.

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Announces a
Five-Year Review
For the
STAMINA MILLS SUPERFUND SITE
North Smithfield, Rhode Island,

The United States Environmental Protection Agency will begin conducting a Five-Year Review of the clean up activities conducted at the Stamina Mills, Rhode Island, Superfund Site in North Smithfield, Rhode Island. The Five Year Review process evaluates the remedies implemented at the Site and determines if the remedies are still protective of human health and the environment. The Review will evaluate present Site conditions.

EPA began clean-up activities at the Stamina Mills Site in the 1990's with the demolition of the old mill buildings. Following demolition, EPA initiated other components of the remedy including soil vapor extraction in a former solvent spill area, groundwater extraction and treatment using air stripping, and removal of the old landfill area. EPA's final Record of Decision issued in September 1990 and the subsequent Explanation of Significant Differences issued in June 2000, describe in detail the selected remedy for the site. Site issued.

When completed, a copy of the review report will be placed in the Information Repository located in the North Smithfield Public Library, 20 Main Street, Slatersville, Rhode Island, 401-767-2780.

EPA will also conduct a number of telephone interviews with nearby businesses, residents, local officials, state officials, and others to obtain their opinion on the clean-up process. If you would like to speak with us about this Site, please contact
Byron Mah, EPA Remedial Project Manager, via email
HYPERLINK "mailto:mah.byron@epa.gov"
mah.byron@epa.gov or
phone at 1-617-918-1249 or Toll free:
1-888-372-7341 ext 81249.

EPA
Region 1, New England

Appendix H

Major System Component Replacements — 1998 through June 2010

GWTS Major Component Replacements - 1998 Through June 2010

Year	Month	Component	Actual Replacement Date	Make/Model
2004	March	Air Stripper B-600 blower	March 2, 2004	Ametex/DR858AY72W
2004	October	FI-303 flow meter	October 5, 2004	-
2005	September	LTP-201 Motor Starter	September 19, 2005	Baldor/330-4528-100
2005	October	GWTS Effluent pH probe	October 4, 2005	-
2005	December	VTS heater element	December 5, 2005	-
2007	January	Air Stripper flow meter	January 15, 2007	-
2007	January	Bag Filter solenoid valve	January 15, 2007	-
2007	September	Bag Filter pressure switches	September 28, 2007	-
2007	October	Bag Filter pressure switches	October 1, 2007	-
2008	August	FI/FT-303 flow transmitter/sensor	August 22, 2008	-
2008	August	FI/FT-601 flow transmitter/sensor	August 22, 2008	-
2008	September	Moisture Separation Tank - float switch (initial installation)	September 4, 2008	-
2010	April	LTP-201	May 6, 2010	Moyno/34460
2010	May	LTP-301	May 27, 2010	Grundfos/CR10-02 A-GJ-A-E-HQQE

GWE/MPE Major Component Replacements - 1998 Through June 2010

Year	Month	Component	Actual Replacement Date	Make/Model
2002	May	MW-10 motor and lead	May 20, 2002	unknown
2002	August	MW-10 pump	August 20, 2002	unknown
2003	January	MW-10 lead	January 13, 2003	unknown
2003	May	SMW pump, motor, and lead	May 29, 2003	unknown
2007	August	MPE flow meter	-	-
2008	March	SMW flow meter	March 24, 2008	-
2008	May	SMW pump	May 12, 2008	Grundos/5E8
2009	December	SMW pump	December 2, 2009	Grundos/5E8
2010	May	MW-10 pump	May 12, 2010	Grundfos/5E8
2010	May	B-3 pump	May 12, 2010	Grundfos/10E8

ordered 8/17/2007

Appendix I

Site Inspection Form — June 28, 2010

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Stamina Mills Superfund Site	**Date of inspection: June 28, 2010**
Location and Region: North Smithfield, RI (Region 1)	**EPA ID: RID980731442**
Agency, office, or company leading the five-year review: USEPA Region 1	**Weather/temperature: Sunny, Hot (92 F)**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ **Access controls**
- ☒ **Institutional controls**
- ☒ **Groundwater containment**
- ☐ Surface water collection and treatment
- ☒ **Other__vapor extraction and treatment_**
- ☐ Monitored natural attenuation
- ☒ **Groundwater pump and treatment**
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager _Lori Anne Goetz___ __Project Manager, EnSafe Inc.__ __6/28/2010___**
   Name Title Date
   Interviewed ☒ **at site** ☐at office ☐ by phone Phone no. ______________
   Problems, suggestions; Report attached __**Specific technical discussions included in following pages.**_
   ___**Michael Spina, EnSafe, was also in attendance.**________

2. **O&M staff __Robert Atwood__ _President, Resource Control Associates_ _ 6/28/2010__**
   Name Title Date
   Interviewed ☒ **at site** ☐at office ☐by phone Phone no. ______________
   Problems, suggestions; Report attached _**Specific technical discussions included in following pages.**

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency __**USEPA**_________________________
Contact __**Byron Mah**__ __**Remedial Project Manager**__ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __**Present at site inspection. Specific technical discussions included in following pages.**_

Agency ____________________________
Contact ____________________________ __________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

Agency ____________________________
Contact ____________________________ __________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

Agency ____________________________
Contact ____________________________ __________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	☐ O&M manual	☒ **Readily available**	☐ Up to date	☐ N/A
	☐ As-built drawings	☒ **Readily available**	☐ Up to date	☐ N/A
	☐ Maintenance logs	☒ **Readily available**	☐ Up to date	☐ N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	☒ **Readily available**	☐ Up to date	☐ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
3.	**O&M and OSHA Training Records**	☒ **Readily available**	☐ Up to date	☐ N/A
	Remarks **Training records are available at the office**			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ **N/A**
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ **N/A**
	☐ Waste disposal, POTW	☐ Readily available	☒ **Up to date**	☐ N/A
	☐ Other permits	☐ Readily available	☐Up to date	☒ **N/A**
	Remarks **Wastewater discharge permit with the Woonsocket Regional Wastewater Commission, renewed annually**			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ **N/A**
	Remarks			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ **N/A**
	Remarks			
7.	**Groundwater Monitoring Records**	☒ **Readily available**	☐ Up to date	☐ N/A
	Remarks			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ **N/A**
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☒ **Readily available**	☐ Up to date	☐ N/A
	☐ Water (effluent)	☒ **Readily available**	☐ Up to date	☐ N/A
	Remarks **Discharge records are available at the main office**			
10.	**Daily Access/Security Logs**	☒ **Readily available**	☐ Up to date	☐ N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ **Contractor for PRP**
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other____

2. **O&M Cost Records**
☒ **Readily available** ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate____________________ ☐ Breakdown attached

Total annual cost by year for review period if available

From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ___**Costs are discussed under separate cover**_______

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ **N/A**
Remarks____**Recently repaired**________________________________

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ **N/A**
Remarks ____**Signage on front gate**___________________________

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐ Yes	☒ **No**	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☒ **No**	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) __**town ordinance**________________________

Frequency __**annual reporting to USEPA**__

Responsible party/agency _**Town of North Smithfield**_

Contact _**Robert Ericson**_ _**North Smithfield Town Planner**_ _________ ____________

Name Title Date Phone no.

Reporting is up-to-date	☒ **Yes**	☐ No	☐ N/A
Reports are verified by the lead agency	☒ **Yes**	☐ No	☐ N/A
Specific requirements in deed or decision documents have been met	☐ Yes	☐ No	☒ **N/A**
Violations have been reported	☐ Yes	☐ No	☒ **N/A**

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ **ICs are adequate** ☐ ICs are inadequate ☐ N/A

Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ **No vandalism evident**

Remarks

2. **Land use changes on site** ☒ **N/A**

Remarks

3. **Land use changes off site** ☒ **N/A**

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☐Applicable ☒ **N/A**

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks

B. Other Site Conditions

Remarks __**Some indications of erosion along fenceline/retaining wall/School Street on north property line. The site security fence sits along the top of the retaining wall and abuts the RIDOT guardrail. Kayser-Roth is currently working with a fencing contractor to move a fenceposts to stable ground and therefore stabilize the fence along the retaining wall. See site photos.**

VII. LANDFILL COVERS ☐ Applicable ☒ **N/A**

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent______________ Depth____________
   Remarks____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths____________ Widths___________ Depths__________
   Remarks____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent______________ Depth____________
   Remarks____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent______________ Depth____________
   Remarks____

5. **Vegetative Cover** ☐Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent______________ Height____________
   Remarks____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent______________
   ☐ Ponding ☐ Location shown on site map Areal extent______________
   ☐ Seeps ☐ Location shown on site map Areal extent______________
   ☐ Soft subgrade ☐ Location shown on site map Areal extent______________
   Remarks____

9.	**Slope Instability** ☐ Slides ☐Location shown on site map ☐ No evidence of slope instability Areal extent______________ Remarks____ ____
B. Benches	☐Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)
1.	**Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay Remarks____ ____
2.	**Bench Breached** ☐ Location shown on site map ☐ N/A or okay Remarks____ ____
3.	**Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay Remarks____ ____
C. Letdown Channels	☐ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)
1.	**Settlement** ☐ Location shown on site map ☐ No evidence of settlement Areal extent______________ Depth____________ Remarks____ ____
2.	**Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation Material type_______________ Areal extent_____________ Remarks____ ____
3.	**Erosion** ☐Location shown on site map ☐ No evidence of erosion Areal extent______________ Depth____________ Remarks____ ____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent______________ Depth____________
Remarks____
____

5. **Obstructions** Type_____________________ ☐ No obstructions
☐ Location shown on site map Areal extent______________
Size____________
Remarks____
____

6. **Excessive Vegetative Growth** Type____________________
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent______________
Remarks____
____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks____
____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks____
____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
☐Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks____
____

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☐ N/A
Remarks____
____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks____
____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
Remarks____
____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent______________ Depth____________ ☐ N/A
☐ Siltation not evident
Remarks____
____

2. **Erosion** Areal extent______________ Depth____________
☐ Erosion not evident
Remarks____
____

3. **Outlet Works** ☐ Functioning ☐ N/A
Remarks____
____

4. **Dam** ☐ Functioning ☐ N/A
Remarks____
____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____________ Vertical displacement________________
Rotational displacement_____________
Remarks____
____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks____
____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐Location shown on site map ☐ Siltation not evident
Areal extent_______________ Depth_____________
Remarks____
____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_______________ Type_____________
Remarks____
____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_______________ Depth_____________
Remarks____
____

4. **Discharge Structure** ☐ Functioning ☐ N/A
Remarks____
____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ **N/A**

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent_______________ Depth_____________
Remarks____
____

2. **Performance Monitoring** Type of monitoring ____________________________
☐ Performance not monitored
Frequency_________________________________ ☐ Evidence of breaching
Head differential____________________________
Remarks____
____

IX. GROUNDWATER/SURFACE WATER REMEDIES	☒ **Applicable** ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☒ **Applicable** ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ **Good condition** ☒ **All required wells properly operating** ☐ Needs Maintenance ☐ N/A
Remarks **USEPA identified downtime concerns with GWE wells during the 2005 to 2010 five-year review period, specifically with respect to Grundfos pump/lead wiring connector issues which have occurred in both SMW and B-3. At USEPA's request, a technical evaluation has been prepared and included as an appendix to the five-year review summarizing the problem and corrective measures.**

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ **Good condition** ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ **Readily available** ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines	☐ Applicable ☒ **N/A**

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☒ **Applicable** ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ **Air stripping** ☒ **Carbon adsorbers**
☒ **Filters** ___ **bag filters**_
☐ Additive (*e.g.*, chelation agent, flocculent)
☐ Others
☒ **Good condition** ☐ Needs Maintenance
☒ **Sampling ports properly marked and functional**
☒ **Sampling/maintenance log displayed and up to date**
☐ Equipment properly identified
☐Quantity of groundwater treated annually _____ **variable – 3 to 5 million gallons/year**_
☐ Quantity of surface water treated annually
Remarks _**Label tanks/units for third party understanding (do not reply on P&ID)**_

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☒ **Good condition** ☐ Needs Maintenance
Remarks

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☒ **Good condition** ☒ **Proper secondary containment** ☐ Needs Maintenance
Remarks ___ **Inspect floor (secondary containment) for cracks quarterly. Patch cracks in floor. At USEPA's request, photographs of patches have been included in an appendix to the five-year review.**_______

4. **Discharge Structure and Appurtenances**
☐ N/A ☒ **Good condition** ☐ Needs Maintenance
Remarks

5. **Treatment Building(s)**
☐ N/A ☒ **Good condition (esp. roof and doorways)** ☐ Needs repair
☒ **Chemicals and equipment properly stored**
Remarks

6. **Monitoring Wells** (pump and treatment remedy)
☒ **Properly secured/locked** ☒ **Functioning** ☐ Routinely sampled ☒ **Good condition**
☒**All required wells located** ☐ Needs Maintenance ☐ N/A
Remarks __ **Monitoring well inspection completed prior to five-year review. Offsite wells (Stage-1, select Stage 2) sampled in May 2010. SVE/MPE wells assessed during spring startup procedures. B-3, SMW, MW-10 are assessed and inspected on an as-needed basis as part of O&M procedures.**__

D. Monitoring Data

1. Monitoring Data
☒ **Is routinely submitted on time** ☒ **Is of acceptable quality**

2. Monitoring data suggests:
☒ **Groundwater plume is effectively contained** ☒ **Contaminant concentrations are declining**

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ **N/A**
Remarks____
____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

____
____
____
____
____
____
____
____
____
____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

____
____
____
____
____
____
____
____
____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. ____
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. ____

Appendix J
Well Pump Uptime Memorandum / Corrective Actions

Technical Memorandum

To: Byron Mah, USEPA
From: EnSafe Inc., by Lori Goetz and Craig Wise PE
Date: July 19, 2010
Subject: Stamina Mills Site Groundwater Extraction Well Pump Downtime

During the 2010 Five-Year Review Site Inspection on June 28, 2010, you expressed concern regarding the operational down time we are experiencing with groundwater extraction, specifically due to problems with wiring leads. In response and on behalf of Kayser Roth, EnSafe Inc. has completed an internal review of this well pump downtime issue. In this technical memorandum we present the following:

- A summary of operational history for all well pumps
- A summary of periods of downtime in recent past (since the last five-year review) and troubleshooting/response actions
- Our plans for corrective measures to minimize future downtime

Operational History

As discussed in the *2010 Five-Year Review*, the groundwater extraction system (GWE) has been operational since 2000. Table 1 summarizes uptime history for each of the three GWE wells, and identifies major downtime causes for each year. Average uptime is greater than 80%. Causes of downtime fall into two categories: groundwater treatment system (GWTS) problems, and well-specific outages. GWTS downtime is discussed in detail in the *2010 Five-Year Review*.

Well outages have been infrequent until the last few years, when, perhaps due to age, we have encountered problems with the SMW and more recently B-3.

Recent Well Downtime and Troubleshooting/Response Actions

The primary outages for SMW were in 2008 and 2009, with failures occurring several months apart. Troubleshooting procedures for each shutdown followed a standard diagnosis procedure. Corrective measures were implemented in an effort to improve uptime:[1]

[1] Corrective measures were documented in corresponding monthly and quarterly reports.

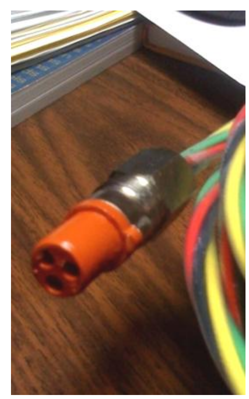
Table 1
GWE Operational Summary

Year	Maximum Hours Possible	SMW Hours Operational	SMW Percent Operational	B-3 Hours Operational	B-3 Percent Operational	MW-10 Hours Operational	MW-10 Percent Operational	GWTS Percent Operational	Pump/ Lead Repairs	Comments
2000	5,184	3,936	76%	3,936	76%	3,936	76%	77%		GWTS startup.
2001	8,760	7,656	87%	7,656	87%	7,656	87%	87%		
2002	8,760	7,344	84%	7,344	84%	7,344	84%	84%	*	MW-10 motor/ lead replacement (May 2002). MW-10 pump replacement (August 2002).
2003	8,760	6,856	78%	7,667	88%	7,451	85%	88%	*	MW-10 lead replacement (January 2003). SMW pump/motor/lead replacement (May 2003)
2004	8,760	7,649	87%	7,649	87%	7,649	87%	87%		
2005	8,760	6,886	79%	6,886	79%	6,886	79%	79%		VTS heating element replacement (December 2005).
2006	8,760	8,394	96%	8,394	96%	8,394	96%	96%		
2007	8,760	7,702	88%	7,702	88%	7,702	88%	89%		
2008	8,760	5,580	64%	7,127	81%	7,127	81%	81%	*	SMW pump/motor/lead replacement (May 2008). GWTS repairs following controller failure/replacement (June 2008). SMW lead replacement (December 2008).
2009	8,760	6,892	79%	7,747	88%	8,202	94%	94%	*	SMW lead replacement (March 2009). SMW pump/motor/lead replacement (December 2009).
2010	3,624	3,053	84%	3,068	85%	3,068	85%	85%	*	Scheduled downtime for B-3/MW-10 replacement (May 2010). Unscheduled LTP-301 replacement (May 2010).

Notes:
2010 data through May 31, 2010
.

- In April 2008 the SMW well pump failed after eight years of continuous operation. A new pump, motor, and leads were ordered, and the pump was replaced and the well restarted in May 2008. This outage was not considered unusual, given the service life of the pump.
- In November 2008, troubleshooting of intermittent SMW failures identified a short in the leads (caused by a cut in the wire), a faulty isolation switch in the well head vault, and the associated overload switch in the control panel. The motor leads and switches were replaced in December 2008.
- In February 2009, the motor leads failed. Inspection found that the leads had abraded against the open-rock walls of the former production well. In addition, a flaw was found in the lead's connector plug (manufacturer's defect). A new lead was installed, sheathed inside a protective sleeve, and installation procedures revised to minimize inadvertent contact between the well bore and the pump assembly.
- SMW shut down following a power failure in November 2009. Troubleshooters initially ascribed the failure to a faulty motor starter, the pump was removed from the well, leading to the discovery that the impellers had been destroyed, and the shaft seized. Root cause for the catastrophic failure is unknown. In December 2009 the pump was replaced, with the pump intake covered with a mesh screen as a precaution against the ingestion of any foreign materials that could lead to a similar failure.

Each of the above failures appears to entail a unique cause, and each event has triggered permanent corrective measures. We have considered periodic pump replacement. In the interest of sustainable remediation and given ready replacement availability we suggest that pumps be replaced only on failure, when no cause other than end of useable life is apparent.



In June 2010, following scheduled replacement of the well pump in B-3, the motor leads in B-3 failed.[2] Prior to B-3's installation, the pump and leads had been checked by the site electrician. Upon deployment, however, the pump caused panel problems. Upon removal, water was found in the socket where the leads connect to the pump (lead connector plug shown at right). The defective lead was returned to the manufacturer for inspection and repair and assessment. The manufacturer's assessment is included as Attachment 1; they suspect that the connector was not installed correctly (the compression fitting was not tightened adequately), as the plug was not deformed from the installation.

Rather than waiting for the repair to be completed, new leads were installed in B-3. Diagnosis of the lead issue was made on June 3rd, and the new leads were available onsite on June 8th.

[2] Downtime of GWE wells was extended due to LTP-301 replacement, which required approximately 2 weeks. Replacement of MW-10 occurred at the same time.

However, due to scheduling issues with the electrician, the well was not restarted until June 18, 2010. The pump has been operating continuously since that time.

Table 2
Lead Replacement/Repair History

Date	Well	Replacement Cause	Lead Spec	New Lead Manufacturer
April 2008	SMW	Pump replacement	75' Teflon jacketed #12/3	Morris Industries
November 2008	SMW	Cut/abrasion in lead	50' Teflon jacketed #12/3	Environmental Equipment and Supply
February 2009	SMW	Abraded lead, Manufacturer's defect at plug	50' Teflon jacketed #12/3	Environmental Equipment and Supply
December 2009	SMW	Pump replacement	50' Teflon jacketed #12/3	Morris Industries
May 2010	B-3	Pump replacement	150' Teflon jacketed #12/3	Morris Industries
June 2010	B-3	Installation error	150' Teflon jacketed #12/3	Morris Industries

Results of our Assessment and Corrective Measures

At this time, we agree with the lead supplier that the failure mode for the B-3 lead failure was water infiltration and electrical short circuit, caused by an installation error. This too is independent and unrelated to previous failures associated with pump leads. Our recommended corrective measure is to amend our O&M procedures further, to reflect the following procedural steps associated with pump lead installation:

1. Assure that the compression fitting is threaded properly (see Attachment 1). Stainless-steel threads are subject to galling and could prevent accurate application/measurement of torque. Inspect all threads before assembly and use manufacturer recommended thread lubricants.
2. Torque the compression fitting to manufacturer recommended value to ensure proper seal.
3. Have an observer (not the person who installed the lead) confirm a secure seal before lowering the pump into the well. We plan to have an EnSafe technician fill this role.

We will continue with our pre- and post-deployment electrical check of leads, consistent with manufacturer's installation procedures.

Please do not hesitate to comment or ask questions.

As noted above, prior events each entailed a unique cause, and each event triggered permanent corrective measures. Where appropriate, these corrective measures have been implemented for all downhole applications (e.g., sheathing for leads). No additional corrective measures are required for the well pump/lead issue.

We are proceeding forward with operations as suggested herein.

Attachment 1
Morris Industries Damaged Lead Evaluation
June 2010

To whom it may concern:

Every lead manufactured by Morris Industries is tested twice before shipment to the end user. Each lead is tested once assembled but just prior to application of the motor lead epoxy sealant. Once that epoxy has cured, each lead is tested again. If the lead fails any of the testing, it is discarded. The lead you have returned shows no obvious reason for failure, however, after closer inspection, the best possibility is improper assembly with the motor. Once the motor lead is installed properly, the rubber (viton) base will compress to form a water tight seal. If you remove this lead, you should be able to see some deformity that will show the rubber has been compressed. In this case there is no deformity noted and there is water/moisture that has entered the internal motor lead jacketing. One of the conductor pins has been blown out which would also suggest contact with water or an over voltage situation.
Without being able to pin point the cause with 100% certainty, the motor lead will be replaced under warranty as a good faith gesture.
We have included proper installation instructions as well. Please make sure that the lead is not cross threaded in the motor. This is also a common cause of failure, but since the motor was not returned, that can not be determined as a cause.

Rodger LaForce
Morris Industries

SUBMERSIBLE MOTOR LEAD INSTALLATION

1. **Assemble the lead to the motor without the pump on the motor**

2. **Inspect the lead and motor socket to assure they are free of damage. The mating areas must be clean and free of moisture.**

3. **The rubber lead bushing is coated with a silicone grease and is covered with a plastic bag. The silicone grease is required for proper seating of the bushing. DO NOT remove this grease from the rubber bushing.**

4. **Align and support a portion of the lead cable behind the lead connector with the motor socket. This is most easily done vertically. The object is to relieve the weight of the cable from affecting the alignment of the bushing.**

5. **Align the key on the lead connector with the motor socket and insert the bushing. Use a slight side to side movement (not a twist) and firm hand pressure to place the bushing. Make sure the bushing has been inserted for it's full length. This procedure is very important. Just tightening the jam nut will not correctly align or place the bushing. This is the main cause of field installation failures.**

6. **Start the jam nut with you fingers and tighten finger tight. Be careful not to cross thread this connection.**

7. **Finish tightening the jam nut to the torque indicated below. This will supply the correct compression to complete the sealing process.**

8. **Check insulation resistance from leads to ground before power is applied to verify the integrity of the system. 1st check, before motor installed in well, minimum should be 10,000,000 ohms or 10 megohms. 2nd check, motor in well, minimum should be 2,000,000 ohms or 2 megohms.**

Tightening torques:

All 4" motors- 15 to 20 ft lbs.
All 6" motors- 50-60 ft lbs.

Motor lead manufactured with pride by Morris Industries, 975 W. Siddonsburg Rd, Dillsburg PA 17019. (800)637-7724

Appendix K
Concrete Repair Photographs

Technical Memorandum

To: Byron Mah, USEPA
From: EnSafe Inc., by Lori Goetz and Craig Wise PE
Date: July 20, 2010
Subject: Stamina Mills Site Groundwater Extraction Well Pump Downtime

During the 2010 Five-Year Review Site Inspection on June 28, 2010, USEPA identified minor cracks and damage to the concrete slab of the treatment building. USEPA indicated that, given the building slab is used as secondary containment, any cracks in the slab could act as a migration pathway in the event of an overflow event.

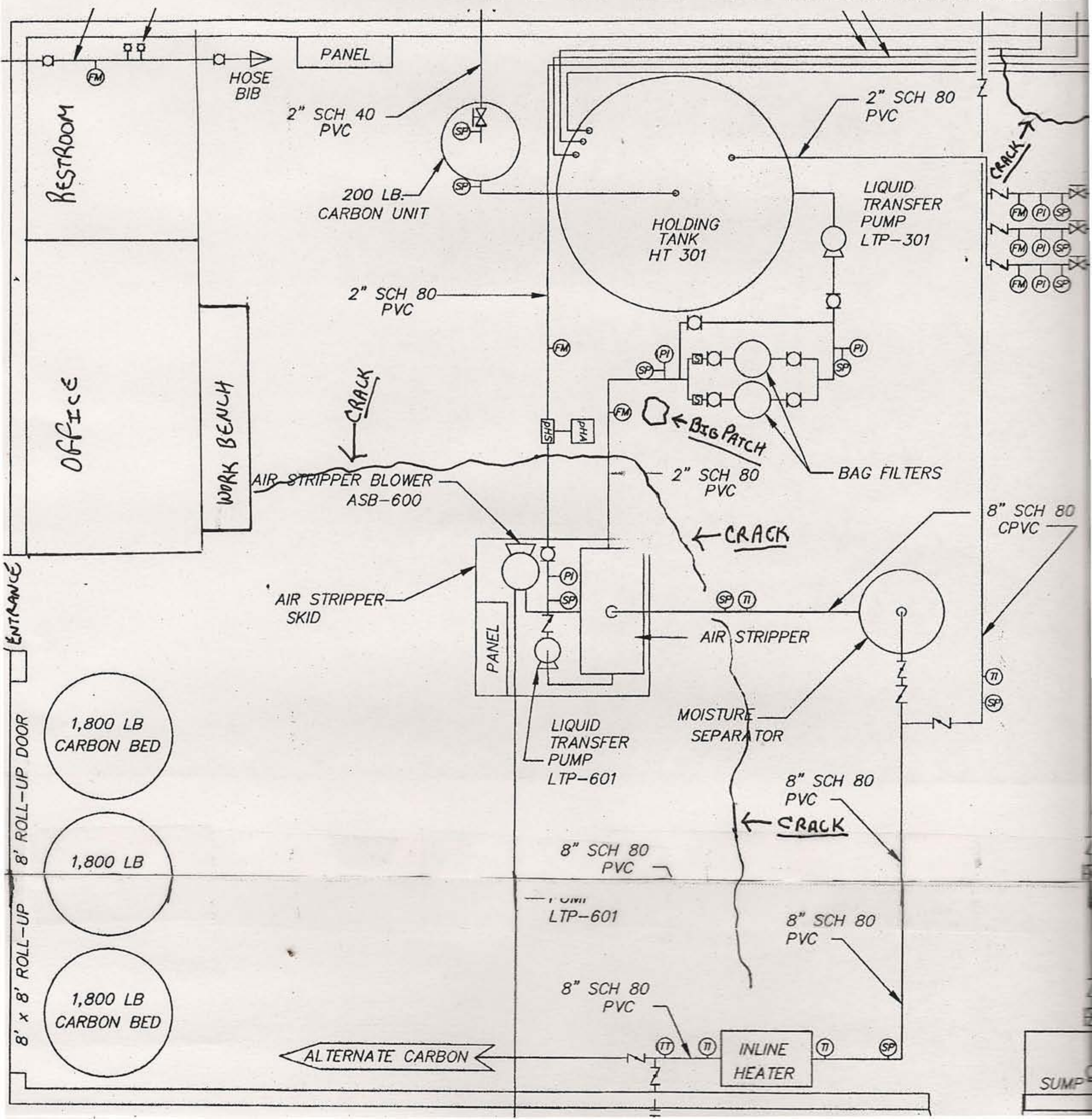
The treatment building slab is constructed of reinforced concrete approximately 6 to 8 inches thick. The foundation was constructed on 10 to 15 feet of engineered fill to remove artificial void spaces beneath the building associated with former mill structures and minimize the potential for differential settling beneath the slab.

The cracks noted in the floor were shallow surface cracks, with a typical width of approximately 1 mm or less. Cracks were sealed with concrete patch. Damage was noted in one location where equipment had been anchored to the floor; concrete around the bolt had been damaged to a depth of approximately 0.5 to 1 inch around the anchor bolt. This area was cleaned, then patched with fresh concrete.

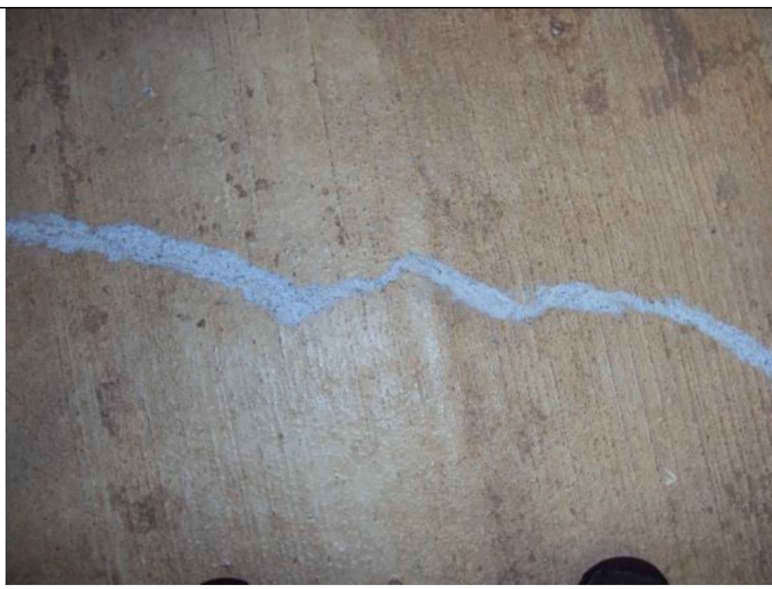
Per USEPA's request, the following procedures have been implemented at the site:

- Inspect floor (secondary containment) for cracks quarterly.
- Patch cracks in floor as needed.

Photographs of some of the patches are attached. A diagram showing the treatment system layout, as well as the patched/repaired areas, is also attached.



PANEL
HOSE BIB
RESTROOM
OFFICE
WORK BENCH
2" SCH 40 PVC
200 LB. CARBON UNIT
2" SCH 80 PVC
HOLDING TANK HT 301
LIQUID TRANSFER PUMP LTP-301
CRACK
BIG PATCH
BAG FILTERS
AIR STRIPPER BLOWER ASB-600
AIR STRIPPER SKID
AIR STRIPPER
PANEL
LIQUID TRANSFER PUMP LTP-601
MOISTURE SEPARATOR
8" SCH 80 CPVC
8" SCH 80 PVC
ENTRANCE
8' ROLL-UP DOOR
8' x 8' ROLL-UP
1,800 LB CARBON BED
1,800 LB
1,800 LB CARBON BED
ALTERNATE CARBON
INLINE HEATER
SUMP
FM
PI
SP
TI
PHS
PHA

	Hairline crack in floor near workbench area.
	Patched crack in floor.

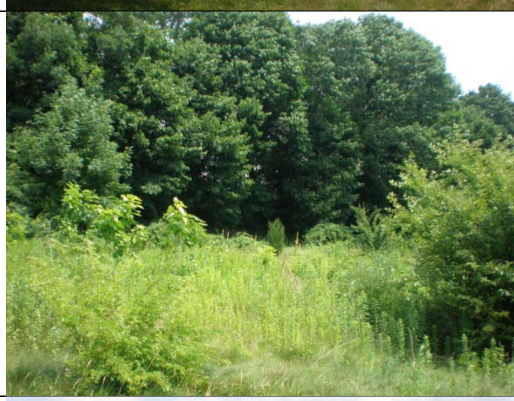
	Similar crack in floor (close-up).
	Patched crack in floor.

	Floor damage near anchor bolt.
	Cleaned and prepped area, prior to patch.

	Patched area.

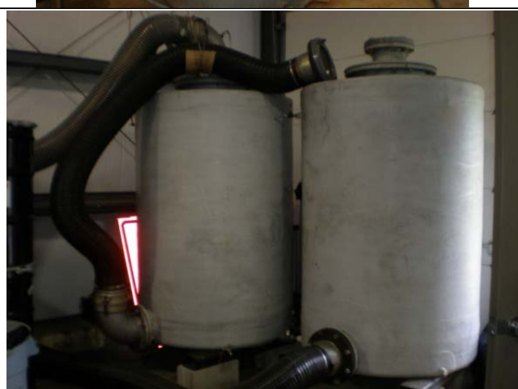
Appendix L

Site Photographs — June 28, 2010 Site Inspection

	Entry gate sign, providing contact information for Stamina Mills Site.
	View of Site across TCE spill area (SVE/MPE treatment area) to west, towards treatment building.
	View of Site to east, across northern portion of former landfill area.
	View of site to east, across southern portion of former landfill area. Note re-vegetation of former landfill area along bank of Branch River.

<table>
<tr><td></td><td>View of B-3 and SVE/MPE well field from School Street (view to south).</td></tr>
<tr><td></td><td>Dip in fencing at erosion area along School Street (view is to west). Post at dip will be relocated to firmer ground to stabilize fence.</td></tr>
<tr><td>
</td><td>Holding Tank 301 (equalization tank) inside treatment building.</td></tr>
</table>

	Bag filter units inside treatment building.
	Air stripper inside treatment building.

	Moisture separator (pre-carbon) in treatment building.
	Indoor carbon vessels (winter operations).
	Exterior carbon vessels (one of two shown, summer operations).

<table>
<tr><td></td><td>Primary control panel.</td></tr>
<tr><td></td><td>Secondary control panel (SVE/MPE building).</td></tr>
<tr><td></td><td>Liquid transfer pump controls (SVE/MPE building).</td></tr>
</table>

	Liquid transfer pump 201 (SVE/MPE building).
	MPE liquid/vapor separator (SVE/MPE building).
	134 School Street, location of Soil Vapor Assessment investigations.

	126 School Street, location of Soil Vapor Assessment investigations.
	Forestdale Pond dam, subject of ongoing hydropower assessments.
	For sale signs posted by property owner in June 2010.

Appendix M
Site Interview Documentation

Stamina Mills Superfund site Five Year Review Meeting
EPA-Town of North Smithfield RI
July 22, 2010
9:30 am

Meeting Notes

Participants:

EPA: Byron Mah, Remedial Project Manager, Sarah White, Community Involvement Coordinator

Town of North Smithfield: Paulette Hamilton, Town Administrator and Robert Ericson, Town Planner

As part of EPA's five year review of the remedy at the Stamina Mills Superfund site, EPA held a conference call with officials from the Town of North Smithfield. The purpose of the call was update residents on test results/data related to the five year review of the remedy and to hear the town's concerns about current site and future site related issues.

Current data/ plume:

EPA's Remedial Project Manager, Byron Mah, gave an update on the five year review and reported that current data shows that the plume is getting smaller and that progress in the cleanup is being made. The pump and treat system is working. The treatment system plus the town's groundwater well ordinance which prohibits use of groundwater wells near the site is making a difference. Both ensure that the public is being protected and that people aren't being exposed to contaminants. That said, EPA reported that there are still sizeable amount of contaminants in the groundwater on the site but it is pulling out of the neighborhood.

Status of Future Hydropower project:

Town reported that they've been awarded a $421,000 grant to improve energy use in town buildings. The town will use a rebate from the grant money to research a FERC licensing exemption for using the dam for hydropower. It is determined whether or not licensing is required; the town will put out a Request for Proposals (RFP) for a notice of intent to redevelop the dam. This is the town's strategy.

Status of Stamina Mills property Ownership:

Town ownership of the site is still in limbo. Byron asked why there is a for sale sign on the fence and expressed concern that the town has tax title but hasn't officially foreclosed on the property and that this could cause problems with their redevelopment plans because the owner still has right of redemption. The town explained that if the current owner wants to pay the back taxes, that fine.

Length of Remediation/ Allowing for reuse:

Town asked how long the EPA will be involved in the site? How long will the cleanup take? EPA response is that it's difficult to say. It could take 15, 20 or 50 years. EPA said there is a lot of residual contamination in the ground but at the surface the soil is clean. The treatment system (piping) however can be scaled back. EPA can make arrangements to move some of the piping to allow for redevelopment of the site but doesn't want to take out until needed. EPA said the building which houses the treatment system will have to remain for some time so groundwater treatment can continue. EPA said redevelopment would have to work around the building and the wells on site but white piping can go when the property is needed for redevelopment.

Institutional Controls/ Groundwater well Ordinance Violations:

EPA asked if the town has had any violations of the groundwater well ordinance this year. Town's response: "none". For the record, EPA requested that the town building inspector send EPA a letter saying there have not been any violations. EPA requested that a cross reference to the town's groundwater well ordinance be recorded with the property so that future investors are made aware. The ordinance should run with the property.

Community Outreach:

The Town Administrator requested that EPA hold a community meeting to update residents on the site cleanup in the fall. EPA agreed that the fall would be a good time to hold a public meeting. Meeting would be held at the N. Smithfield Town library. EPA will coordinate with the town prior to the meeting.

Appendix N
1,4-Dioxane Analysis

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
A-175	PH218A175-092000	9/25/2000	1	71552006	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
B-3	PH218B3-092000	9/25/2000	1	71552004	71-55-6	1,1,1-Trichloroethane	**2**	Y	J			µg/L
I-21	PH218I21-092000	9/25/2000	1	71552005	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
MW-10	PH218MW10-092000	9/25/2000	1	71552002	71-55-6	1,1,1-Trichloroethane	**9**	Y	J			µg/L
MW-15	PH218MW15-092000	9/25/2000	1	71552007	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
SMW	PH218SMW-092000	9/25/2000	1	71552001	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
I-37	PH218I37-092000	9/26/2000	1	71552008	71-55-6	1,1,1-Trichloroethane	2	N	U	2	2	µg/L
MW-17	PH218MW17-092000	9/26/2000	1	71552010	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
MW-18	PH218MW18-092000	9/26/2000	1	71552011	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
I-12	PH218I12-092000	9/27/2000	1	71552014	71-55-6	1,1,1-Trichloroethane	**0.8**	Y	J			µg/L
I-30	PH218I30-092000	9/27/2000	1	71552017	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
MW-2	PH218MW2-092000	9/27/2000	1	71552016	71-55-6	1,1,1-Trichloroethane	2500	N	U	2500	2500	µg/L
MW-10	MW105-062001	6/22/2001	1	81340001	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
A-175	PH219A1-062001	6/25/2001	1	81378002	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
B-3	PH219B3-062001	6/25/2001	1	81378014	71-55-6	1,1,1-Trichloroethane	400	N	U	400	400	µg/L
I-30	PH219130-062001	6/25/2001	1	81378001	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
SMW	PH219SMW-062001	6/25/2001	1	81378013	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
I-37	PH219137-062001	6/26/2001	1	81378004	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
MW-15	19MW15-062001	6/26/2001	1	81378003	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
MW-17	19MW17-062001	6/26/2001	1	81378006	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
MW-18	19MW18-062001	6/26/2001	1	81378007	71-55-6	1,1,1-Trichloroethane	1	N	U	1	1	µg/L
I-12	PH219I12-062001	6/27/2001	1	81378010	71-55-6	1,1,1-Trichloroethane	**0.7**	Y	J			µg/L
MW-2	19MW26-062001	6/27/2001	1	81378018	71-55-6	1,1,1-Trichloroethane	1000	N	U	1000	1000	µg/L
A-175	PH31A175-032002	3/13/2002	1	A0404-02A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
B-3	PH31B3-032002	3/13/2002	1	A0404-06A	71-55-6	1,1,1-Trichloroethane	400	N	U	400	400	µg/L
I-12	PH31I12-032002	3/13/2002	1	A0404-08A	71-55-6	1,1,1-Trichloroethane	**0.43**	Y	J			µg/L
MW-10	PH31MW10-032002	3/13/2002	1	A0404-04A	71-55-6	1,1,1-Trichloroethane	1000	N	U	1000	1000	µg/L
SMW	PH31SMW-032002	3/13/2002	1	A0404-03A	71-55-6	1,1,1-Trichloroethane	200	N	U	200	200	µg/L
I-37	PH31I37-032002	3/14/2002	1	A0404-09A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
MW-17	PH31MW17-032002	3/14/2002	1	A0404-11A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
MW-2	PH31MW2-032002	3/14/2002	1	A0404-15A	71-55-6	1,1,1-Trichloroethane	4000	N	U	4000	4000	µg/L
A-175	PH3GA17502-122002	12/9/2002	1	A1833-10A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
B-3	PH3GB302-122002	12/9/2002	1	A1833-02A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
MW-17	PH3GMW1702-122002	12/9/2002	1	A1833-01A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
SMW	PH3GSMW02-122002	12/9/2002	1	A1833-03A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
I-12	PH3GI1202-122002	12/10/2002	1	A1833-08A	71-55-6	1,1,1-Trichloroethane	**0.42**	Y	J			µg/L
MW-2	PH3GMW202-122002	12/10/2002	1	A1833-07A	71-55-6	1,1,1-Trichloroethane	**8**	Y	J			µg/L
I-37	PH3G13702-122002	12/11/2002	1	A1833-12A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
MW-10	PH3GMW1002-122002	12/11/2002	1	A1833-14A	71-55-6	1,1,1-Trichloroethane	**2**	Y				µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
B-3	B3-032003	3/18/2003	1	B0462-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10P-032003	3/18/2003	1	B0462-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-032003	3/18/2003	1	B0462-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-15	PS15-042003	4/7/2003	1	B0583-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-18	PS18-042003	4/7/2003	1	B0583-07A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-8	PS8-042003	4/8/2003	1	B0583-14A	71-55-6	1,1,1-Trichloroethane	**10**	Y		5	5	µg/L
S-10	S10-042003	4/8/2003	1	B0583-11A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-2	S2-042003	4/8/2003	1	B0583-12A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-6	S6-042003	4/8/2003	1	B0583-06A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-8	S8-042003	4/8/2003	1	B0583-13A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-9	S9-042003	4/8/2003	1	B0583-10A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-1	PS1-042003	4/9/2003	1	B0583-15A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-11	PS11-042003	4/9/2003	1	B0583-21A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-12	PS12-042003	4/9/2003	1	B0583-22A	71-55-6	1,1,1-Trichloroethane	**2**	Y	J	5	5	µg/L
PS-2	PS2-042003	4/9/2003	1	B0583-17A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-4	PS4-042003	4/9/2003	1	B0583-20A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-5	PS5-042003	4/9/2003	1	B0583-18A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-6	PS6-042003	4/9/2003	1	B0583-16A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-9	PS9-042003	4/9/2003	1	B0583-19A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-13	PS13-042003	4/10/2003	5	B0583-28A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-16	PS16-042003	4/10/2003	1	B0583-26A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-17	PS17-042003	4/10/2003	1	B0583-27A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-21	PS21-042003	4/10/2003	1	B0583-25A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-24	PS24-042003	4/10/2003	1	B0583-23A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-3	S3-042003	4/10/2003	1	B0583-24A	71-55-6	1,1,1-Trichloroethane	**9**	Y		5	5	µg/L
A-175	PH3GA17503-092003	9/30/2003	1	B1573-01A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
MW-2	PH3GMW03-092003	9/30/2003	1	B1573-05A	71-55-6	1,1,1-Trichloroethane	**52**	Y				µg/L
B-3	PH3GB303-092003	10/1/2003	1	B1573-09A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GL1203-092003	10/1/2003	1	B1573-10A	71-55-6	1,1,1-Trichloroethane	**0.39**	Y	J			µg/L
MW-10	PH3GMW1003-092003	10/1/2003	1	B1573-07A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
MW-17	PH3GMW1703-092003	10/1/2003	1	B1573-02A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
SMW	PH3SMW03-092003	10/1/2003	1	B1573-06A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
I-37	PH3G13703-092003	10/2/2003	1	B1573-03A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
B-3	B3-032004	3/15/2004	1	C0221-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10-032004	3/15/2004	1	C0221-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-032004	3/15/2004	1	C0221-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
PS-1	PS1-042004	4/19/2004	1	C0331-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-2	PS2-042004	4/19/2004	1	C0331-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-24	PS24-042004	4/19/2004	1	C0337-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-4	PS4-042004	4/19/2004	1	C0331-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-6	PS6-042004	4/19/2004	1	C0337-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-11	PS11-042004	4/20/2004	1	C0337-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-12	PS12-042004	4/20/2004	1	C0337-06A	71-55-6	1,1,1-Trichloroethane	**1**	Y	J	5	5	µg/L
PS-13	PS13-042004	4/20/2004	1	C0337-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-15	PS15-042004	4/20/2004	1	C0337-08A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-16	PS16-042004	4/20/2004	1	C0337-07A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-5	PS5-042004	4/20/2004	1	C0337-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-8	PS8-042004	4/20/2004	1	C0346-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-17	PS17-042004	4/21/2004	1	C0346-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-18	PS18-042004	4/21/2004	1	C0346-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-21	PS21-042004	4/21/2004	1	C0346-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-9	PS9-042004	4/21/2004	1	C0346-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-10	S10-042004	4/21/2004	1	C0346-06A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-2	S2-042004	4/21/2004	1	C0346-11A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-3	S3-042004	4/21/2004	1	C0346-09A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-6	S6-042004	4/21/2004	1	C0346-08A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-8	S8-042004	4/21/2004	1	C0346-07A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-9	S9-042004	4/21/2004	1	C0346-10A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
B-3	B3-062004	6/7/2004	1	C0529-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10-062004	6/7/2004	1	C0529-04A	71-55-6	1,1,1-Trichloroethane	**2**	Y	J			µg/L
SMW	SMW-062004	6/7/2004	1	C0529-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-175	PH3GA17504-062004	6/21/2004	1	C0611-02A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-37	PH3GI03704-062004	6/21/2004	1	C0611-01A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
MW-17	PH3GMW1704-062004	6/21/2004	1	C0611-03A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
B-3	PH3G0B0304-062004	6/22/2004	1	C0611-08A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
I-12	PH3GI01204-062004	6/22/2004	1	C0611-11A	71-55-6	1,1,1-Trichloroethane	**0.39**	Y	J			µg/L
MW-10	PH3GMW1004-062004	6/22/2004	1	C0611-09A	71-55-6	1,1,1-Trichloroethane	**1**	Y	J			µg/L
MW-2	PH3GMW0204-062004	6/22/2004	1	C0611-12A	71-55-6	1,1,1-Trichloroethane	400	N	U	400	400	µg/L
SMW	PH3G0SMW04-062004	6/22/2004	1	C0611-07A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
B-3	B3-092004	9/7/2004	1	C1095-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10-092004	9/7/2004	1	C1095-04A	71-55-6	1,1,1-Trichloroethane	**3**	Y	J			µg/L
SMW	SMW-092004	9/7/2004	1	C1095-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
B-3	B3-122004	12/6/2004	1	C1509-02A	71-55-6	1,1,1-Trichloroethane	**1**	Y	J			µg/L
MW-10	MW10-122004	12/6/2004	1	C1509-04A	71-55-6	1,1,1-Trichloroethane	**1**	Y	J			µg/L
SMW	SMW-122004	12/6/2004	1	C1509-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
B-3	B3-032005	3/7/2005	1	D0260-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10-032005	3/7/2005	1	D0260-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-032005	3/7/2005	1	D0260-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-1	PS1-042005	4/18/2005	1	D0439-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-2	PS2-042005	4/18/2005	1	D0439-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-24	PS24-042005	4/18/2005	25	D0439-04A	71-55-6	1,1,1-Trichloroethane	120	N	U	120	120	µg/L
PS-4	PS4-042005	4/18/2005	8	D0439-03A	71-55-6	1,1,1-Trichloroethane	40	N	U	40	40	µg/L
PS-6	PS6-042005	4/18/2005	50	D0439-05A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
PS-11	PS11-042005	4/19/2005	5	D0439-08A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-12	PS12-042005	4/19/2005	100	D0439-09A	71-55-6	1,1,1-Trichloroethane	500	N	U	500	500	µg/L
PS-13	PS13-042005	4/19/2005	40	D0439-07A	71-55-6	1,1,1-Trichloroethane	200	N	U	200	200	µg/L
PS-15	PS15-042005	4/19/2005	20	D0454-03A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
PS-16	PS16-042005	4/19/2005	50	D0439-11A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
PS-17	PS17-042005	4/19/2005	16	D0454-05A	71-55-6	1,1,1-Trichloroethane	80	N	U	80	80	µg/L
PS-18	PS18-042005	4/19/2005	25	D0454-04A	71-55-6	1,1,1-Trichloroethane	130	N	U	130	130	µg/L
PS-21	PS21-042005	4/19/2005	25	D0454-06A	71-55-6	1,1,1-Trichloroethane	130	N	U	130	130	µg/L
PS-5	PS5-042005	4/19/2005	8	D0439-06A	71-55-6	1,1,1-Trichloroethane	40	N	U	40	40	µg/L
PS-8	PS8-042005	4/19/2005	5	D0454-01A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-9	PS9-042005	4/19/2005	50	D0454-02A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
S-10	S10-042005	4/19/2005	20	D0454-08A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
S-8	S8-042005	4/19/2005	4	D0454-09A	71-55-6	1,1,1-Trichloroethane	20	N	U	20	20	µg/L
A-173	5YRGA17300-052005	5/6/2005	1	D0534-07A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-142	5YRGA14200-052005	5/9/2005	1	D0534-09A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-143	5YRGA14300-052005	5/9/2005	1	D0534-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-167	5YRGA16700-052005	5/9/2005	1	D0534-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-200	5YRGA20000-052005	5/9/2005	1	D0534-08A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-203	5YRGA20300-052005	5/9/2005	1	D0534-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-77	5YRGA07700-052005	5/9/2005	1	D0534-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
B-3	B3-112005	11/21/2005	1	D1408-01A	71-55-6	1,1,1-Trichloroethane	**1**	Y	J			µg/L
MW-10	MW10-112005	11/21/2005	1	D1408-03A	71-55-6	1,1,1-Trichloroethane	**2**	Y	J			µg/L
SMW	SMW-112005	11/21/2005	1	D1408-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
B-3	B3-122005	12/19/2005	1	D1537-04A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
MW-10	MW105-122005	12/19/2005	1	D1537-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-122005	12/19/2005	1	D1537-03A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
B-3	B3-032006	3/13/2006	1	E0273-03A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
MW-10	MW10-032006	3/13/2006	1	E0273-05A	71-55-6	1,1,1-Trichloroethane	20	N	U	20	20	µg/L
SMW	SMW-032006	3/13/2006	1	E0273-04A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
PS-1	PS1-042006	4/20/2006	1	E0510-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-11	PS11-042006	4/20/2006	20	E0510-09A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
PS-12	PS12-042006	4/20/2006	100	E0510-08A	71-55-6	1,1,1-Trichloroethane	500	N	U	500	500	µg/L
PS-13	PS13-042006	4/20/2006	40	E0510-07A	71-55-6	1,1,1-Trichloroethane	200	N	U	200	200	µg/L
PS-15	PS15-042006	4/20/2006	20	E0510-11A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
PS-16	PS16-042006	4/20/2006	50	E0510-10A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
PS-17	PS17-042006	4/20/2006	16	E0510-15A	71-55-6	1,1,1-Trichloroethane	80	N	U	80	80	µg/L
PS-18	PS18-042006	4/20/2006	25	E0510-16A	71-55-6	1,1,1-Trichloroethane	120	N	U	120	120	µg/L
PS-2	PS2-042006	4/20/2006	1	E0510-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-21	PS21-042006	4/20/2006	25	E0510-14A	71-55-6	1,1,1-Trichloroethane	120	N	U	120	120	µg/L
PS-24	PS24-042006	4/20/2006	25	E0510-04A	71-55-6	1,1,1-Trichloroethane	120	N	U	120	120	µg/L
PS-4	PS4-042006	4/20/2006	8	E0510-03A	71-55-6	1,1,1-Trichloroethane	40	N	U	40	40	µg/L
PS-5	PS5-042006	4/20/2006	8	E0510-06A	71-55-6	1,1,1-Trichloroethane	40	N	U	40	40	µg/L
PS-6	PS6-042006	4/20/2006	50	E0510-05A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
PS-8	PS8-042006	4/20/2006	5	E0510-12A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-9	PS9-042006	4/20/2006	50	E0510-13A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
S-10	S10-042006	4/20/2006	20	E0510-17A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
S-2	S2-042006	4/20/2006	1	E0510-21A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-3	S3-042006	4/20/2006	1	E0510-19A	71-55-6	1,1,1-Trichloroethane	**9**	Y		5	5	µg/L
S-8	S8-042006	4/20/2006	4	E0510-18A	71-55-6	1,1,1-Trichloroethane	20	N	U	20	20	µg/L
B-3	B3-062006	6/5/2006	1	E0725-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10-062006	6/5/2006	1	E0725-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-062006	6/5/2006	1	E0725-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
A-175	PH3GA175LF-072006	7/20/2006	1	E1068-02A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
B-3	PH3GB3LF-072006	7/20/2006	1	E1068-03A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
SMW	PH3GSMWLF-072006	7/20/2006	1	E1068-04A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
MW-10	PH3GMW10LF-072006	7/20/2006	1	E1068-05A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
I-37	PH3GI3785-072006	7/20/2006	1	E1068-06A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-37	PH3GI37159-072006	7/20/2006	1	E1068-07A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-37	PH3GI37219-072006	7/20/2006	1	E1068-08A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-37	PH3GI37249-072006	7/20/2006	1	E1068-09A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI1285-072006	7/20/2006	1	E1068-10A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12159-072006	7/20/2006	1	E1068-11A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12219-072006	7/20/2006	1	E1068-12A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12249-072006	7/20/2006	1	E1068-14A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12313-072006	7/20/2006	1	E1068-15A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12345-072006	7/20/2006	1	E1068-16A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12366-072006	7/20/2006	1	E1068-17A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
I-12	PH3GI12415-072006	7/20/2006	1	E1068-18A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
MW-2	PH3GMW216-072006	7/20/2006	1	E1068-19A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
MW-2	PH3GMW219-072006	7/20/2006	1	E1068-20A	71-55-6	1,1,1-Trichloroethane	**5**	Y	J			µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
MW-2	PH3GMW222-072006	7/20/2006	1	E1069-02A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
MW-2	PH3GMW225-072006	7/20/2006	1	E1069-03A	71-55-6	1,1,1-Trichloroethane	**6**	Y	J			µg/L
MW-2	PH3GMW230-072006	7/20/2006	1	E1069-04A	71-55-6	1,1,1-Trichloroethane	**5**	Y	J			µg/L
MW-2	PH3GMW2LF-072006	7/20/2006	1	E1069-05A	71-55-6	1,1,1-Trichloroethane	**5**	Y	J			µg/L
B-3	B3-092006	9/11/2006	1	E1378-01A	71-55-6	1,1,1-Trichloroethane	**1.7**	Y	J			µg/L
MW-10	MW10-092006	9/11/2006	1	E1378-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-092006	9/11/2006	1	E1378-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
B-3	B3-120506	12/5/2006	50	E1873-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
SMW	SMW-120506	12/5/2006	1	E1873-02a	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-10	MW10-120506	12/5/2006	1	E1873-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
WSP-020	WSP-020-031207	3/12/2007	40	F0301-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
WSP-030	WSP-030-031207	3/12/2007	50	F0301-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
WSP-040	WSP-040-031207	3/12/2007	40	F0301-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-1	PS1-032007	3/27/2007	1	F0392-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-13	PS13-032007	3/27/2007	1	F0392-07A	71-55-6	1,1,1-Trichloroethane	**11**	Y		5	5	µg/L
PS-2	PS2-032007	3/27/2007	1	F0392-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-24	PS24-032007	3/27/2007	1	F0392-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-4	PS4-032007	3/27/2007	1	F0392-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-5	PS5-032007	3/27/2007	8	F0392-06A	71-55-6	1,1,1-Trichloroethane	40	N	U	40	40	µg/L
PS-6	PS6-032007	3/27/2007	1	F0392-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-11	PS11-032007	3/28/2007	1	F0392-09A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-12	PS12-032007	3/28/2007	50	F0392-08A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
PS-15	PS15-032007	3/28/2007	1	F0392-11A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-16	PS16-032007	3/28/2007	20	F0392-10A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
PS-17	PS17-032007	3/28/2007	1	F0392-15A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-18	PS18-032007	3/28/2007	25	F0392-16A	71-55-6	1,1,1-Trichloroethane	130	N	U	130	130	µg/L
PS-21	PS21-032007	3/28/2007	50	F0392-14A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
PS-8	PS8-032007	3/28/2007	5	F0392-12A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-9	PS9-032007	3/28/2007	20	F0392-13A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
S-10	S10-032007	3/28/2007	20	F0392-17A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
S-2	S2-032007	3/28/2007	50	F0392-22A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	250	µg/L
S-3	S3-032007	3/28/2007	200	F0392-20A	71-55-6	1,1,1-Trichloroethane	1000	N	U	1000	1000	µg/L
S-6	S6-032007	3/28/2007	5	F0392-19A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
S-8	S8-032007	3/28/2007	10	F0392-18A	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
S-9	S9-032007	3/28/2007	5	F0392-21A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
A-175	PH3GA175LF-042007	4/13/2007	1	F0461-03A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
B-3	PH3GB3LF-042007	4/13/2007	1	F0461-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
I-12	PH3GI12415-042007	4/13/2007	1	F0461-07A	71-55-6	1,1,1-Trichloroethane	**0.29**	Y	J			µg/L
I-37	PH3GI3785-042007	4/13/2007	1	F0461-09A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.5	µg/L
MW-10	PH3GMW10LF-042007	4/13/2007	1	F0461-06A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
MW-2	PH3GMW222-042007	4/13/2007	1	F0461-10A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
WSP-040	WSP-040 6/04/07	6/4/2007	1	F0749-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.51	µg/L
WSP-030	WSP-030 6/04/07	6/4/2007	50	F0749-04A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	26	µg/L
WSP-020	WSP-020 6/04/07	6/4/2007	1	F0749-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.51	µg/L
A-175	PH3-G-A175-LF	12/13/2007	1	F1871-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.05	µg/L
B-3	PH3-G-B3-LF	12/27/2007	1	F1941-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.05	µg/L
SMW	PH3-G-SMW-LF	12/27/2007	1	F1941-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.05	µg/L
MW-10	PH3-G-MW10-LF	12/27/2007	1	F1941-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.05	µg/L
MW-2	PH3-G-MW2-22	12/27/2007	1	F1941-04A	71-55-6	1,1,1-Trichloroethane	**5.2**	Y		5	0.05	µg/L
I-12	PH3-G-I12-415	12/27/2007	1	F1941-06A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.005	µg/L
I-37	PH3-G-I37-85	12/27/2007	1	F1941-09A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.005	µg/L
WSP-030	WSP-030-080310	3/10/2008	1	G0292-01A	71-55-6	1,1,1-Trichloroethane	**1.2**	Y	J	5	0.41	µg/L
WSP-020	WSP-020-080310	3/10/2008	1	G0292-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-040	WSP-040-080310	3/10/2008	1	G0292-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-020	WSP-020-080324	3/24/2008	2	G0391-01A	71-55-6	1,1,1-Trichloroethane	10	N	U	10	0.82	µg/L
WSP-030	WSP-030-080324	3/24/2008	50	G0391-02A	71-55-6	1,1,1-Trichloroethane	250	N	U	250	21	µg/L
WSP-040	WSP-040-080324	3/24/2008	1	G0391-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
PS-1	PS1-042008	4/1/2008	1	G0435-01	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-11	PS11-042008	4/1/2008	1	G0435-09	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-12	PS12-042008	4/1/2008	1	G0435-08	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-13	PS13-042008	4/1/2008	1	G0435-07	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-16	PS16-042008	4/1/2008	1	G0435-10	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-17	PS17-042008	4/1/2008	1	G0435-12	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-2	PS2-042008	4/1/2008	1	G0435-02	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-21	PS21-042008	4/1/2008	1	G0435-11	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-24	PS24-042008	4/1/2008	1	G0435-04	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-4	PS4-042008	4/1/2008	1	G0435-03	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-5	PS5-042008	4/1/2008	1	G0435-06	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-6	PS6-042008	4/1/2008	1	G0435-05	71-55-6	1,1,1-Trichloroethane	**5.9**	Y		5	5	µg/L
PS-15	PS15-042008	4/2/2008	1	G0435-13	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-18	PS18-042008	4/2/2008	1	G0435-16	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-8	PS8-042008	4/2/2008	1	G0435-14	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-9	PS9-042008	4/2/2008	1	G0435-15	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-10	S10-042008	4/2/2008	1	G0435-17	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-2	S2-042008	4/2/2008	1	G0435-22	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-3	S3-042008	4/2/2008	160	G0435-20	71-55-6	1,1,1-Trichloroethane	800	N	U	800	800	µg/L
S-6	S6-042008	4/2/2008	1	G0435-19	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-8	S8-042008	4/2/2008	1	G0435-18	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-9	S9-042008	4/2/2008	1	G0435-21	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
WSP-020	WSP-020 060208	6/2/2008	4	G0839-02A	71-55-6	1,1,1-Trichloroethane	20	N	U	20	1.6	µg/L
WSP-030	WSP-030 060208	6/2/2008	8	G0839-03A	71-55-6	1,1,1-Trichloroethane	40	N	U	40	3.3	µg/L
WSP-040	WSP-040 060208	6/2/2008	1	G0839-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
WSP-020	WSP-020-090808	9/8/2008	1	G1482-01	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-030	WSP-030-090808	9/8/2008	1	G1482-02	71-55-6	1,1,1-Trichloroethane	**1.4**	Y	J	5	0.41	µg/L
WSP-040	WSP-040-090808	9/8/2008	1	G1482-03	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-040	WSP-040-120808	12/1/2008	5	G2231-01	71-55-6	1,1,1-Trichloroethane	25	N	U	25	2.1	µg/L
WSP-030	WSP-030-120808	12/1/2008	25	G2231-02	71-55-6	1,1,1-Trichloroethane	130	N	U	130	10	µg/L
OMW01	OMW01G001	12/3/2008	1	G2257-02A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.11	µg/L
OMW02	OMW02G001	12/3/2008	1	G2257-03A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.11	µg/L
OMW03	OMW03G001	12/3/2008	1	G2257-04A	71-55-6	1,1,1-Trichloroethane	0.5	N	U	0.5	0.11	µg/L
S-3	S-3	3/19/2009	1	H0442-01A	71-55-6	1,1,1-Trichloroethane	**14**	Y		5	0.22	µg/L
S-10	S-10	3/19/2009	1	H0442-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
S-2	S-2	3/19/2009	1	H0442-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
S-8	S-8	3/19/2009	1	H0442-04A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
S-6	S-6	3/19/2009	1	H0442-05A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
S-9	S-9	3/19/2009	5	H0442-06A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	1.1	µg/L
PS-18	PS-18	3/19/2009	1	H0442-07A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-17	PS-17	3/19/2009	1	H0442-08A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-16	SP-16	3/19/2009	1	H0442-09A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-12	PS-12	3/19/2009	1	H0442-10A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-13	PS-13	3/19/2009	1	H0442-11A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-21	PS-21	3/19/2009	1	H0442-12A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-5	PS-5	3/19/2009	1	H0442-13A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-11	PS-11	3/19/2009	1	H0442-14A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-6	PS-6	3/19/2009	1	H0442-15A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-9	PS-9	3/19/2009	40	H0442-16A	71-55-6	1,1,1-Trichloroethane	200	N	U	200	8.8	µg/L
PS-8	PS-8	3/19/2009	40	H0442-17A	71-55-6	1,1,1-Trichloroethane	200	N	U	200	8.8	µg/L
PS-15	PS-15	3/19/2009	1	H0442-18A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-24	PS-24	3/19/2009	1	H0442-19A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-2	PS-2	3/20/2009	1	H0442-20A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-1	PS-1	3/20/2009	1	H0442-21A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.22	µg/L
PS-4	PS-4	3/20/2009	3	H0442-22A	71-55-6	1,1,1-Trichloroethane	15	N	U	15	0.66	µg/L
WSP-020	WSP-020-032309	3/23/2009	1	H0452-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-030	WSP-030-032309	3/23/2009	1	H0452-02A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-040	WSP-040-032309	3/23/2009	1	H0452-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
OMW01	OMW01G0409	4/8/2009	1	H0599-01	71-55-6	1,1,1-Trichloroethane	0.22	N	U	0.22	0.22	µg/L
OMW02	OMW02G0409	4/8/2009	1	H0599-02	71-55-6	1,1,1-Trichloroethane	0.22	N	U	0.22	0.22	µg/L
OMW03	OMW03G002	4/9/2009	1	H0599-04	71-55-6	1,1,1-Trichloroethane	0.22	N	U	0.22	0.22	µg/L
WSP-020	WSP-020-061509	6/15/2009	1	H1084-01A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L
WSP-030	WSP-030-061509	6/15/2009	20	H1084-02A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	0.41	µg/L
WSP-040	WSP-040-061509	6/15/2009	1	H1084-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.41	µg/L

Historical 1,1,1-Trichloroethane Concentrations
3Q00 through 1Q10

Location	Sample ID	Sample Date	Dilution Factor	Lab ID	CAS No.	Analyte	Result	Detect (Y/N)	Qualifier	RL	MDL	Units
WSP-020	WSP 020-090909	9/9/2009	20	H1742-02A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	0.18	µg/L
WSP-030	WSP 030-090909	9/9/2009	5	H1742-01A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	0.18	µg/L
WSP-040	WSP 040-090909	9/9/2009	20	H1742-03A	71-55-6	1,1,1-Trichloroethane	100	N	U	100	0.18	µg/L
WSP-030	WSP 030-121409	12/14/2009	1	H2555-01A	71-55-6	1,1,1-Trichloroethane	5	N	UJ	5	0.18	µg/L
WSP-020	WSP 020-121409	12/14/2009	5	H2555-02A	71-55-6	1,1,1-Trichloroethane	25	N	U	25	0.18	µg/L
WSP-040	WSP 040-121409	12/14/2009	1	H2555-03A	71-55-6	1,1,1-Trichloroethane	5	N	U	5	0.18	µg/L
PS-1	PS1-042010	3/29/2010	1	J0598-01	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-2	PS2-042010	3/29/2010	1	J0598-02	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
PS-4	PS4-042010	3/29/2010	10	J0598-03	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
PS-11	PS11-042010	4/1/2010	2	J0598-17	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
PS-12	PS12-042010	4/1/2010	20	J0598-16	71-55-6	1,1,1-Trichloroethane	100	N	U	100	100	µg/L
PS-13	PS13-042010	4/1/2010	25	J0598-15	71-55-6	1,1,1-Trichloroethane	130	N	U	130	130	µg/L
PS-15	PS15-042010	4/1/2010	5	J0598-05	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-16	PS16-042010	4/1/2010	2.5	J0598-18	71-55-6	1,1,1-Trichloroethane	13	N	U	13	13	µg/L
PS-17	PS17-042010	4/1/2010	10	J0598-09	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
PS-18	PS18-042010	4/1/2010	10	J0598-19	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
PS-21	PS21-042010	4/1/2010	2.5	J0598-08	71-55-6	1,1,1-Trichloroethane	13	N	U	13	13	µg/L
PS-24	PS24-042010	4/1/2010	5	J0598-04	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-5	PS5-042010	4/1/2010	5	J0598-14	71-55-6	1,1,1-Trichloroethane	25	N	U	25	25	µg/L
PS-6	PS6-042010	4/1/2010	100	J0598-13	71-55-6	1,1,1-Trichloroethane	500	N	U	500	500	µg/L
PS-8	PS8-042010	4/1/2010	40	J0598-06	71-55-6	1,1,1-Trichloroethane	200	N	U	200	200	µg/L
PS-9	PS9-042010	4/1/2010	10	J0598-07	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
S-10	S10-042010	4/1/2010	10	J0598-10	71-55-6	1,1,1-Trichloroethane	50	N	U	50	50	µg/L
S-2	S2-042010	4/1/2010	2	J0598-20	71-55-6	1,1,1-Trichloroethane	10	N	U	10	10	µg/L
S-3	S3-042010	4/1/2010	100	J0598-21	71-55-6	1,1,1-Trichloroethane	500	N	U	500	500	µg/L
S-6	S6-042010	4/1/2010	1	J0598-12	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-8	S8-042010	4/1/2010	1	J0598-11	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L
S-9	S9-042010	4/1/2010	1	J0598-22	71-55-6	1,1,1-Trichloroethane	5	N	U	5	5	µg/L

Notes:
All units are micrograms per liter
RL = reporting limit
MDL = method detection limit
U = not detected at detection limit shown
J = estimated value

Stamina Millls Phase III May 2010
Groundwater Results - 1,4-Dioxane

			Sample Location:	B-3	B-3	MW-10	SMW
			Sample ID:	B3LFG2Q10	B3LFH2Q10	MW10LFG2Q10R	SMWLFG2Q10R
			Sample Date:	6/18/2010	6/18/2010	6/18/2010	6/18/2010
			Sample Type:	Groundwater	Duplicate	Groundwater	Groundwater
Method	**CAS No.**	**Analyte**	**Units**				
SVOA	123-91-1	1,4-Dioxane	µg/L	2 U	2 U	2 U	2 U

***Notes*:**

SVOA = semivolatile organic compunds
µg/L = micrograms per liter
U = not detected

Stamina Mills Superfund Site
Phase III Groundwater Sampling Event - May 2010
1,1,1-TCA Results

			Sample Location:	B-3	MW-10	MW-2	MW-2	SMW
			Sample ID:	B3LFG2Q10	MW10LFG2Q10	MW222G2Q10	MW222H2Q10	SMWLFG2Q10
			Sample Date:	6/18/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010
			Sample Type:	Groundwater	Groundwater	Groundwater	Duplicate	Groundwater
Method	**CAS No.**	**Analyte**	**Units**					
VOA	71-55-6	1,1,1-Trichloroethane	µg/L	40 U	5 U	5 U	5 U	5 U

			Sample Location:	A-175	I-12	I-20	I-20	I-20	I-20	I-24	I-24	I-24	I-30	I-30	I-30	I-37	I-37
			Sample ID:	A175LFG2Q10	I12415G2Q10	I20151G2Q10	I20151H2Q10	I20301G2Q10	I2055G2Q10	I24111G2Q10	I2461G2Q10	I2486G2Q10	I30111G2Q10	I3061G2Q10	I3086G2Q10	I3785G2Q10	I3785H2Q10
			Depth (Feet):		415	151	151	301	55	111	61	86	111	61	86	85	85
			Sample Date:	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010	5/24/2010
			Sample Type:	Groundwater	Groundwater	Groundwater	Duplicate	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Duplicate
Method	**CAS No.**	**Analyte**	**Units**														
VOA_Trace	71-55-6	1,1,1-Trichloroethane	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.84**	**0.68**	0.5 U	0.5 U	**0.28 J**	0.5 U	0.5 U

Lori Goetz

From: Lori Goetz
Sent: Wednesday, March 31, 2010 3:08 PM
To: 'Mah.Byron@epamail.epa.gov'
Subject: Stamina Mills - 1,4-dioxane

Byron –
I checked with our chemist, who said that EPA has removed 1,4-Dioxane from the SOM01.2 trace method, which is what we run on our offsite, Phase III groundwater monitoring program wells (Stage 1 and 2 wells).

To run 1,4-dioxane, we would need to run SVOCs. We can't do this offsite, because we have no way to purge the wells (offsite wells are sampled using PDBs). Onsite, we can collect adequate SVOC sample volume easily enough from the MW-10, SMW, and B-3 sample ports, if we want to make that recommendation in the 5-year review. For 1,4-dioxane by Modified SOM01.2 SVOC scan, the RL is routinely 2 ug/L.

In answer to Chau's question as to whether 1,1,1-TCA is an issue at the site, we first looked at the last Phase III monitoring report. During the December 2007 event, 1,1,1-TCA was only detected in MW-2, at 5.2 ug/L. From a quick (and I mean quick) review of other data, it seems that any detections of 1,1,1-TCA that we do have tend to be sporadic and in this low end range (1 to 5 ug/L). For more detail, we'll have to dive into a lot of very old data, sort through blind QA/QC samples (such as spiked PE samples), etc. If we need to do this, let me know – it will be time consuming and will mean pulling the original reports from archive.

- Lori

Lori Goetz

From: Lori Goetz
Sent: Friday, April 02, 2010 9:07 AM
To: mah.byron@epamail.epa.gov
Subject: Stamina Mills - 1,4-Dioxane

Follow Up Flag: Follow up
Flag Status: Completed

Byron -
To document our call from Thursday, 4/1 - concurrent with our April 2010 Phase III Groundwater event, we will sample SMW, MW-10, and B-3 for 1,4-dioxane. Samples will be analyzed using SOM01.2 using SVOC methods. 1,4-dioxane's contract required reporting limit using this method is 2 micrograms per liter, which meets the risk based goal of 6 ug/L Chau Vu identified in our call on Wednesday 3/31.

Our objective sampling these three wells is to determine whether 1,4-dioxane is present/absent. These wells are sampled using dedicated sampling ports inside the treatment building, and it will not be a problem to obtain sufficient sample volume for the 1,4-dioxane scan. We will collect one duplicate.

In parallel with the five year review and the 1,4-dioxane assessment above, we'll look at the last five years of monitoring data and look at (a) the frequency of 1,1,1-TCA detections, and (b) the concentrations of detections. From that, we'll qualitatively assess 1,4-dioxane risks.

Please let me know if you have any questions or if I didn't capture everything.

- Lori

Lori Goetz

From: Mah.Byron@epamail.epa.gov
Sent: Friday, April 02, 2010 9:57 AM
To: Lori Goetz
Subject: Re: Stamina Mills - 1,4-Dioxane

Follow Up Flag: Follow up
Flag Status: Completed

Lori:

I believe that you captured our conversation correctly. And Yes, based on the limited 1,1,1-TCA data, we can do a qualitative assessment. I would like to check all monitoring data since the last FYR up to now for 1,1,1-TCA. Depending on how it looks then we can make some statements based on this data and assumptions.

Byron

Byron Mah, Remedial Project Manager / Project Officer / Special Emphasis Program Manager

US Environmental Protection Agency - New England John W. McCormack Building
5 Post Office Square, Mail Code: OSRR07-1 Boston, MA 02109

Office: (617) 918-1249, Fax: (617) 918-0249
Email: mah.byron@epa.gov
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| From: |
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|"Lori Goetz" <lgoetz@Ensafe.com>
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| To: |
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|Byron Mah/R1/USEPA/US@EPA
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|Stamina Mills - 1,4-Dioxane |
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Byron -
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(a) the frequency of 1,1,1-TCA detections, and (b) the concentrations of detections. From that, we'll qualitatively assess 1,4-dioxane risks.

Please let me know if you have any questions or if I didn't capture everything.

- Lori