FINAL FOCUSED FEASIBILITY STUDY REPORT
HOPEWELL PRECISION SITE
HOPEWELL JUNCTION, NEW YORK

Work Assignment No.: 164-RICO-02TK

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PROJECT:	RAC 2 Contract No.: 68-W-98-210 Work Assignment: 164-RICO-02TK Remedial Investigation/Feasibility Study
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SUBJECT:	Final Focused Feasibility Study Report Hopewell Precision Site Hopewell Junction, NY

Dear Mr. Thantu:

CDM Federal Programs Corporation (CDM) is pleased to submit this Final Focused Feasibility Study Report for the Hopewell Precision site in Hopewell Junction, New York. All comments received on the Draft report have been addressed as specified in the Response to Comments letter.

If you have any comments concerning this submittal, please contact me at (212) 785-9123 or Ms. Susan Schofield at (203) 262-6633.

Very truly yours,

CDM FEDERAL PROGRAMS CORPORATION

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Acronyms

ARARs	applicable or relevant and appropriate requirements
bgs	below the ground surface
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cis-1,2-DCE	*cis*-1,2-dichloroethene
CLP	Contract Laboratory Program
CWA	Clean Water Act
D	deep
DESA	Division of Environmental Science and Assessment
DOT	Department of Transportation
EPA	Environmental Protection Agency
FFS	Focused Feasibility Study
GAC	granular activated carbon
gpd	gallons per day
gpm	gallons per minute
GRA	General response action
LDL	low detection limit
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goals
MEK	methyl ethyl ketone
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OMM	operation, maintenance, and monitoring
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
POET	point-of-entry treatment
PPE	personal protective equipment
RAC	Response Action Contract
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RST	Removal Support Team
S	shallow
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TBC	To-be-considered
TCE	trichloroethene
TDS	total dissolved solids
the site	Hopewell Precision Site
TKN	Total Kjehldahl nitrogen

TMV	toxicity, mobility or volume
TOC	total organic carbon
TSS	total suspended solids
USC	United States Code
UV	ultraviolet
VOC	volatile organic compound
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethene
µg/kg	microgram per kilogram
µg/L	microgram per liter

Section 1
Introduction

CDM Federal Programs Corporation (CDM) received Work Assignment 164-RICO-02TK under the Response Action Contract (RAC) to perform a remedial investigation/feasibility study (RI/FS) at the Hopewell Precision Site (the site), located in Hopewell Junction, Dutchess County, New York (Figure 1-1), for the United States Environmental Protection Agency (EPA), Region 2. EPA requested CDM to perform a Focused Feasibility Study (FFS) to evaluate alternatives for alternate water supplies in the area of the identified groundwater plume.

The only current source of drinking water within the identified groundwater plume is from private wells. Since groundwater contamination from volatile organic compounds (VOCs) exceeds EPA and New York State drinking water standards, EPA deemed it appropriate to expedite evaluation of alternate water supplies for the area within the groundwater plume. A separate FS will be conducted to evaluate remedial options for the groundwater resource and for other contaminated media at the site.

This FFS evaluates the three alternatives requested by EPA in Work Assignment Amendment Number 6: 1) No Action, 2) Installation and Operation and Maintenance of Point-of-Entry Treatment (POET) Systems on Presently- and Future-Impacted Private Wells, and 3) Provision of Alternate Water Supply (Installation of the Waterline and Distribution System) to Homeowners with Presently- and Future-Impacted Private Wells.

1.1 Purpose and Report Organization

The purpose of the FFS is to develop, screen, and evaluate the remedial alternatives for alternate water supplies. This report was prepared in accordance with EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)* (EPA 1988). This FFS report is comprised of six sections as described below.

Section 1 - Introduction provides a brief summary of the site background and site history and a summary of the identified groundwater contamination.

Section 2 - Development of Remedial Action Objectives and General Response Actions develops the remedial action objectives (RAOs) and general response actions (GRAs) for the FFS, including an evaluation of applicable or relevant and appropriate requirements (ARARs).

Section 3 - Development of Remedial Action Alternatives presents the remedial alternatives.

Section 4 - Detailed Description of Remedial Action Alternatives provides preliminary design assumptions for the alternatives. This information is used to develop the cost estimates for each alternative in Section 5.

Section 5 - Detailed Analysis of Remedial Action Alternatives provides the detailed analysis of each alternative with respect to the following seven criteria: overall protection of human health and the environment; compliance with the ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. Two evaluation criteria are not evaluated in this FFS, but will be assessed during the Record of Decision (ROD) process: state acceptance; and community acceptance. An overall comparison between the remedial alternatives is also examined in this section.

Section 6 - References provides a list of references used to prepare the FFS.

1.2 Site Background Information

This section includes a site description and a brief history of the site.

1.2.1 Site Description

The Hopewell Precision Site is located in Hopewell Junction, Dutchess County, New York (Figure 1-1). The site consists of the Hopewell Precision facility and the downgradient area affected by the groundwater plume and vapors. The Hopewell Precision facility was located at 15 Ryan Drive from 1977 to 1980. The facility moved to the adjacent property at 19 Ryan Drive in 1980 and continues to operate at that location. The combined size of the two properties is 5.7 acres. The rest of the site consists mostly of residential neighborhoods, all of which are served by private wells and septic systems. Almost 27,000 people live within 4 miles of the Hopewell Precision facility. Commercial development (e.g., strip malls, businesses, gas stations) in the area is primarily along New York State Route 82, which traverses the area in a northeast/southwest direction. An area of farmland borders the eastern side of a section of Route 82. Whortlekill Creek flows in a southerly direction across the residential area and along the western border of the site. Several ponds are present within the area, including two large former quarries (Redwing Lake and the gravel pit) that are filled with groundwater (Figure 1-2).

1.2.2 Site History

The history of the Hopewell Precision Site is summarized from the HRS package prepared by Roy F. Weston (2004).

Hopewell Precision is an active manufacturer of sheet metal parts and assemblies for furniture. The company operated at its original location at 15 Ryan Drive from 1977 to 1980 and moved to its current location at the adjacent property at 19 Ryan Drive in 1980. The property at 19 Ryan Drive was vacant land prior to 1980 and Hopewell Precision has been the sole occupant of the building. The former facility at 15 Ryan Drive has been used by Nicholas Brothers Moving Company for equipment storage and office space since 1981.

Processes at Hopewell Precision include shearing, punching, bending, welding, and painting. The painting process includes degreasing prior to the wet spray paint application. Hopewell Precision currently uses a water-based degreaser, but the company used trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) in a vapor degreasing machine until 1998. Hopewell Precision purchased 12 drums (7,020 pounds) of 1,1,1-TCA in 1980 and 15 drums (9,000 pounds) in 1994. The company generated 1,675 gallons (32 drums) of 1,1,1-TCA waste for off-site disposal from 1986 through 1998. The company purchased 48 drums (31,680 pounds) of TCE in 1996 and 1997, but does not have any hazardous waste manifests for off-site disposal of TCE. Hopewell Precision no longer uses TCE or 1,1,1-TCA for degreasing.

EPA was made aware of Hopewell Precision in October 1979 through a letter from a former Hopewell Precision employee. During an on-site inspection at the former facility (15 Ryan Drive) in November 1979, EPA observed solvent odors coming from an open disposal area. At the time of the inspection, Hopewell Precision was dumping one to five gallons per day of waste solvents, paint pigments, and sodium nitrate directly onto the ground. In August 2003, a former employee stated that the common practice for disposal of waste solvents at the former facility was to pour the material on the ground outside the building. Waste paints and thinners were dumped on a daily basis and waste solvents from the degreaser were dumped on a biweekly basis while he worked at Hopewell Precision in 1979 and 1980.

The former facility was served by a 25-foot deep well that was sampled in March 1980 (sample collection point was a rest room faucet). The analytical results indicated the presence of 1,1,1-TCA at 3.6 micrograms per liter (μg/L) and TCE at 0.6 μg/L. New York State Department of Environmental Conservation (NYSDEC) installed 3 monitoring wells, each 39 to 40 feet deep, at the former facility in May 1985 and sampled the wells in March 1986. The analytical results for monitoring well B-3, located between the current and former buildings, indicated the presence of 1,1,1-TCA at 23 μg/L and TCE at an estimated 4 μg/L. Samples collected from the on-site monitoring wells by Hopewell Precision in April 1993 showed the continuing presence of 1,1,1-TCA and TCE. In 1985, the Dutchess County Department of Health sampled four private drinking water wells near the site and no VOCs were detected in any of the samples.

NYSDEC performed a Hazardous Waste Compliance Inspection of Hopewell Precision in May 1987. The inspector observed eleven 55-gallon drums of waste paint and thinners; six 55-gallon drums of waste 1,1,1-TCA; and one 55-gallon drum of unknown material at the facility. NYSDEC determined that Hopewell Precision was in violation of hazardous waste regulations because it was operating as a hazardous waste storage facility without a permit or interim status authorization. Hopewell Precision subsequently identified the drum of unknown material as paint thinner and performed corrective measures, including waste disposal, that NYSDEC found to be satisfactory.

During another inspection in October 2002, NYSDEC observed four full or partially full 55-gallon drums of waste paint and solvent at the facility. The NYSDEC inspector reported that a spray booth/paint finishing operation generated waste paint and paint thinner. As a result of the inspection, NYSDEC cited the facility for 10 violations of hazardous waste regulations. Hopewell Precision subsequently corrected the violations to NYSDEC's satisfaction.

In February 2003, as part of an effort to make decisions on historic sites, EPA sampled 75 residential wells near the Hopewell Precision facility. Analysis of these samples revealed that five residential wells were contaminated with TCE ranging from 1.2

µg/L to 250 µg/L. At that time, NYSDEC, on behalf of New York State Department of Health (NYSDOH), requested EPA to conduct a removal action at the site, including installation of carbon filter systems on the residential wells.

From February to November 2003, EPA collected groundwater samples from hundreds of private drinking water wells in the vicinity of Hopewell Precision. TCE and 1,1,1-TCA were both detected in numerous private well samples, at individual concentrations up to 250 µg/L for TCE and 11.7 µg/L for 1,1,1-TCA. In addition, 1,1-dichloroethene (1,1-DCE), a breakdown product of TCE or 1,1,1-TCA, was detected in two samples. Several instances of TCE detection exceeded the compounds Maximum Contaminant Level (MCL) of 5 µg/L. EPA has installed POET systems to remove VOCs at 38 homes where TCE exceeded or approached the MCL. NYSDEC has installed POET systems at 14 homes impacted by 1,1,1-TCA above the State standard of 5 µg/L.

In April 2003, EPA collected water and sediment samples from small ponds located about 300 feet south-southwest (downgradient) of the Hopewell Precision facilities. TCE was detected at concentrations of 4 µg/L and 3.4 µg/L in the water samples and 88 micrograms per kilogram (µg/kg) in one of the two sediment samples. EPA collected additional samples from two ponds located approximately 900 and 4,500 feet southwest of Hopewell Precision in May 2003. TCE was detected at an estimated concentration of 3.6 ug/kg in a sediment sample from the closer pond, but was not detected in a water sample from the same location or in sediment and water samples collected from the farther pond on Creamery Road.

In July 2003, EPA collected on-site and off-site soil samples. TCE was detected in two on-site soil samples and 1,1,1-TCA was detected in one on-site sample, but neither contaminant was detected in any off-site samples. EPA completed test holes and collected additional soil samples in December 2003, concentrating the investigation between the current and former Hopewell Precision facilities. Background samples were collected from test holes near the northern property boundaries. TCE was detected in 5 soil samples, at depths ranging from 0 to 12 feet. The maximum detected concentration was 3.7 µg/kg; TCE was not detected in background samples from the same depth range.

In October and December 2003, EPA installed and sampled temporary shallow monitoring wells on both properties. The analytical results indicated TCE concentrations up to 144 µg/L in groundwater at depths ranging from 10 to 30 feet below the ground surface (bgs).

The EPA Removal Action Branch has conducted indoor air testing at the Hopewell Precision Site. Since February 2004, EPA has collected sub-slab and/or indoor air samples from about 200 homes. EPA has installed sub-slab ventilation systems at 55 homes, to reduce the residents' exposure to indoor air contaminants associated with the site.

The Hopewell Precision Site was listed on the National Priorities List on April 27, 2005.

1.3 Remedial Investigation Results for Groundwater

The sections below present a brief summary of the groundwater investigations conducted during the RI, including monitoring well sample results and residential well sample results. Detailed information on the groundwater contamination can be found in the Remedial Investigation Report (CDM 2008).

Selected site-related contaminants are used to focus the evaluation of the nature and extent of contamination in groundwater and other media. To select the site-related contaminants, the analytical data collected during the RI were reviewed, the spatial distribution of contamination was evaluated and the historical site activities and previous investigations conducted at the site were reviewed. Based on these evaluations, seven VOCs were selected as related to past activities at the Hopewell Precision facility: TCE, 1,1,1-TCA, 1,1-DCE, chloromethane, *cis*-1,2-dichloroethene (*cis*-1,2-DCE), methyl ethyl ketone (MEK, also known as 2-butanone), and tetrachloroethene (PCE). The rationale for selecting these seven VOCs is discussed below.

- TCE and 1,1,1-TCA were used at the Hopewell Precision facility for degreasing sheet metal prior to spray paint application and were commonly detected in groundwater and vapors.
- 1,1-DCE is a degradation product of TCE and 1,1,1-TCA and was detected in residential well samples and vapor samples, although not with great frequency.
- Chloromethane was detected in residential well samples, monitoring well samples, and surface water samples, although not with great frequency.
- *Cis*-1,2-DCE is a primary degradation product of TCE and PCE, although it was not widely detected in site media.
- MEK (2-butanone) was detected in vapor samples and did not exceed its screening criteria in groundwater or soil. MEK was identified as a site-related contaminant in previous investigations.
- PCE has been used as a cleaning solvent, although its use was not specifically documented at the Hopewell Precision facility. However, PCE was detected in a limited number of soil samples at the facility and was also detected at very low levels (generally below 1 µg/L) in numerous monitoring well samples and in vapor samples.

1.3.1 Monitoring Well Sample Results

Monitoring well installation, water level measurements, and sample results are summarized below.

1.3.1.1 Monitoring Well Installation

A total of 35 overburden monitoring wells (EPA-7D, EPA-7S, EPA-8I, EPA-8S, EPA-9S, EPA-10D, EPA-10S, EPA-11D, EPA-11S, EPA-12D, EPA-12S, EPA-13D, EPA-13S, EPA-14S, EPA-15D, EPA-16D, EPA-16S, EPA-17D, EPA-17S, EPA-18D, EPA-18S, EPA-19D,

EPA-19S, EPA-20S, EPA-21D, EPA-21S, EPA-22D, EPA-22S, EPA-23D, EPA-23S, EPA-24S, EPA-25D, EPA-25S, EPA-26D, and EPA-26S) were installed from November 2006 to February 2007. Monitoring well pairs (consisting of a shallow [S] and a deep [D] well) were installed at 15 locations and single wells were installed at 5 locations. Monitoring well locations are shown on Figure 1-3. Well construction details are provided on Table 1-1. Two wells, EPA-07S and EPA-07D, are background wells. All of the wells were installed in the unconsolidated sediments, with shallow wells generally screened just below the groundwater table and the deep wells screened just above the bedrock.

1.3.1.2 Synoptic Water Level Measurements

A round of synoptic water level measurements were collected at all monitoring wells prior to each round of sampling (March and July 2007). An electronic water level meter was used to obtain the depth-to-water measurements at each well to an accuracy of 0.01 foot. Water level elevations were used to determine the local groundwater flow direction. In addition, a round of water measurements was taken on September 25, 2007. Water level measurements are included on Table 1-2.

1.3.1.3 Monitoring Well Samples

Groundwater samples were collected from the 35 newly installed monitoring wells and 3 existing monitoring wells at the Hopewell Precision property in March and July 2007. Groundwater samples were analyzed by Contract Laboratory Program (CLP) laboratories for trace VOCs, semi-volatile organic compounds (SVOCs), and pesticides/polychlorinated biphenyls (PCBs). EPA's Division of Environmental Science and Assessment (DESA) laboratory analyzed Target Analyte List (TAL) metals including cyanide and mercury, hardness, total suspended solids (TSS), and total dissolved solids (TDS). Katahdin Laboratory, under subcontract to CDM, analyzed alkalinity, ammonia, total Kjehldahl nitrogen (TKN), chloride, sulfate, sulfide, nitrate, total organic carbon (TOC), and methane, ethane, ethene. Ferrous iron was analyzed on site. Groundwater sample full data are provided in the RI Report and all VOC detections are included on Figure 1-4.

1.3.1.4 Monitoring Well Results

Analytical results for monitoring well samples were compared to the screening criteria described on Table 1-3. Discussions of analytical results are presented by sampling round in the following sections, with the primary focus on detections of site-related contaminants: TCE, 1,1,1-TCA, 1,1-DCE, *cis*-1,2-DCE, chloromethane, MEK (2-butanone) and PCE. The monitoring well results will be discussed from north to south, based on proximity to the Hopewell Precision facility.

Site-Related Contaminants

<u>Hopewell Precision Facility</u>

Five wells at the Hopewell Precision facility were sampled (EPA-05, MW-B1, MW-B3, EPA-08S, and EPA-08I). In Round 1, TCE and 1,1,1-TCA were detected in MW-B3 at 0.58 J µg/L and 0.11J µg/L, respectively. In Round 2, 1,1,1-TCA was detected in four of the five wells at concentrations ranging from 0.094 J µg/L at EPA-08S and MW-B3 to 0.05 J µg/L at MW-B1. PCE was only detected in one of the five wells, EPA-08I, in the Round 2 sample at 0.076 J µg/L. PCE was not detected in any of the Round 1 samples.

TCE was detected in two of the five wells, MW-B3 and EPA-08S, at 0.56 μg/L and 3.1 μg/L, respectively. None of the detections of site-related contaminants in these wells exceeded screening criteria.

Oak Ridge Road to Hamilton Road

Ten wells are located between Oak Ridge Road and Hamilton Road (EPA-10S, EPA-10D, EPA-12S, EPA-12D, EPA-14S, EPA-15D, EPA-16S, EPA-16D, EPA-19S, and EPA-19D). At 6 of the 10 wells (EPA-10S, EPA-12S, EPA-15D, EPA-16S, EPA-16D, and EPA-19S) TCE was detected above the screening criterion during both sampling rounds. Levels ranged from 94 μg/L at EPA-10S to 7 μg/L at EPA-19S. 1,1,1-TCA was also detected in these 6 wells at concentrations below the screening criterion ranging from 2.7 μg/L in EPA-16D to 0.67 μg/L in EPA-15D. No PCE or chloromethane was detected in these six wells.

Four of the 10 wells (EPA-10D, EPA-12D, EPA-14S, and EPA-19D) had no site-related contaminants above the screening criteria. EPA-10D, EPA-12D, and EPA-19D are likely screened below the plume core and EPA-14S is located on the western edge of the plume. TCE was detected in all four wells at concentrations ranging from 1.9 μg/L at EPA-10D to 0.1 J μg/L at EPA-14S. 1,1,1-TCA was detected in two of the four wells, EPA-12D and EPA-19D, at 2.4 μg/L and 0.54 μg/L, respectively. PCE was detected in EPA-10D, EPA-14S, and EPA-19D at concentrations ranging from 0.61 μg/L at EPA-10D to 0.099 J μg/L at EPA-14S.

Hamilton Road to the Gravel Pit

Eleven wells are located downgradient of the plume core, between Hamilton Road and the gravel pit (EPA-18S, EPA-18D, EPA-21S, EPA-21D, EPA-23S, EPA-23D, EPA-24S, EPA-25S, EPA-25D, EPA-26S, and EPA-26D). Concentrations of site-related contaminants in these wells were below the screening criteria. 1,1,1-TCA was detected in 8 of the 11 wells ranging from 3.7 μg/L in EPA-23S to 0.08 J μg/L in EPA-26D. TCE is detected in 2 of 11 wells, EPA-21S and EPA-21D, at 0.21 J μg/L and 0.52 μg/L, respectively. PCE was not detected in any of these wells during Round 1, but was detected in 4 of the 11 wells (EPA-18D, EPA-21S, EPA-21D, and EPA-23D) during Round 2, ranging from 0.23 J μg/L at EPA-23D to 0.11 J μg/L at EPA-18D.

No site-related contaminants were detected during either round of sampling at EPA-09S, EPA-11S, EPA-11D, EPA-17S, EPA-20S, or EPA-22S. EPA-09S is likely to the west of the plume and EPA-11S, EPA-11D, EPA-17S, EPA-20S, and EPA-22S are likely to the east of the plume. The results for Round 1 indicated that EPA-13S, EPA-13D, EPA-17D, and EPA-22D were also outside of the plume boundary. However, PCE was detected an order of magnitude below the screening criterion in each of these wells during Round 2. Since no TCE or 1,1,1-TCA was detected in EPA-13S, EPA-13D, EPA-17D, and EPA-22D, the wells are not considered to be within the plume. In addition, PCE levels were extremely low, well below 1 μg/L.

Chloromethane was detected in three monitoring wells, EPA-19S, EPA-23D, and EPA-25S ranging from 0.46 J μg/L at EPA-25S to 0.19 J μg/L at both EPA-23D and EPA-19S. Chloromethane is not associated with the plume core and detections are not spatially continuous. No 1,1-DCE, cis-1,2-DCE, or MEK (2-butanone) were detected in either round of monitoring well samples.

Two wells, EPA-07S and EPA-07D, were installed upgradient of the Hopewell Precision facility to determine background groundwater conditions. No site-related contaminants were detected in either well during Round 1. During Round 2, 1,1,1-TCA was detected in both upgradient wells at 0.052 J µg/L at EPA-07S and 0.065 J µg/L at EPA-07D. No other site-related contaminants were detected in the Round 2 samples at EPA-07S or EPA-07D.

Other Organics

Sixteen other organic compounds were detected in the monitoring well samples, including: trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, acetone, carbon disulfide, *trans*-1,2-dichloroethene, MTBE, chloroform, cyclohexane, carbon tetrachloride, metylcyclohexane, toluene, *trans*-1,3-dichlorpropene, ethylbenzene, styrene, isopropylbenzene, and 1,3-dichlorobenzene. None exceeded screening criteria. Six SVOCs were detected in Round 1 samples and eight SVOCs were detected in Round 2. Atrazine in EPA-05 exceeded the screening criteria by 10 times in the Round 1 sample, but not in the Round 2 sample. Chrysene and benzo(b)fluoranthene exceeded the screening criteria at EPA-12S by 2 orders of magnitude in the Round 2 sample, but were not detected in the Round 1 sample. Five pesticides were detected in the Round 1 samples; none exceeded screening criteria. Two pesticides were detected in the Round 2 samples and beta-BHC slightly exceeded screening criterion in EPA-17D. No PCBs were detected in either round of sampling.

Inorganics

Fifteen inorganics were detected in Round 1 samples and 13 inorganics were detected in Round 2 samples. In Round 1, arsenic was detected in EPA-13S at 16 µg/L, approximately 1.5 times the screening criteria, but was not detected in the Round 2 sample. Cadmium was detected in EPA-07S and EPA-10D above screening criterion in the Round 1 samples, but was not detected in the Round 2 samples. Chromium was detected in seven Round 1 samples and four Round 2 samples but only exceeded the screening criterion in the EPA-10D Round 2 sample. Zinc detections ranged from 4 to 60 times screening criterion; it were detected and exceeded screening criteria in 15 samples from Round 1 and 4 samples from Round 2. The highest concentration for both rounds was from EPA-17D.

Three metals, iron, manganese and sodium, were commonly detected at the site at concentrations exceeded screening criteria. During Round 1, manganese was detected in 36 samples and concentrations exceeded screening criteria in 12 samples, including background well EPA-07S. Manganese was detected in 33 samples in Round 2 and exceeded screening criteria in 11 samples. Sodium was detected in 37 samples in each round, with 29 samples exceeding screening criteria in Round 1 and 30 samples exceeding screening criteria in Round 2. The highest sodium concentration was in the EPA-07S Round 1 sample. Iron was detected in 33 samples in Round 1 and 35 samples in Round 2. In Round 1, iron exceeded the screening criterion in 29 samples and in Round 2 25 samples exceeded the screening criterion. Iron exceeded the screening criterion in the background wells EPA-07S and EPA-07D in Round 1 and in EPA-07S in Round 2. The highest iron concentration was detected in the EPA-10D Round 2 sample. The manganese and sodium concentrations were generally higher during Round 1, while the iron concentrations were generally higher during Round 2.

Summary of Monitoring Well Sample Results

TCE is the primary site-related contaminant detected in the monitoring well samples, with the highest concentrations in the shallow monitoring wells located between Oak Ridge Road and Hamilton Road with concentrations exceeding 50 μg/L. The concentrations and distribution of the site-related contaminants correlate well with the groundwater screening results. The monitoring well network bounds the horizontal and vertical extent of the plume except at EPA-15D and EPA-16, where the plume appears to extend the full thickness of the overburden sediments. 1,1,1-TCA, PCE, and chloromethane were also detected below screening criteria.

The detections of non-site related VOCs, SVOCs, pesticides, and inorganics do not correlate in distribution or magnitude with the VOC plume. It is not likely that these compounds are related to activities at the Hopewell Precision facility.

1.3.2 Residential Well Sample Results

Two rounds of residential well sampling events were conducted, as described below. The results are shown on Figures 1-5 through 1-9.

1.3.2.1 Residential Well Sampling

Limited Sampling Event

Groundwater samples from selected residential wells were collected in August 2006. Wells were selected for sampling based on their location near the source area, near residential wells treated with POET systems, or in the southern part of the groundwater plume where the predominant contaminant is 1,1,1-TCA. Residential well samples were collected as close as possible to the wellhead, prior to any treatment. The residential well samples were analyzed for low detection limit (LDL) VOCs only. A total of 48 samples were collected, along with 3 duplicates.

Large-Scale Sampling Event

Groundwater samples were collected at residential wells located over the identified groundwater plume, with the exception of wells outfitted with POET treatment systems. A total of 195 samples were collected in August 2007. Eleven duplicate samples were also collected. Samples were analyzed for LDL VOCs with the exception of one sample, which was also analyzed for TAL inorganics including mercury.

1.3.2.2 Residential Well Sample Results

Discussions of analytical results are presented by sampling round, with the primary focus on site-related contaminants: TCE, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, chloromethane, MEK, and PCE. For discussion purposes, residential well results are described as clusters by street names. Residential wells outfitted with POET systems were sampled by EPA's Removal Support Team (RST) and NYSDEC. The results of these samples will not be explicitly discussed in the following text, which focuses on samples collected for the RI. However, the results for wells outfitted with POET systems are included in the groundwater plume maps (Figures 1-10 and 1-11).

Round 1 Sample Results

Site-Related Contaminants

The screening criteria for the seven site-related contaminants are 5 µg/L. None of the residential well samples exceeded these criteria in Round 1.

1,1,1-TCA was detected in 12 of the 48 Round 1 residential wells. Levels in these wells ranged from 0.11 J to 2.2 µg/L. The highest results were detected near the corner of Baris Lane and Clove Branch Road (2.2 µg/L); along Hamilton Road (1.1 µg/L); and along Route 82, just north of the intersection with Clove Branch Road (1.0 µg/L). Results below 1.0 µg/L are clustered north of the intersection of Route 82 and Creamery Road (two wells), and near the intersection of Clove Branch Road and Cavello Road. Round 1 1,1,1-TCA results are illustrated on Figure 1-5.

PCE was detected in one residential well located along Route 82, just north of the intersection with Clove Branch Road (0.17 J µg/L); the same residential well had 1,1,1-TCA at 1.0 µg/L. Round 1 PCE results are illustrated on Figure 1-6.

Eight of the 48 residential wells contained TCE during Round 1, with levels ranging from 0.13 J to 4.7 µg/L. The distribution of TCE in residential wells is similar to 1,1,1-TCA. The highest results (4.7 µg/L) were detected near the corner of Baris Lane and Clove Branch Road, and near the intersection of Clove Branch Road and Cavello Road (1.3 and 2.6 µg/L). Results below 1.0 µg/L were detected north of the intersection of Route 82 and Creamery Road (one well); north of the intersection of Route 82 and Clove Branch Road (two wells) and at the intersection of Clove Branch Road and Cavello Road (one well). Round 1 TCE results are illustrated on Figure 1-7.

Low levels of chloromethane (0.12 J µg/L) were detected in three residential wells along Route 82: near the intersection with Creamery Road; near the intersection with Mary Lane (0.16 J µg/L); and near the intersection with Clove Branch Road (0.35 J µg/L.

1,1-DCE was detected in one residential well located on Hamilton Road (0.11 J µg/L). Cis-1,2-DCE was not detected in any of the Round 1 residential wells.

Other VOCs

Eleven other VOCs were detected in Round 1 residential well samples, at levels below screening criteria. These VOCs are not considered to be related to site contamination. 2-hexanone was detected in one residential well at 3.3 µg/L. The remaining VOCs were detected at trace levels (well below 1.0 µg/L), as follows: carbon disulfide in five wells (0.11 J - 0.16 J µg/L); MTBE in five wells (0.12 J - 0.8 µg/L); vinyl chloride in two wells (0.12 J - 0.14 J µg/L); toluene in two wells (0.16 J µg/L); 1,2,4-trichlorobenzene in two wells (0.11 J - 0.24 J µg/L); 1,2-dichlorobenzene in one well (0.12 J µg/L); 1,3-dichlorobenzene in one well (0.18 J µg/L); 1,2,3-trichlorobenzene in one well (0.18 J µg/L); m,p-xylene in one well (0.17 J µg/L); and cis-1,3-dichloropropene in one well (0.17 J µg/L).

Round 2 Sample Results

Site-Related Contaminants

1,1,1-TCA was detected in 23 of the 195 Round 2 residential wells, with levels ranging from 0.5 J to 3.3 µg/L. The highest results were detected on Baris Lane (2.2 µg/L); on Cavello Road (2.2 µg/L); and along Route 82, just north of the intersection with Clove Branch Road (1.0 µg/L). Results below 1.0 µg/L are clustered north of the intersection of Route 82 and Creamery Road (two wells), and near the intersection of Clove Branch Road and Cavello Road. Round 2 1,1,1-TCA results are illustrated on Figure 1-8.

TCE was detected in 16 of the 195 of the Round 2 residential wells, with levels ranging from 0.53 to 7.4 µg/L. The highest results were detected near the corner of Baris Lane and Clove Branch Road (7.4 µg/L); clustered near the intersection of Clove Branch Road and Cavello Road (4.0, 3.7, 3.4, and 2.7 µg/L; and along Route 82, just south of the Creamery Road intersection (3.5 µg/L). Lower results were detected along Route 82 (0.53 - 0.98 µg/L); clustered along Cavello Road (0.67 - 1.8 µg/L); and near the intersection of Creamery Road and Hamilton Road (1.2 and 1.9 µg/L). Round 2 TCE results are illustrated on Figure 1-9.

MEK (2-Butanone) was detected in two wells, ranging from 0.77 - 1.6 µg/L.

The site-related contaminants PCE, 1,1-DCE, cis-1,2-DCE, and chloromethane were not detected in Round 2 residential well samples.

Other Organics

Eight other non site-related VOCs were detected at trace levels, all below screening criteria. Each of these VOCs was detected at no more than two wells. Chloroethane was detected in one residential well at 0.59 µg/L. Acetone was detected at two wells, ranging from 5.1 to 7.4 µg/L. Chloroform, bromodichloromethane, and dibromochloromethane were all detected in one residential well along Route 82, at concentrations of 3.0, 1.8, and 1.1 µg/L, respectively; chloroform was also detected in one other well at 0.56 µg/L. Carbon disulfide was detected in two wells, ranging from 0.77 to 1.6 µg/L. Toluene was detected in two wells ranging from 0.53 to 0.94 µg/L.

Summary of Residential Well Contamination

The majority of residential well samples did not contain detectable levels of VOCs. 1,1,1-TCA, which is the most prevalent site-related contaminant during both sampling rounds, was detected in 25 percent of wells sampled in Round 1, and in approximately 13 percent of wells sampled in Round 2. TCE was detected in approximately 17 percent of wells in Round 1 and 8 percent in Round 2. In wells with detectable VOCs, levels were well below site-specific groundwater screening criteria, and in many cases, were only detected at trace levels. In general, the majority of 1,1,1-TCA and TCE results for both rounds are clustered in the area along Clove Branch Road, between Baris Lane and Route 82, and just downgradient of this area.

1.3.2.3 Summary of Groundwater Results

Results from the second round of monitoring well sampling (July 2007), the second round of residential well sampling (July 2007), and other results (September/October 2006 groundwater screening survey and wells with POET systems) were used to create plume maps for TCE and 1,1,1-TCA.

Figures 1-10 and 1-11 show the TCE and 1,1,1-TCA plumes, respectively, along with the shallow groundwater potentiometric surface (since most of the contamination was detected in the shallow zone). The plume outlines were projected to plan view in the areas of the highest concentrations detected below the ground surface.

Figure 1-10 shows the TCE plume above the screening criterion of 5 µg/L. The shape of the plume is indicative of the heterogeneous nature of the aquifer and the presence of preferential flow paths. The area of highest concentration, or the plume core, is denoted by the 50 µg/L contour. This area extends from just south of Oak Ridge Road to just north of Creamery Road. The shape of the plume mirrors the potentiometric surface and shows the groundwater turning to the west in this area as it flows preferentially between a low conductivity till to the north and the till mound to the south. The till mound is further defined by an area where TCE is not detected. The plume appears to flow around the till on both the east and west. There are low-level detections of TCE both to the west and south of the 5 µg/L contour and low levels of TCE discharge to the stream, Redwing Lake, and the gravel pit.

Figure 1-11 shows the 1,1,1-TCA plume to the 1 µg/L level. The concentrations and extent of the 1,1,1-TCA plume are significantly different than the TCE plume. There is no evidence of the 1,1,1-TCA plume in the groundwater on the eastern lobe of the TCE plume. The lower overall concentrations of 1,1,1-TCA may reflect the history of disposal practices at the Hopewell Precision facility. It may also be caused by 1,1,1-TCA's low vapor pressure and greater tendency to partition to the atmosphere or soil vapor.

1.4 Area for Alternate Water Supply

The results of the groundwater investigation and the resultant plume maps for TCE and 1,1,1-TCA were utilized to determine the area to be considered for alternate water supplies. Figure 1-12 shows the outline of the area that will be used throughout this FFS as the area for alternate water supply and overlays the plume maps for TCE and 1,1,1-TCA.

Section 2
Development of Remedial Action Objectives and General Response Actions

RAOs are media-specific goals for protecting human health and the environment. Remedial alternatives are developed to meet the RAOs, which are based on regulatory requirements that may apply to the various remedial activities being considered for the FFS. This section of the FFS presents the RAOs and identifies Federal, State, and local regulations that may affect the remedial action.

2.1 Identification of Remedial Action Objectives

In this FFS, POETs on residential wells or alternate water supplies are considered to address groundwater contamination that is currently or may impact residential wells in the future. The RAO for the FFS is:

- Prevent or minimize current and future human exposure to VOC-contaminated groundwater by providing an alternative water supply

2.2 Potential ARARs, Guidelines, and Other Criteria

Potential ARARs are broken down into three groups:

- Chemical-specific ARARs
- Location-specific ARARs
- Action-specific ARARs

Additionally, to-be-considered (TBC) criteria are also evaluated. TBC criteria are not federally enforceable standards but may be technically or otherwise appropriate to consider in developing site- or media-specific RAOs or cleanup goals.

Each of these groups of ARARs and TBCs is described below. A summary of the potential ARARs and TBCs criteria is provided in Tables 2-1, 2-2 and 2-3.

2.2.1 Chemical-specific ARARs and TBCs

Chemical-specific ARARs are defined as those that specify achievement of a particular cleanup level for specific chemicals or classes of chemicals. These standards usually take the form of health- or risk-based numerical limits that restrict concentrations of various chemical substances to a specified level.

2.2.1.1 Federal Standards and Guidelines

Groundwater at the site is currently used as a source of drinking water. Federal primary drinking water standards are considered to be applicable because the groundwater is a source of drinking water.

Federal Drinking Water Standards and Regulations

- National Primary Drinking Water Standards (40 CFR 141). Drinking water standards (MCLs and non-zero maximum contaminant level goals [MCLGs]) for the site-related contaminants are provided in Table 2-4. Note that these MCLs are considered applicable for groundwater which is a current source of drinking water (CERCLA Section 300.430[e][2][i][B]).

2.2.1.2 New York Standards and Guidelines

New York State chemical-specific standards and guidelines exist for groundwater.

Drinking Water Standards and Regulations

- New York State Department of Health Drinking Water Standards (10 NYCRR Part 5). Sets MCLs for public drinking water supplies. This is an applicable ARAR since public water would have to comply with these requirements. The standards for the site-related contaminants are included in Table 2-4.

2.2.2 Location-specific ARARs

Location-specific ARARs are those which are applicable or relevant and appropriate due to the location of the site or area to be remediated. Possible applicable regulations at the site are relevant to wetlands, flood plains, historical places, archaeological significance, endangered species, and wildlife habitats.

2.2.2.1 Federal Standards and Guidelines

Wetlands and Flood Plains Standards and Regulations

- Statement on Procedures on Flood plain Management and Wetlands Protection (40 CFR 6 Appendix A).
- Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-12, 1985)
- RCRA Location Standards (40 CFR 264.18)
- Flood plain Executive Order (EO 11988)
- Wetlands Executive Order (EO 11990)
- National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321: 40 CFR 1500 to 1508)
- Clean Water Act (CWA) Section 404 (b)(1) Guidelines for Specification of Disposal Sites for Dredge or Fill Material; Section 404(c) Procedures; 404 Program Definitions; 404 State Program Regulations.

Historic Preservation Standards and Regulations

- National Historic Preservation Act (40 CFR 6.301)

2.2.2.2 New York Standards and Guidelines

Wetlands and Flood Plains Standards and Regulations (6 NYCRR)

- New York Wetland Laws (Articles 24-25).
- New York Freshwater Wetland Permit Requirements and Classification (Articles 663 and 664)
- Flood Plain Management Regulations - Development Permits (500 ECL Article 36)

Wildlife Habitat Protection Standards and Regulations (6 NYCRR)

- Endangered and Threatened Species of Fish and Wildlife (Part 182)

2.2.3 Action-specific ARARs and TBCs

Action-specific ARARs are those which are applicable or relevant and appropriate to particular remedial actions, technologies, or process options. These regulations do not define site cleanup levels but do affect the implementation of specific types of remediation. For example, although outdoor air has not been identified in the RI report as a contaminated medium of concern, air quality ARARs are listed below, because some potential remedial actions may result in air emissions of toxic or hazardous substances. These action-specific ARARs are considered in the screening and evaluation of various technologies and process options in subsequent sections of this report.

2.2.3.1 Federal Standards and Guidelines

General

- Occupational Safety and Health Administration (OSHA) Record keeping, reporting, and related regulations (29 CFR 1904)
- OSHA General Industry Standards (29 CFR 1910)
- OSHA Construction Industry standards (29 CFR 1926)
- Resource Conservation and Recovery Act (RCRA): Identification and Listing of Hazardous Waste (40 CFR 261); Standards Applicable to Generators of Hazardous Waste (40 CFR 262); Standards for Owners/Operators of permitted hazardous waste facilities (40 CFR 264.10-164.18); Preparedness and prevention (40 CFR.30-264.31); Contingency Plan and Emergency procedures (40 CFR 264.50-264.56)

Transportation of Hazardous Waste

- Department of Transportation (DOT) Rules for Transportation of Hazardous Materials (49 CFR 107, 171, 172, 177, and 179)
- RCRA Standards Applicable to Transporters of Hazardous Waste (40 CFR 263)

Disposal of Hazardous Waste

- Land Disposal Restrictions (40 CFR 268)

2.2.3.2 New York Standards and Guidelines

Transportation of Hazardous Waste (6 NYCRR)

- Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (Part 372)
- Waste Transporter Permit Program (Part 364)

Disposal of Hazardous Waste (6 NYCRR)

- Standards for Universal Waste (Part 374-3)
- Land Disposal Restrictions (Part 376)

2.2.3.3 Local Standards and Guidelines

Water Use

- Code of the Town of East Fishkill, Part II, General Regulations, Chapter 186 Water

2.3 Preliminary Remediation Goals

Both Federal and State chemical-specific ARARs were identified for drinking water and are considered to be applicable for the alternate water supplies since the water is used as a source of potable water. Drinking water standards are presented in Table 2-4. These standards are considered when determining whether residences should be supplied with an alternative water supply.

Remediation of the groundwater resource will be considered in the FS for the Hopewell site.

2.4 General Response Actions

General response actions are broad categories of actions that might satisfy the RAOs and that characterize the range of remedial responses appropriate to prevent human exposure to contaminated groundwater through ingestion, inhalation, and dermal contact. GRAs applicable to limit exposure to contaminated groundwater are described below.

2.4.1 No Action

The National Contingency Plan (NCP) and CERCLA require the evaluation of a No Action alternative as a basis for comparison with other remedial alternatives. Under the No Action alternative, no remedial actions are implemented and the current status of the site remains unchanged and no action would be taken to reduce the potential for exposure to contamination.

2.4.2 Institutional and Engineering Controls

Institutional controls typically are administrative restrictions placed to minimize future use of the site (e.g., well drilling restrictions). These limited measures are implemented to provide some protection of human health and the environment from exposure to site contaminants. Institutional controls are generally used in conjunction with other remedial technologies; alone they will not prevent contaminant migration or reduce contamination.

2.4.3 Long-term Monitoring

Long-term monitoring is a response action by which the volume and toxicity of contaminants are reduced by naturally occurring processes in groundwater. Processes which reduce contamination levels in groundwater include dilution, volatilization, adsorption, biodegradation, and chemical reactions with other subsurface constituents. Monitoring is performed to track movement and changes of contaminants in the groundwater.

2.4.4 Point-of-Entry Treatment Systems

POET systems remove contaminants in the water at or near the point where the water pipes enter the home or building. The entire water supply utilized in the home is treated. Several treatment systems are available for POET systems, but the most commonly used is granular activated carbon (GAC). GAC is extremely porous and has a large surface area due to the high porosity. Many organic compounds, such as chlorinated and nonchlorinated solvents, naturally occurring organic matter, some gasoline components, and trihalomethanes, can be adsorbed onto the GAC surface. In addition, GAC is moderately effective for removal of some heavy metals and metals that are bound to organic molecules. Other treatment systems include solid block activated carbon, reverse osmosis, ultraviolet light, microfiltration, ultrafiltration, and nanofiltration, all of which can effectively remove TCE and 1,1,1-TCA. At the Hopewell site, the primary contaminants in the groundwater are TCE and 1,1,1-TCA, which are effectively removed by GAC treatment. Because the POET systems currently in use at the Hopewell site use GAC, the other cited technologies will not be discussed further.

2.4.5 Alternate Public Water Supplies

Alternate public water supplies would include connecting residences and businesses within the designated hook up area to a public water system through service connections. The alternate water supply would include installation of water mains throughout the hook up area as well as service connections from the main to each home or building. Water for the alternative supply could be from several different sources such as surface water, development of a new public water wellfield, or piping water from the Hudson River (located approximately 15 miles west of the Hopewell area).

The Town of East Fishkill provides water for an area known as Little Switzerland, just northeast of the Hopewell Precision facility. An oversized water storage tank is present, and the excess well capacity could be used to supply the Hopewell area. User fees within this district are approximately $3 per 1,000 gallons. This FFS will assume that the Little Switzerland area is used as the source of drinking water and that additional storage capacity would be added, as deemed necessary, to ensure adequate water supplies are available.

Section 3
Development of Remedial Action Alternatives

In Section 2, potentially applicable GRAs and related technologies and process options were identified. In this section, the technologies and process options are combined to form the three remedial action alternatives to provide an alternate water supply to the Hopewell area. Assumptions used to develop the alternatives are discussed in Section 3.1 and the alternatives are described briefly in Section 3.2.

3.1 Development of Remedial Action Alternatives

The remedial technologies and process options presented in Section 2 include:

- No Action (retained for comparison only)
- Individual POET systems for potentially impacted residential and commercial properties
- Infrastructure construction to enable residential and commercial properties to be connected to the nearby public water supply

Remedial alternatives were developed to provide an alternate water supply to residential and commercial properties that have exhibited the presence of site-related contaminants in groundwater samples collected from their private well or are located in close proximity to such properties. These properties are referred to throughout the FFS as the 'study area' (see Figure 1-12). Several existing land parcels (because of their size) within the study area could be subdivided within the foreseeable future. A total of 377 potential future private wells/properties are assumed for the alternatives discussed in this FFS based on the following:

- 321 existing residential properties.
- 14 existing commercial properties.
- 8 potential future additional lots along the west side of Route 82, created via the subdivision of a large parcel not currently residential assumed to be developed as residential properties with approximately 100 feet of frontage
- 16 potential future additional lots, created via the subdivision of the 16 residential properties large enough to be subdivided (≥2.2 acres, since the Town of East Fishkill requires lots to be no less than one acre) into 32 properties.
- 18 potential future additional lots with approximately 100 feet of frontage each along the east side of Route 82 within the current Phillips Farm property (the large farmland on the eastern side of Route 82 in the study area). Phillips Farm is not currently impacted, nor is it expected to be impacted within the 30-year evaluation period, yet it lies along the main supply line proposed in Alternative AWS-3. Phillips Farm is considering developing their property into 115 residential clusters and a smaller farm. Such a development is likely 5 to 10 years in the future and would likely require water supplies of a scope similar to this FFS. Therefore, the farmland was assumed to remain in its current state for this FFS, with additional service connections assumed along the main supply line

along Route 82 based on potential future development of additional lots with approximately 100 feet of frontage each.

The locations of the potential future additions and the subdivided lots are provided in Appendix C.

3.2 Descriptions of Remedial Action Alternatives

In this section, remedial alternatives for the study area are briefly described.

3.2.1 Alternative AWS-1: No Action

The No Action alternative was retained for comparison purposes as required by the NCP. No remedial actions would be implemented under the No Action alternative. Groundwater within the study area would continue to be used as the source of drinking water for private wells. This alternative does not include institutional controls or long-term groundwater monitoring.

3.2.2 Alternative AWS-2: Installation and Operation of POET Systems

The objective of this alternative is to provide an alternate water supply to all properties within the study area utilizing the existing private wells. Individual POET systems would be installed at each property to ensure that water extracted from the existing private wells is treated prior to consumption or other household use by the residents/workers. This alternative includes the implementation of a quarterly sampling program to monitor the effectiveness of the POET systems. The alternative also includes the comprehensive long-term operation, maintenance, and monitoring (OMM) associated with the implementation of this alternative.

If, during implementation of this alternative, sample results from the groundwater monitoring program performed under the remedy for groundwater suggest that the groundwater has become impacted, a POET system would be installed and operated at the affected property and any restrictions placed on the study area properties would be extended to the newly affected property.

3.2.3 Alternative AWS-3: Provision of Alternate Water Supply

The objective of this alternative is to provide an alternate water supply to all properties within the study area by installing a system to deliver water from a nearby existing public water supply system. The nearby Little Switzerland Water District would be expanded to include the study area. Additional storage capacity would be constructed near the existing Little Switzerland Storage Tank. Water mains would be constructed to expand the Little Switzerland supply system and deliver water from the Little Switzerland Storage Tank Area to the study area. A service connection from the main would be extended to each house and/or commercial building within the water district, in accordance with East Fishkill regulations. The delivery route of the water mains is presented in Figure 3-1.

Following connection to the public water supply, private wells within the study area would be abandoned in accordance with New York State requirements. Abandonment would result in the cessation of annual sampling of the private residential wells. The continued enforcement of Town of East Fishkill regulations requiring owners within a municipal water district to connect to the municipal water supply would restrict the use of untreated groundwater within the study area, thereby preventing the potential future use of contaminated groundwater.

If, during implementation of this alternative, sample results from the groundwater monitoring program performed under the remedy for groundwater suggest that a supply well outside of the study area has become impacted, connection to the alternate water supply would be provided.

3.3 Screening of Remedial Alternatives

Since only a limited number of remedial alternatives were developed, all alternatives will be carried forward for detailed analysis. Screening of remedial alternatives will not be performed.

Section 4
Detailed Description of Remedial Action Alternatives

4.1 Identification of Remedial Action Alternatives

Three remedial alternatives were developed, as requested by EPA, to meet the RAO described in Section 2. The alternatives are:

Alternative AWS-1:	No Action
Alternative AWS-2:	Installation and Operation of POET Systems
Alternative AWS-3:	Provision of Alternate Water Supply

4.2 Detailed Description of Remedial Action Alternatives

The remedial action alternatives are described in this section with sufficient detail to complete analyses presented in Section 5. Preliminary design assumptions were developed for each alternative in order to complete detailed analyses and to estimate costs. The design assumptions were based on existing data and information, which are representative of the conditions that would be encountered during implementation of the selected alternative.

4.2.1 Alternative AWS-1: No Action

The No Action alternative was retained for comparison purposes as required by the NCP. No remedial actions would be implemented under Alternative AWS-1. Groundwater within the study area would continue to be used as the source of drinking water for private wells. This alternative does not include institutional controls.

4.2.2 Alternative AWS-2: Installation and Operation of POET Systems

This alternative provides water to the study area by treating the potentially contaminated groundwater through installation of POET systems on the private wells. Alternative AWS-2 consists of the following component:

- Onsite Treatment of Existing Water Supply

Onsite Treatment of Existing Water Supply. Groundwater extracted by the existing private wells would be treated via a POET system prior to the points of use within the home/building. The POET system would remove suspended solids via bag filtration, VOCs via carbon adsorption, and bacteria via ultraviolet (UV) disinfection.

Bag filters are filtration systems commonly used in water treatment. Based on the design of systems installed within the area by EPA and NYSDEC, it is assumed that each POET system would employ one 5-micron bag filter for the removal of suspended solids from the water.

Carbon adsorption is a process by which volatile contaminants are transferred from the water to the activated carbon by physical adsorption. GAC is the most commonly used carbon to remove contaminants for water. Usually one or more vessels filled with GAC are connected in series or parallel, and operate under atmospheric or positive pressure. Raw water would be pumped through these vessels and contaminants would be adsorbed to the GAC. As the GAC becomes saturated, its ability to adsorb contaminants would gradually be expended. Based on analytical monitoring and the estimated operational life of the GAC, it would be replenished prior to saturation or upon observance of breakthrough. The spent GAC would be sent offsite for disposal or regeneration.

Prior to and following the carbon adsorption treatment, water would be disinfected via inline ultraviolet radiation units. The UV radiation units would effectively destroy bacteria within the water supply. The UV units would be outfitted with alarms to detect decreased intensity in the bulbs.

Daily water usage estimates are necessary to design the POET systems, including estimates of GAC that would be needed. Estimated average daily household water usage demands vary. NYSDOH recommends 75 gallons per day (gpd) per user. Based on the 2000 census, the Town of East Fishkill has used an estimate of 3 users per lot to perform past calculations, resulting in a daily household demand of 225 gpd. NYSDEC recommends estimating usage based on an average of 150 gpd per bedroom. An estimate of 3 bedrooms per lot would give an average daily household demand of 450 gpd. The Town's 2006 Annual Drinking Water Quality Reports show average daily household usage rates between 160 and 200 gpd for the Pinewood Knolls, Revere Park, and Brettview Water Districts. Annual Drinking Water Quality Reports for the Little Switzerland Water District for 2005 and 2006 show average daily household usage rates of 453 and 639 gpd. The high rates are attributed by the Town to leaks in the distribution system. Most of these leaks have been repaired, and metered usage rates are reported at approximately 225-250 gpd. Systems operation for residential properties will be based on a mean daily water usage estimate of 250 gpd. For commercial properties, system operation will be based on an approximate mean usage rate of 670 gpd.

There are 377 parcels within the study area. Fifty-two of these parcels currently use POET systems installed and operated by either EPA (38 systems) or NYSDEC (14 systems). The FFS assumed that these POET systems can continue to be used. For cost estimating purposes, it was assumed that each property within the study area (that currently does not have a POET system) would be provided with a new POET system equal to the existing systems which continue to operate successfully within the study area. The number of systems to be installed is estimated to be 325, including an estimated 14 properties with commercial zoning designations.

Operation, Maintenance, and Monitoring of POET Systems
The OMM of the POET systems would be conducted as part of the alternative. Maintenance of the filters, GAC vessels, UV units, and other equipment and appurtenances would be conducted as required. In addition, costs associated with long-term maintenance of the POET systems are included. POET systems are mainly

used as short-term solutions because they are prone to operational issues such as breakthrough, fouling and breakdown.

As part of the system OMM program, a long-term water sampling program would be instituted to determine the effectiveness of the individual POET system at each property. Quarterly samples of the effluent and annual samples of the influent would be collected to ensure the effectiveness of the systems to provide an alternate water supply and to monitor groundwater quality. It is assumed that sampling events will be combined with maintenance events. Under this alternative, annual samples of POET system influent (raw water) would also continue to monitor groundwater quality. The aqueous samples (quarterly and annual) would be analyzed for trace level VOCs.

Duration of Alternative

Contaminants have been detected in monitoring and residential wells throughout the study area; however, the higher levels of groundwater contamination are currently located near Clove Branch Road. It is expected that non-destructive natural attenuation processes would be the only mechanism to reduce contaminant concentrations. It is assumed that the treatment of groundwater prior to use would be required for the 30-year FFS evaluation period.

Preliminary calculations estimate that the time required for groundwater with a concentration of 5 µg/L of TCE to move to the vicinity of West Old Farm Road is 20 to 40 years (see Appendix D). Therefore, for cost estimating purposes, this alternative was evaluated for the 30-year FFS evaluation period, with the current study area and number of users held constant. The long-term OMM program would monitor the migration and reduction of the contaminants over time. Every five years, an evaluation of the remedial action would be performed, including an evaluation of OMM data to determine if any of the POET systems should be eliminated or any additional systems are required.

4.2.3 Alternative AWS-3: Provision of Alternate Water Supply

This alternative provides water to the study area via the delivery of water from a nearby existing public water supply. Alternative AWS-3 would consist of the following components:

- Connection to Existing Public Water Supply
- Well Abandonment
- Operation, Maintenance, and Monitoring

Connection to Existing Public Water Supply

Private properties within the study area would be provided with a connection to a nearby existing public potable water supply, in conjunction with the expansion of the Little Switzerland Water District. As identified in Figure 1-12, each property would be connected to the Little Switzerland Water District located approximately one half-mile north of the Hopewell Precision facility.

East Fishkill regulations state that: (1) any source of water other than from a municipal public water system is considered nonpotable and (2) properties within the confines of a municipal water district shall not use nonpotable water as a source of water supply for any purpose, i.e., all owners within a municipal water district shall connect to the public water supply. No deed restrictions would be implemented under this alternative, yet it is assumed that the Town of East Fishkill will continue to enforce the abovementioned codes, preventing use of the aquifer as a source of potable water within the newly expanded water district.

The Little Switzerland Water District is currently supplied by a system that includes two 200-foot supply wells and one 210,000-gallon storage tank, located at the topographic high within the district. The supply wells have reported yields of 140 gallons per minute (gpm) and 220 gpm, giving a maximum yield of 518,000 gpd. The drought recharge rate is estimated to be 373,190 gpd. Extracted groundwater is chlorinated prior to distribution; the raw water is not filtered.

The 210,000-gallon storage tank was installed in 2007; the previously used concrete tank has been taken out of service. The Little Switzerland Water District currently serves approximately 135 homes. Annual Drinking Water Quality Reports for the Little Switzerland Water District for 2005 and 2006 show average daily household usage rates of 453 and 639 gpd. The rates are reportedly high due to leaks in the distribution system. The Town of East Fishkill reports that most of these leaks have been repaired, and although metered usage rates are reportedly approximately 250 gpd, current rates are approximately 450 gpd due to losses along approximately 2,000 feet of the Little Switzerland distribution loop. Based on the Town's current estimated household usage rate of 450 gpd, the average daily water need is approximately 60,750 gallons. The study area includes an assumed 363 residential properties and 14 commercial properties to be connected to the public water supply. A survey would be conducted during the design phase to provide a more accurate count of residences requiring public water. Based upon usage estimates (250 gpd and 670 gpd) described under Alternative AWS-2, the study area properties would require a mean daily supply of 100,130 gallons, bringing the total mean daily water usage to 163,740 gpd. Peak demand within Little Switzerland is currently estimated to be 40% greater than the annual mean demand, however this rate fluctuation is likely dampened due to the losses within the existing loop. Estimating the peak daily usage at 300% of the mean daily usage gives a peak demand of 469,140 gpd. Following the expected repair within the Little Switzerland loop (and dropping the usage estimates to 250 gpd for existing users) this peak demand would fall to 388,140 gpd (300% of 129,380 gpd). Such demands could be served via the operation of both of the existing wells. Although such operation would not provide for a standby well, it is assumed that such conditions would be of short duration and understood that provisional service agreements with other potable water purveyors could be established as necessary. Any consideration of additional supply is beyond the scope of this FFS as such activities would require consideration of all local districts in conjunction with the Town's long-term development plans.

These calculations suggest that the additional water needed to supply the Hopewell area could not be supported by the existing Little Switzerland storage capacity, but could be supplied by the Little Switzerland wells. Therefore, an additional storage tank would be constructed adjacent to the existing storage tank, within the footprint of the former storage tank (see tank photos in Appendix E).

A ten-inch diameter water main would be installed along Dogwood Road, 800 feet of which is estimated to be underlain by shallow bedrock. Ten-inch diameter piping would also be installed in or along State Route 82, creating a main distribution trunk. New eight-inch water mains would be constructed to deliver water from the main within study area streets. Some rehabilitation of the existing distribution system and some upgrading from six-inch to eight-inch diameter pipes might also be required to establish appropriate connections to the existing system. During the installation of the water supply line, fire hydrants will be installed every 500 linear feet of supply line. The proposed water main delivery route is presented in Figure 3-1.

Under this alternative, connection from the water main to the house would be provided in the form of 3/4 inch copper piping, typical of the connections made within the Little Switzerland district. Soil cuttings from the connection of the private properties to the water mains would remain on the property.

Well Abandonment

Following connection to a public water supply, private wells in the hook up area would be abandoned in accordance with New York State requirements. As a result of the well abandonment, annual sampling of private residential wells would be terminated. However, the abandonment of private wells at a time a municipal supply becomes available is the responsibility of the supplier and is therefore not included in the costs for this FFS.

Operation, Maintenance, and Monitoring

OMM is currently provided by the existing public water utility. Under this alternative, the utility would continue to oversee the OMM of the system. Therefore, no costs are included for OMM.

Duration of Alternative

As noted under Alternative AWS-2, the study area and number of users are held constant over the 30-year evaluation period. Every five years, an evaluation of the remedial action would be performed.

Section 5
Detailed Analysis of Remedial Action Alternatives

In this section, a detailed analysis is performed of each remedial action alternative described in Section 4. Preliminary design assumptions were developed for each alternative in order to complete the detailed analyses and to estimate implementation costs. The design assumptions were based upon existing site data and information, and are expected to be representative of the conditions that would be encountered during the remedial action. The nine criteria specified to evaluate FFS alternatives are defined in Section 5.1. The detailed analysis of the alternatives is presented in Sections 5.2 and 5.3.

5.1 Introduction

The detailed analysis of each alternative consists of an evaluation against the nine criteria set forth in the NCP and in *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988).

Threshold Criteria

Threshold criteria are requirements that must be met in order for alternatives to be eligible for selection. Threshold criteria include:

- Overall protection of human health and the environment
- Compliance with ARARs

Primary Balancing Criteria

Balancing criteria are used to assess the relative effectiveness of alternatives based upon their strengths and weaknesses. Primary balancing criteria include:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

Two additional criteria, designated as modifying criteria, are also specified for assessment after the public comment period. Modifying criteria include:

- State acceptance
- Community acceptance

In this FFS, alternatives are evaluated with respect to the first seven criteria listed above. The state acceptance criterion will be evaluated in the Proposed Plan. The community acceptance criterion will be evaluated after the public comment period in a Responsiveness Summary that is part of the ROD. A further definition of these criteria is presented in the following paragraphs; the definitions are based on the CERCLA FS guidance (EPA 1988).

5.1.1 Overall Protection of Human Health and the Environment

This criterion provides an evaluation of each alternative to assess whether it provides adequate protection of human health and the environment. This overall assessment is based on other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Evaluation of alternatives against this criterion focuses on whether an alternative achieves adequate protectiveness and describes how risks through each pathway are eliminated, reduced, or controlled through treatment, engineering, or institutional controls. This criterion considers any unacceptable short-term or synergistic (e.g., cross-media) effects posed by an alternative.

5.1.2 Compliance with ARARs

This criterion is used to evaluate whether each alternative would meet the ARARs identified in Section 2 of this FFS. The detailed evaluation considers which ARARs are applicable to each of the specific alternatives, and describes how the alternative meets the ARARs, which include chemical-specific, location-specific, and action-specific ARARs. The final determination of applicable ARARs is made by the lead agency.

5.1.3 Long-term Effectiveness and Permanence

This criterion evaluates the results of a remedial alternative subsequent to its implementation in terms of the risk remaining at the site. The two main components include: a) magnitude of residual risk from untreated waste or treatment residuals; and b) adequacy and reliability of controls, if any, used to manage untreated wastes or treatment residuals.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the EPA policy preference for remedial alternatives which utilize technologies that permanently and significantly reduce the toxicity, mobility, or volume (TMV) of hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of the total volume of contaminated medium.

5.1.5 Short-term Effectiveness

This criterion evaluates the effects of the alternative during the construction and implementation phase of the alternative. The main factors addressed in this evaluation are: a) protection of the community during remedial actions; b) protection of workers during remedial actions; c) potential adverse environmental impacts resulting from construction and implementation; and d) time until RAOs are met.

5.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing the alternative, and the availability of services and materials required for its implementation. The specific components of this criterion are described below.

- *Technical feasibility* includes: a) construction and operation, including technical difficulties and unknowns associated with the technologies included in the alternative; b) reliability of the technologies; c) ease of undertaking additional remedial actions (more significant at sites for which an interim action is being conducted); and d) monitoring considerations.

- *Administrative feasibility* refers primarily to the necessary coordination with other offices and agencies such as for permit acquisition.

- *Availability of services and materials* includes assessment of the availability of the treatment, storage, and disposal services necessary to implement the alternative; the availability of the technologies; and the availability of additional equipment or specialists. EPA's FS Guidance document (EPA 1988) also includes the potential for obtaining competitive bids as part of this criterion.

5.1.7 Cost

The cost criterion is divided into the two categories: 1) capital costs; and 2) operation and maintenance (O&M) costs. Capital costs include: a) direct capital costs (such as construction, equipment, land and site development, buildings and services, and disposal costs); b) indirect capital costs (such as engineering expenses, construction management costs, license and permit costs, startup and shakedown costs); and c) contingency allowances. O&M costs are costs associated with long-term operation of the remedy after completion of the construction and include operating labor, maintenance material and labor, auxiliary materials and energy, costs for residue disposal, administrative work, and equipment rehabilitation or replacement costs. For the purposes of this FFS, mobilization and demobilization costs, start-up and health and safety expenses are included as capital costs.

Analysis of costs was performed using vendor-supplied information and other references (e.g., Means Site Work Cost Data; Means Environmental Cost Data), supplemented by the RAC II Team's experience, vendor data, and information made available by the Town of East Fishkill.

In order to compare economic costs of the various alternatives, present worth analyses were performed. For these analyses, it was assumed that the resources and activities required to perform O&M would remain constant over a 30 year period of time. A discount rate of 7 percent was assumed for the purpose of this FFS. Capital costs were calculated in 2007 dollars and not discounted; only O&M costs incurred after the first year were discounted for the net present worth analysis. O&M costs are assumed to occur over the 30 year life of the project. Pursuant to EPA's FS Guidance document (EPA 1988), the costs are expected to be within -30 to +50 percent accuracy.

5.1.8 State Acceptance

This criterion addresses technical and administrative preferences and issues that the State of New York may have regarding each alternative. Alternatives are evaluated based upon their support/acceptance by NYSDEC and other regulatory agencies. NYSDEC comments have been incorporated into the Final FFS, based upon their review of the Draft FFS. State acceptance will be addressed in the Proposed Plan.

5.1.9 Community Acceptance

This criterion will incorporate public comments which have been provided to federal and state agencies during the RI/FS process. The assessment of community acceptance will address those alternatives that the community formally supports or opposes. Community input on the FFS report will be solicited during the public comment period for the Proposed Plan, during which time the FFS Report will be available for public review. A responsiveness summary will be prepared to address comments received during the public comment period. A summary of the public comments and responses will be included in the ROD. As a result, no assessment or estimate of community acceptance will be made in this FFS report.

5.2 Individual Analysis of Alternatives

The remedial alternatives developed for the site include:

- Alternative AWS-1: No Action
- Alternative AWS-2: Installation and Operation of POET Systems
- Alternative AWS-3: Provision of Alternate Water Supply

The detailed analysis of remedial alternatives is discussed in detail below. The results of this analysis and the corresponding cost estimates are summarized in Tables 5-1 and 5-2, respectively.

5.2.1 Alternative AWS-1: No Action

Alternative AWS-1 is described in detail in Section 4.2.1.

5.2.1.1 Overall Protection of Human Health and the Environment

The No Action alternative would not provide overall protection of human health. Currently, there is risk to human health since the groundwater is used as a source of potable water at several hundred private properties. Because no remedial action would be implemented under this alternative, there would be no means available to prevent current and future exposure to the contaminated groundwater.

This alternative would not provide protection to human health since potentially contaminated groundwater would continue to be used as a source of potable water.

The alternative would not achieve the RAOs.

5.2.1.2 Compliance with ARARs

Due to the continued presence of site-related contaminants above drinking standards, this alternative would not comply with the chemical-specific ARARs for drinking water.

As this alternative involves no action, location- and action-specific ARARs are not applicable.

5.2.1.3 Long-term Effectiveness and Permanence

Magnitude of Residual Risk - No Action would not be considered to be a permanent remedy. The existing risk to human health due to consumption of potentially contaminated groundwater would remain.

Adequacy of Controls - Currently there is risk to human health since the groundwater is used for drinking water. This alternative would not provide adequate control of risks to human health or the environment because there are no mechanisms to prevent future exposure.

Reliability of Controls - Under this alternative there would be no mechanism in place to prevent current and future risk to human health; therefore, this alternative would not be considered reliable.

No Action is not considered to be effective in the long term.

5.2.1.4 Reduction of Toxicity, Mobility or Volume through Treatment

The implementation of this alternative would not affect the TMV of the contaminants.

5.2.1.5 Short-term Effectiveness

This alternative would not include a remedial action. Therefore, it would have no short-term impact to workers or the community. There would be no adverse environmental impacts to habitats or vegetation as there would be no remedial action under this alternative.

5.2.1.6 Implementability

This alternative would be easily implemented, since no services or permit equivalency would be required.

5.2.1.7 Cost

There would be no capital cost or O&M cost associated with this alternative.

5.2.2 Alternative AWS-2: Installation and Operation of POET Systems

Alternative AWS-2 is described in detail in Section 4.2.2.

5.2.2.1 Overall Protection of Human Health and the Environment

Alternative AWS-2 would be protective of human health because contaminated groundwater would be treated prior to use by the residents and workers within the Hopewell site study area. Each property within the study area would be equipped with individual POET systems to remove contaminants from groundwater extracted by private wells. However, some potential for exposure to contaminated water remains, if the GAC in the POET systems becomes saturated with contaminants and breakthrough occurs. The use of contaminated groundwater in the future would be eliminated via the implementation of the long-term OMM program.

The OMM of the POET systems would monitor the private wells within the study area, tracking the migration and reduction of the contaminants over time to determine if any of the POET systems should be eliminated or any changes in treatment are required.

This alternative would achieve the RAOs.

5.2.2.2 Compliance with ARARs

This alternative would meet the chemical-specific ARARs. At its point of use, groundwater extracted from within the study area would be treated to remove contaminants to concentrations below MCLs.

A Stage I Cultural Resources Survey would be conducted during the design phase. This alternative would not impact wetlands and floodplains, as construction would be limited to roadways and developed properties, outside of the limits of the wetlands and floodplains. There are no known endangered species in the area. This alternative would be designed to comply with action-specific ARARs. Tables 2-2 and 2-3 summarize the requirements of the location- and action-specific ARARs and their FFS considerations.

5.2.2.3 Long-term Effectiveness and Permanence

Magnitude of Residual Risk - This alternative would have long-term effectiveness and permanence. The residents and workers would not be exposed to contaminated groundwater once the impacted properties are equipped with POET systems. However, some potential for exposure to contaminated water remains, if the GAC in the POET systems becomes saturated with contaminants and breakthrough occurs.

OMM of the POET systems would be implemented to verify that the contaminant concentrations existing in site groundwater would not pose an unacceptable risk to human health at their point-of-use.

Adequacy of Controls - This alternative would provide adequate control of the risk to human health. Long-term system monitoring would monitor the effectiveness of the individual POET systems. Alarms within the systems would identify for the users the need for service. The systems would be maintained in accordance with a comprehensive OMM program to ensure effectiveness. Careful coordination would be necessary to monitor the POET systems and achieve quick responses to alarms and malfunctions.

Reliability of Controls - POET systems are considered an adequate control system. Long-term system monitoring, including the analysis of water samples via state- and EPA-certified analytical laboratories, would be reliable. However, POET systems are generally utilized as short-term solutions since they are prone to operational issues such as breakthrough, fouling, and breakdown over the long-term. This alternative would require significant maintenance to uphold a high standard of reliability.

5.2.2.4 Reduction of Toxicity, Mobility or Volume through Treatment

The extraction and treatment of groundwater under Alternative AWS-2 would reduce the toxicity and volume of the contaminants through the operation of the private wells and treatment of the extracted groundwater at its point-of-use, yet not on the order of a full-scale extraction and treatment system designed to remediate site-wide groundwater. The amount of groundwater treated would depend on total resident usage. The toxicity and volume (mass) of contaminants in groundwater would also be gradually reduced over time by naturally occurring processes. In addition, this alternative would reduce toxicity in potable water used by residents.

To some extent the mobility of the contaminants would be increased through the operation of the private wells, yet the mobility within the potential exposure pathway would ultimately be decreased as the POET systems would stop contaminants from reaching end users.

5.2.2.5 Short-term Effectiveness

This alternative would include very limited site work and would have minimal short-term impact to the communities and worker. There would be no adverse environmental impacts to habitats or vegetation due to the implementation of this alternative.

It is estimated that it would take approximately four months to install POETs at the properties within the study area. A time period of 30 years, the maximum specified for evaluation under CERCLA FS guidance (EPA 1988), is assumed for the long-term OMM under this alternative.

5.2.2.6 Implementability

This alternative would be easily implemented. Similar POET systems previously installed at the Hopewell site continue to operate as designed, providing clean, potable water to several dozen residences. The ongoing OMM of the systems would present some degree of difficulty based on the coordination involved with accessing and servicing systems at over 300 unique properties.

5.2.2.7 Cost

A summary of the capital costs, annual O&M costs, five-year review costs, and total present worth is provided in Table 5-1. Detailed cost estimates are presented in Appendix B. The total present worth for this alternative is $15.5 million over the 30-year life of the alternative.

5.2.3 Alternative AWS-3: Provision of Alternate Water Supply

Alternative AWS-3 is described in detail in Section 4.2.3.

5.2.3.1 Overall Protection of Human Health and the Environment

Alternative AWS-3 would be protective of human health because contaminated and potentially contaminated groundwater would no longer be utilized as the source of drinking water for the residents and workers within the Hopewell site study area. Residential and commercial properties within the study area would be provided with a service connection to a public potable water supply. Existing private water supply wells would be abandoned to eliminate their future use. Potential future use of contaminated groundwater would be restricted via East Fishkill's existing regulations regarding mandatory connections to the municipal water supply within the newly expanded water district.

This alternative would achieve the RAOs.

5.2.3.2 Compliance with ARARs

Alternative AWS-3 would meet the chemical-specific ARARs. The use of groundwater extracted from within the study area would be eliminated. The residences would be provided with drinking water from a public supply system. Residents and workers would not be exposed to contaminated groundwater. Contaminant concentrations in the groundwater would be expected to decrease over time only through naturally occurring processes. The long-term groundwater monitoring program that will be implemented under the groundwater remedy to be evaluated in the FS for the site and is not included in the FFS.

A Stage I Cultural Resources Survey would be conducted during the design phase. This alternative would not impact wetlands and floodplains, as construction would be limited to roadways and residential properties, outside of the limits of any wetlands and floodplains. There are no known endangered species in the area. This alternative would be designed to comply with action-specific ARARs. Tables 2-2 and 2-3 summarize the requirements of the location- and action-specific ARARs and their FFS considerations.

5.2.3.3 Long-term Effectiveness and Permanence

Magnitude of Residual Risk - This alternative would have long-term effectiveness and permanence. The residents would not be exposed to contaminated groundwater once their houses are connected to the municipal water supply. Their existing private wells would be abandoned. Since there is no continuous source of groundwater contamination at the Hopewell Precision facility, residual contaminated groundwater would gradually decrease over time.

Adequacy of Controls - This alternative would provide adequate control of risk to human health. Affected residences would be hooked up to a municipal water supply. It is assumed that the Town of East Fishkill will continue to enforce the regulation requiring all owners within the expanded water district to connect to the municipal supply, providing additional control, including control with respect to future users. Dutchess County would need to enforce groundwater use restrictions including a well permitting program that would prevent the installation of new private water supply wells within the study area. As part of this alternative, current wells would be abandoned to ensure that potential exposure to contaminated groundwater would be eliminated.

Reliability of Controls - Municipal water supplies are considered reliable. Additionally, current wells in use would be abandoned to ensure groundwater would not be used. The long-term effectiveness of this alternative would be assessed through five-year reviews.

5.2.3.4 Reduction of Toxicity, Mobility or Volume through Treatment

The implementation of this alternative would have no direct effect on the toxicity, mobility, or volume of the contaminants. However, this alternative would reduce toxicity in potable water provided to residents. In addition, if residents are no longer utilizing the groundwater as a source of drinking water, the range of potential treatment alternatives for the groundwater resource (to be evaluated in the FS for the site) would be expanded to include technologies that would inject remedial materials into the aquifer to promoted reduction in contamination levels (e.g., microbes).

5.2.3.5 Short-term Effectiveness

The site work, including the installation of the water main and associated piping would be performed without significant health risk to the community. Site workers would wear appropriate personal protective equipment (PPE) and implement standard construction procedures to protect workers from physical hazards and to minimize exposure to potential contamination.

No adverse impacts to habitats or vegetation would be anticipated from activities associated with implementation of this alternative.

The estimated period for constructing the system and distribution improvements and connecting all properties within the study area to the public water supply is two years.

5.2.3.6 Implementability

This alternative would be technically and administratively implementable using conventional construction methods and equipment. Materials and services for implementation of this alternative are readily available. There would be some limited disruptions to traffic. Obtaining permission and right of way for installing and routing the distribution piping and additional storage could prove time consuming. Competitive bids can be obtained from a number of contractors. Monitoring of the water supply would be performed as currently performed by the Little Switzerland water district.

5.2.3.7 Cost

A summary of the capital costs, annual O&M costs, five-year review costs, and total present worth is provided in Table 5-2. The details of this alternative and the associated estimated costs are presented in Appendix B. Total net present worth for implementation of Alternative AWS-3 over the 30-year life of the alternative is $15.6 million.

5.3 Comparative Analysis of Alternatives

This section compares the alternatives using the nine criteria. Table 5-3 summarizes the comparison among the three alternatives.

5.3.1 Overall Protection of Human Health and the Environment

Currently there are risks to human health because the contaminated groundwater at the site is used as a source of drinking water. Alternative AWS-1 would not provide protection of human health, since potential exposure to contaminated groundwater would not be restricted and contamination would remain in groundwater for some time in the future. Alternatives AWS-2 and AWS-3 would be protective of human health by eliminating current and future exposure to contaminated groundwater, yet AWS-3 would provide a greater measure of security. Alternative AWS-2 would utilize treatment processes at individual wells to eliminate contaminants from site groundwater prior to use as potable water. However, some potential for exposure to contaminated water remains, if the GAC in the POET systems becomes saturated with contaminants and breakthrough occurs. Alternative AWS-3 would provide potable water via a public supply system, which would activate local regulations that would disallow use of water from other sources (i.e., private wells). Alternative AWS-3 would be more reliable in the long term than the POET systems under Alternative AWS-2.

5.3.2 Compliance with ARARs

Alternative AWS-1 would not comply with the chemical-specific ARARs for groundwater; location- and action-specific ARARs are not applicable to AWS-1. Alternatives AWS-2 and AWS-3 would meet the chemical-specific ARARs, since the potable water supply would no longer potentially contain contaminants at concentrations above MCLs. Alternatives AWS-2 and AWS-3 would also comply with location- and action-specific ARARs.

5.3.3 Long-term Effectiveness and Permanence

Alternative AWS-1 would not be effective or permanent, since the contaminants would not be destroyed and there would be no mechanism to prevent current and future exposure to contaminated groundwater. Alternative AWS-3 would be effective and permanent since a municipal water supply is considered reliable. Alternative AWS-2 would be effective in the short term, yet would require significantly more maintenance to uphold the required standard of reliability; POET systems generally are used as short term solutions and would be subject to accidental breakthrough, fouling, and breakdown. Monitoring and servicing over 300 POET systems for breakthrough, fouling, and breakdown and regular sampling would be cumbersome and would require highly coordinated efforts.

5.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives AWS-1 and AWS-3 would not reduce the VOC mass through treatment since no active treatment of contaminated groundwater occurs. Under Alternative AWS-2, the POET systems would remove contaminants from the groundwater, albeit only at their point-of-use. The extraction and treatment of groundwater under Alternative AWS-2 would, to some extent, increase the mobility of the contaminants through the operation of the private wells. Alternatives AWS-2 and AWS-3 would reduce the toxicity in potable water supplied to residents. Under AWS-3, if residents are no longer utilizing the groundwater as a source of drinking water, the range of potential treatment alternatives for the groundwater resource (to be evaluated in the FS for the site) would be expanded to include technologies that would inject remedial materials into the aquifer to promote reduction in contamination levels (e.g., microbes).

5.3.5 Short-term Effectiveness

Alternative AWS-1 would have no impact to nearby communities. Under Alternative AWS-1, protection of the community and workers would not be applicable since no remedial action would occur.

Alternative AWS-2 would be minimally disruptive to the existing residents and workers, since disruption would be of very short duration and on a property-by-property basis. Alternative AWS-3 would be the most disruptive in the short-term, since the construction activities would create inconveniences to traffic flow within entire communities for longer periods of time.

No major adverse health impacts would be expected under Alternatives AWS-2 and AWS-3. Under Alternative AWS-3, the community and workers would be protected by appropriate worker PPE and engineering controls including air monitoring.

5.3.6 Implementability

Alternative AWS-1 would be easiest both technically and administratively to implement. Alternative AWS-3 would be the second most difficult to implement technically and administratively based on the type and amount of construction required within the study area. Alternative AWS-2 would be easy to implement initially but would require significant ongoing efforts associated with OMM.

5.3.7 Cost

A summary of the cost estimates for each alternative is presented in Table 5-4. Alternative AWS-1 has no cost. Alternative AWS-3 is more expensive than Alternative AWS-2.

Section 6
References

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Table 1-1
Monitoring Well Construction Summary
Hopewell Precision Site
Hopewell Junction, New York

Well ID	Well Diameter (inches)	Well Depth (feet)	Well Screen Interval (feet)	Sand Pack Interval (feet)	Bentonite Interval (feet)	Grout Interval (feet)	Borehole Diameter (inches)	Protective Casing	Comments
EPA-7D	4	60	50-60	46.5-62	41-46.5	3-41	10	Flush-Mount	
EPA-7S	4	30	20-30	18-32	14-18	3-14	10	Flush-Mount	
EPA-8I	4	80	70-80	69-82	65-69	3-65	10	Flush-Mount	
EPA-8S	4	30	20-30	18--31	15-18	3-15	10	Flush-Mount	
EPA-9S	4	25	15-25	13-27	9-13	3-9	10	Flush-Mount	
EPA-10D	4	55	45-55	43-57	41-43	3-41	10	Flush-Mount	
EPA-10S	4	35	25-35	23-37	21-23	3-21	10	Flush-Mount	
EPA-11D	4	45	35-45	32.5-47	30.5-32.5	3-30.5	10	Flush-Mount	
EPA-11S	4	30	20-30	17.5-32	15.5-17.5	3-15.5	10	Flush-Mount	
EPA-12D	4	45	35-45	31.5-46	27.5-31.5	3-27.5	10	Flush-Mount	
EPA-12S	4	30	20-30	17.5-32	13.5-17.5	3-13.5	10	Flush-Mount	
EPA-13D	4	53	43-53	41-54	39-41	3-39	10	Flush-Mount	Low yield
EPA-13S	4	30	20-30	18-33	16-18	3-16	10	Flush-Mount	Low yield
EPA-14S	4	23	10-23	8-23	4-8	3-4	10	Flush-Mount	
EPA-15D	4	40	30-40	26-50	22-26	3-22	10	Flush-Mount	
EPA-16D	4	50	40-50	38-51	35-38	3-35	10	Flush-Mount	
EPA-16S	4	30	20-30	18-31	15-18	3-15	10	Flush-Mount	
EPA-17D	4	54	44-54	42-55	38-42	3-38	10	Flush-Mount	
EPA-17S	4	27	17-27	14-29	12-14	3-12	10	Flush-Mount	
EPA-18D	4	55	45-55	43-57	39-43	3-39	10	Flush-Mount	
EPA-18S	4	25	15-25	13-27.5	9-13	3-9	10	Flush-Mount	
EPA-19D	4	49.5	39.5-49.5	35-50.5	28-35	3-28	10	Flush-Mount	
EPA-19S	4	25	15-25	12-27	8-12	3-8	10	Flush-Mount	
EPA-20S	4	24	14-24	12-26.5	10-12	3-10	10	Stick-Up	
EPA-21D	4	38	33-38	30-39.5	26-30	3-26	10	Flush-Mount	
EPA-21S	4	25	15-25	13-42.5	9-13	3-9	10	Flush-Mount	
EPA-22D	4	49.5	39.5-49.5	37.5-50	33.5-37.5	3-33.5	10	Flush-Mount	
EPA-22S	4	30	20-30	18-32	14-18	3-14	10	Flush-Mount	
EPA-23D	4	80	70-80	67.5-83	63.5-67.5	3-63.5	10	Flush-Mount	
EPA-23S	4	35	25-35	23-37	19-23	3-19	10	Flush-Mount	
EPA-24S	4	35	25-35	22-37	18-22	3-18	10	Stick-Up	
EPA-25D	4	65	55-65	51-66	47-51	3-47	10	Stick-Up	
EPA-25S	4	35	25-35	23-37	18-23	3-18	10	Stick-Up	
EPA-26D	4	65	55-65	53-67	51-53	3-51	10	Flush-Mount	
EPA-26S	4	30	20-30	18-32	16-18	3-16	10	Flush-Mount	
PZ-1	1	12	2-12	1.5-14	1-1.5	NA	10	Stick-Up	
PZ-2	1	12	2-12	1.5-14	1-1.5	NA	10	Stick-Up	

ID: Identification

Table 1-2
Synoptic Water Level Readings
Hopewell Precision Site
Hopewell Junction, New York

Well ID	Date	Easting (X) Datum[1]	Northing (Y) Datum[1]	Elevation (feet amsl)	Depth to Water (feet)	Water Level Elevation (feet amsl)
EPA-7D	3/5/07	1013479.82	688609.96	296.34	6.78	289.56
EPA-7S	3/5/07	1013481.48	688615.60	296.53	6.59	289.94
EPA-8I	3/5/07	1012884.80	688669.62	302.98	13.39	289.59
EPA-8S	3/5/07	1012878.00	688671.47	302.87	13.66	289.21
EPA-9S	3/5/07	1012634.07	687572.39	294.58	7.01	287.57
EPA-10D	3/5/07	1011990.02	687576.86	295.79	8.85	286.94
EPA-10S	3/5/07	1011997.62	687576.84	295.55	8.56	286.99
EPA-11D	3/5/07	1011321.79	687193.88	297.30	12.52	284.78
EPA-11S	3/5/07	1011317.31	687190.65	296.74	12.04	284.70
EPA-12D	3/5/07	1010701.16	685659.42	289.06	10	279.06
EPA-12S	3/5/07	1010697.40	685654.24	289.01	10.23	278.78
EPA-13D	3/5/07	1010293.04	687035.14	305.48	1.52	303.96
EPA-13S	3/5/07	1010296.67	687031.16	305.25	8.59	296.66
EPA-14S	3/5/07	1010655.28	684029.38	275.96	5.6	270.36
EPA-15D	3/5/07	1010325.08	684810.35	291.77	19.65	272.12
EPA-16D	3/5/07	1010190.34	685801.23	292.42	13.03	279.39
EPA-16S	3/5/07	1010189.44	685807.51	292.16	NA[2]	NA[2]
EPA-17D	3/5/07	1009081.92	686105.14	289.03	11.92	277.11
EPA-17S	3/5/07	1009084.50	686100.23	288.98	12.47	276.51
EPA-18D	3/5/07	1008661.30	683284.77	268.28	14.07	254.21
EPA-18S	3/5/07	1008657.45	683279.17	268.20	NA[3]	NA[3]
EPA-19D	3/5/07	1008560.62	684224.29	282.53	23.42	259.11
EPA-19S	3/5/07	1008563.96	684228.48	282.43	23.31	259.12
EPA-20S	3/5/07	1008035.46	685340.64	290.13	17.68	272.45
EPA-21D	3/5/07	1006841.60	683404.55	267.54	17.05	250.49
EPA-21S	3/5/07	1006836.10	683399.18	267.17	16.82	250.35
EPA-22D	3/5/07	1007058.38	684675.77	279.34	17.63	261.71
EPA-22S	3/5/07	1007077.85	684685.61	281.00	17.91	263.09
EPA-23D	3/5/07	1005882.18	682011.87	271.46	29.2	242.26
EPA-23S	3/5/07	1005873.25	682015.83	271.25	25.5	245.75
EPA-24S	3/5/07	1005652.53	683251.05	252.93	5.61	247.32
EPA-25D	3/5/07	1004898.64	680870.54	249.28	6.52	242.76
EPA-25S	3/5/07	1004896.39	680885.18	247.44	5.18	242.26
EPA-26D	3/5/07	1004298.16	681470.72	247.43	3.39	244.04
EPA-26S	3/5/07	1004301.81	681467.75	247.89	3.75	244.14
SG-01	3/5/07	1011916.23	686357.47	286.08	3.28[4]	282.80[4,5]
SG-02	3/5/07	1005803.20	683935.21	249.33	NA[4,5]	NA[4,5]
SG-03	3/5/07	1005294.03	681651.54	245.61	NA[4,6]	NA[4,6]
MW-B1	7/13/07	1013225.47	688454.79	306.43	18.61	287.82
MW-B3	7/13/07	1013000.63	688670.37	306.61	18.86	287.75
EPA-5	7/13/07	1012937.87	688433.42	301.66	14.09	287.57
EPA-7D	7/13/07	1013479.82	688609.96	296.34	8.39	287.95
EPA-7S	7/13/07	1013481.48	688615.60	296.53	8.25	288.28
EPA-8I	7/13/07	1012884.80	688669.62	302.98	14.83	288.15
EPA-8S	7/13/07	1012878.00	688671.47	302.87	15.21	287.66
EPA-9S	7/13/07	1012634.07	687572.39	294.58	8.38	286.20
EPA-10D	7/13/07	1011990.02	687576.86	295.79	10.25	285.54

Table 1-2
Synoptic Water Level Readings
Hopewell Precision Site
Hopewell Junction, New York

Well ID	Date	Easting (X) Datum[1]	Northing (Y) Datum[1]	Elevation (feet amsl)	Depth to Water (feet)	Water Level Elevation (feet amsl)
EPA-10S	7/13/07	1011997.62	687576.84	295.55	10.07	285.48
EPA-11D	7/13/07	1011321.79	687193.88	297.30	13.65	283.65
EPA-11S	7/13/07	1011317.31	687190.65	296.74	13.17	283.57
EPA-12D	7/13/07	1010701.16	685659.42	289.06	10.72	278.34
EPA-12S	7/13/07	1010697.40	685654.24	289.01	16.89	272.12
EPA-13D	7/13/07	1010293.04	687035.14	305.48	4.18	301.30
EPA-13S	7/13/07	1010296.67	687031.16	305.25	9.08	296.17
EPA-14S	7/13/07	1010655.28	684029.38	275.96	6.53	269.43
EPA-15D	7/13/07	1010325.08	684810.35	291.77	20.15	271.62
EPA-16D	7/13/07	1010190.34	685801.23	292.42	14.13	278.29
EPA-16S	7/13/07	1010189.44	685807.51	292.16	14.06	278.10
EPA-17D	7/13/07	1009081.92	686105.14	289.03	13.72	275.31
EPA-17S	7/13/07	1009084.50	686100.23	288.98	13.81	275.17
EPA-18D	7/13/07	1008661.30	683284.77	268.28	14.5	253.78
EPA-18S	7/13/07	1008657.45	683279.17	268.20	14.37	253.83
EPA-19D	7/13/07	1008560.62	684224.29	282.53	24.08	258.45
EPA-19S	7/13/07	1008563.96	684228.48	282.43	23.96	258.47
EPA-20S	7/13/07	1008035.46	685340.64	290.13	19.43	270.70
EPA-21D	7/13/07	1006841.60	683404.55	267.54	17.62	249.92
EPA-21S	7/13/07	1006836.10	683399.18	267.17	17.42	249.75
EPA-22D	7/13/07	1007058.38	684675.77	279.34	19.46	259.88
EPA-22S	7/13/07	1007077.85	684685.61	281.00	18.51	262.49
EPA-23D	7/13/07	1005882.18	682011.87	271.46	26.91	244.55
EPA-23S	7/13/07	1005873.25	682015.83	271.25	26.18	245.07
EPA-24S	7/13/07	1005652.53	683251.05	252.93	6.01	246.92
EPA-25D	7/13/07	1004898.64	680870.54	249.28	5.89	243.39
EPA-25S	7/13/07	1004896.39	680885.18	247.44	5.76	241.68
EPA-26D	7/13/07	1004298.16	681470.72	247.43	4.55	242.88
EPA-26S	7/13/07	1004301.81	681467.75	247.89	4.62	243.27
PZ-01	7/13/07	1005761.15	683982.07	256.21	8.08	248.13
PZ-02	7/13/07	1005321.91	681657.00	252.87	8.95	243.92
SG-01	7/13/07	1011916.23	686357.47	286.08	3.77[4]	282.31[4]
SG-02	7/13/07	1005803.20	683935.21	249.33	2.39[4]	246.40[4]
SG-03	7/13/07	1005294.03	681651.54	245.61	2.19[4]	243.42[4]
MW-B1	9/25/07	1013225.47	688454.79	306.43	19.65	286.78
MW-B3	9/25/07	1013000.63	688670.37	306.61	19.92	286.69
EPA-5	9/25/07	1012937.87	688433.42	301.66	15.11	286.55
EPA-7D	9/25/07	1013479.82	688609.96	296.34	9.53	286.81
EPA-7S	9/25/07	1013481.48	688615.60	296.53	9.38	287.15
EPA-8I	9/25/07	1012884.80	688669.62	302.98	15.88	287.10
EPA-8S	9/25/07	1012878.00	688671.47	302.87	16.26	286.61
EPA-9S	9/25/07	1012634.07	687572.39	294.58	9.17	285.41
EPA-10D	9/25/07	1011990.02	687576.86	295.79	11.02	284.77
EPA-10S	9/25/07	1011997.62	687576.84	295.55	10.79	284.76
EPA-11D	9/25/07	1011321.79	687193.88	297.30	14.23	283.07
EPA-11S	9/25/07	1011317.31	687190.65	296.74	13.78	282.96
EPA-12D	9/25/07	1010701.16	685659.42	289.06	11.14	277.92

Table 1-2
Synoptic Water Level Readings
Hopewell Precision Site
Hopewell Junction, New York

Well ID	Date	Easting (X) Datum[1]	Northing (Y) Datum[1]	Elevation (feet amsl)	Depth to Water (feet)	Water Level Elevation (feet amsl)
EPA-12S	9/25/07	1010697.40	685654.24	289.01	11.29	277.72
EPA-13D	9/25/07	1010293.04	687035.14	305.48	5.64	299.84
EPA-13S	9/25/07	1010296.67	687031.16	305.25	9.52	295.73
EPA-14S	9/25/07	1010655.28	684029.38	275.96	7.46	268.50
EPA-15D	9/25/07	1010325.08	684810.35	291.77	20.46	271.31
EPA-16D	9/25/07	1010190.34	685801.23	292.42	14.46	277.96
EPA-16S	9/25/07	1010189.44	685807.51	292.16	14.57	277.59
EPA-17D	9/25/07	1009081.92	686105.14	289.03	14.08	274.95
EPA-17S	9/25/07	1009084.50	686100.23	288.98	14.41	274.57
EPA-18D	9/25/07	1008661.30	683284.77	268.28	14.56	253.72
EPA-18S	9/25/07	1008657.45	683279.17	268.20	14.44	253.76
EPA-19D	9/25/07	1008560.62	684224.29	282.53	24.34	258.19
EPA-19S	9/25/07	1008563.96	684228.48	282.43	24.22	258.21
EPA-20S	9/25/07	1008035.46	685340.64	290.13	20.2	269.93
EPA-21D	9/25/07	1006841.60	683404.55	267.54	17.98	249.56
EPA-21S	9/25/07	1006836.10	683399.18	267.17	17.73	249.44
EPA-22D	9/25/07	1007058.38	684675.77	279.34	19.75	259.59
EPA-22S	9/25/07	1007077.85	684685.61	281.00	19.02	261.98
EPA-23D	9/25/07	1005882.18	682011.87	271.46	27.13	244.33
EPA-23S	9/25/07	1005873.25	682015.83	271.25	26.38	244.87
EPA-24S	9/25/07	1005652.53	683251.05	252.93	6.16	246.77
EPA-25D	9/25/07	1004898.64	680870.54	249.28	6.12	243.16
EPA-25S	9/25/07	1004896.39	680885.18	247.44	5.95	241.49
EPA-26D	9/25/07	1004298.16	681470.72	247.43	4.85	242.58
EPA-26S	9/25/07	1004301.81	681467.75	247.89	4.6	243.29
PZ-01	9/25/07	1005761.15	683982.07	256.21	8.25	247.96
PZ-02	9/25/07	1005321.91	681657.00	252.87	9.23	243.64
SG-01	9/25/07	1011916.23	686357.47	286.08	3.90[4]	282.18[4]
SG-02	9/25/07	1005803.20	683935.21	249.33	2.54[4]	246.79[4]
SG-03	9/25/07	1005294.03	681651.54	245.61	2.55[4]	243.06[4]

Notes:
1 - North American Datum, 1983. New York State Plane, East, 3101 Feet
2 - Inside of well casing kept flooding
3 - Surrounded by snow and covered by water
4 - Depth to water references the extended staff gauge reading as a measuring point for depth to surface water (as surveyors shot the top of post)
5 - No reading due to being obscured by ice
6 - No reading due to being uplifted by ice

Acronyms:
amsl - Above Mean Sea Level
EPA - Environmental Protection Agency
MW - Monitoring Well
NA - Not applicable
PZ - Piezometer
SG - Stream Gage

Table 1-3
Groundwater Screening Criteria
Hopewell Precision Site
Hopewell Junction, New York

Chemical Name	National Primary Drinking Water Standards (1)			New York State Standards (S) and Guidance (G) Values for Class GA Groundwater (2)			NYSDOH Drinking Water Quality Standards (3)			Site-Specific Groundwater Screening Criteria (SSGWSC)
	Value	Note	G/S	Value	Note	G/S	Value	Note	G/S	Value
Volatile Organic Compounds										
1,1,1-Trichloroethane	200		S	5	PC	S	5	POC	S	5
1,1,2,2-Tetrachloroethane	NL			5		S	5	POC	S	5
1,1,2-Trichloro-1,2,2-trifluoroethane	NL			5	PC	S	50	UOC	S	5
1,1,2-Trichloroethane	5		S	1		S	5	POC	S	1
1,1-Dichloroethane	NL			5	PC	S	5	POC	S	5
1,1-Dichloroethene	7		S	5	PC	S	5	POC	S	5
1,2,3-Trichlorobenzene	NL			5	PC	S	5	POC	S	5
1,2,4-Trichlorobenzene	70		S	5	PC	S	5	POC	S	5
1,2-Dibromo-3-chloropropane	0.2		S	0.04		S	0.2		S	0.04
1,2-Dibromoethane (or ethylene dibromide)	0.05		S	0.0006		S	0.05		S	0.0006
1,2-Dichlorobenzene	600		S	3		S	5	POC	S	3
1,2-Dichloroethane	5		S	0.6		S	5	POC	S	0.6
1,2-Dichloropropane	5		S	1		S	5	POC	S	1
1,3-Dichlorobenzene	NL			3		S	5	POC	S	3
1,4-Dichlorobenzene	75		S	3		S	5	POC	S	3
1,4-Dioxane	NL			NL			50	UOC	S	50
2-Butanone (Methyl Ethyl Ketone)	NL			50		G	50	UOC	S	50
2-Hexanone	NL			50		G	50	UOC	S	50
4-Methyl-2-pentanone	NL			NL			50	UOC	S	50
Acetone	NL			50		G	50	UOC	S	50
Benzene	5		S	1		S	5	POC	S	1
Bromochloromethane	NL			5	PC	S	5	POC	S	5
Bromodichloromethane (TTHMs)	80	T	S	50		G	80	T	S	50
Bromoform (TTHMs)	80	T	S	50		G	80	T	S	50
Bromomethane	NL			5	PC	S	5	POC	S	5
Carbon Disulfide	NL			60		G	50	UOC	S	50
Carbon Tetrachloride	5		S	5		S	5	POC	S	5
Chlorobenzene	100		S	5	PC	S	5	POC	S	5
Chloroethane	NL			5	PC	S	5	POC	S	5
Chloroform (TTHMs)	80	T	S	7		S	80	T	S	7
Chloromethane	NL			5	PC	S	5	POC	S	5
cis-1,2-Dichloroethene	70		S	5	PC	S	5	POC	S	5
cis-1,3-Dichloropropene	NL			0.4	J	S	5	POC	S	0.4
Cyclohexane	NL			NL			50	UOC	S	NA
Dibromochloromethane (TTHMs)	80	T	S	50		G	80	T	S	50
Dichlorodifluoromethane	NL			5	PC	S	5	POC	S	5
Ethylbenzene	700		S	5	PC	S	5	POC	S	5
Isopropylbenzene	NL			5	PC	S	5	POC	S	5
Methyl Acetate	NL			NL			50	UOC	S	NA
Methyl Tert-Butyl Ether	NL			10		G	10		S	10
Methylcyclohexane	NL			NL			50	UOC	S	NA
Methylene Chloride (dichloromethane)	5		S	5	PC	S	5	POC	S	5
Styrene	100		S	5	PC	S	5	POC	S	5
Tetrachloroethene	5		S	5	PC	S	5	POC	S	5
Toluene	1,000		S	5	PC	S	5	POC	S	5
trans-1,2-Dichloroethene	100		S	5	PC	S	5	POC	S	5
trans-1,3-Dichloropropene	NL			0.4	J	S	5	POC	S	0.4
Trichloroethene	5		S	5	PC	S	5	POC	S	5
Trichlorofluoromethane	NL			5	PC	S	5	POC	S	5
Vinyl Chloride	2		S	2		S	2		S	2
Xylenes (total)	10,000		S	5	PC	S	5	POC	S	5
o-Xylene	NL			5	PC	S	5	POC	S	5
m,p-Xylene	NL			5	PC	S	5	POC	S	5
Semivolatile Organic Compounds										

Table 1-3
Groundwater Screening Criteria
Hopewell Precision Site
Hopewell Junction, New York

Chemical Name	National Primary Drinking Water Standards (1)			New York State Standards (S) and Guidance (G) Values for Class GA Groundwater (2)			NYSDOH Drinking Water Quality Standards (3)			Site-Specific Groundwater Screening Criteria (SSGWSC)
	Value	Note	G/S	Value	Note	G/S	Value	Note	G/S	Value
1,1'Biphenyl	NL			5	PC	S	50	UOC	S	5
1,2,4,5-Tetrachlorobenzene	NL			5	PC	S	50	UOC	S	5
2,2'-oxybis(1-Chloropropane)	NL			5	PC	S	50	UOC	S	5
2,3,4,6-Tetrachlorophenol	NL			NL			50	UOC	S	50
2,4,5-Trichlorophenol	NL			NL			50	UOC	S	50
2,4,6-Trichlorophenol	NL			NL			50	UOC	S	50
2,4-Dichlorophenol	NL			5	PC	S	50	UOC	S	5
2,4-Dimethylphenol	NL			50		G	50	UOC	S	50
2,4-Dinitrophenol	NL			10		G	50	UOC	S	10
2,4-Dinitrotoluene	NL			5	PC	S	50	UOC	S	5
2,6-Dinitrotoluene	NL			5	PC	S	50	UOC	S	5
2-Chloronaphthalene	NL			NL			50	UOC	S	50
2-Chlorophenol	NL			NL			50	UOC	S	50
2-Methylnaphthalene	NL			NL			50	UOC	S	50
2-Methylphenol	NL			NL			50	UOC	S	50
2-Nitroaniline	NL			5	PC	S	50	UOC	S	5
2-Nitrophenol	NL			NL			50	UOC	S	50
3,3'-Dichlorobenzidine	NL			5	PC	S	50	UOC	S	5
3-Nitroaniline	NL			5	PC	S	50	UOC	S	5
4,6-Dinitro-2-methylphenol	NL			NL			50	UOC	S	50
4-Bromophenyl-phenylether	NL			NL			50	UOC	S	50
4-Chloro-3-methylphenol	NL			NL			50	UOC	S	50
4-Chloroaniline	NL			5	PC	S	50	UOC	S	5
4-Chlorophenyl-phenylether	NL			NL			50	UOC	S	50
4-Methylphenol	NL			NL			50	UOC	S	50
4-Nitroaniline	NL			5	PC	S	50	UOC	S	5
4-Nitrophenol	NL			NL			50	UOC	S	50
Acenaphthene	NL			NL			50	UOC	S	50
Acenaphthylene	NL			NL			50	UOC	S	50
Acetophenone	NL			NL			50	UOC	S	50
Anthracene	NL			50		G	50	UOC	S	50
Atrazine	3		S	7.5		S	3		S	3
Benzaldehyde	NL			NL			50	UOC	S	50
Benzo(a)anthracene	NL			0.002		G	50	UOC	S	0.002
Benzo(a)pyrene	0.2		S	ND		S	0.2		S	0.2
Benzo(b)fluoranthene	NL			0.002		G	50	UOC	S	0.002
Benzo(g,h,i)perylene	NL			NL			50	UOC	S	50
Benzo(k)fluoranthene	NL			0.002		G	50	UOC	S	0.002
bis(2-Chloroethoxy)methane	NL			5	PC	S	50	UOC	S	5
bis(2-Chloroethyl)ether	NL			1		S	50	UOC	S	1
bis(2-Ethylhexyl)phthalate	6		S	5		S	6		S	5
Butylbenzylphthalate	NL			50		G	50	UOC	S	50
Caprolactam	NL			NL			50	UOC	S	50
Carbazole	NL			NL			50	UOC	S	50
Chrysene	NL			0.002		G	50	UOC	S	0.002
Dibenz(a,h)anthracene	NL			NL			50	UOC	S	50
Dibenzofuran	NL			NL			50	UOC	S	50
Diethylphthalate	NL			50		G	50	UOC	S	50
Dimethylphthalate	NL			50		G	50	UOC	S	50
Di-n-butylphthalate	NL			50		S	50	UOC	S	50
Di-n-octylphthalate	NL			50		G	50	UOC	S	50
Fluoranthene	NL			50		G	50	UOC	S	50
Fluorene	NL			50		G	50	UOC	S	50
Semivolatile Organic Compounds (continued)										
Hexachlorobenzene	1		S	0.04		S	1		S	0.04

Table 1-3
Groundwater Screening Criteria
Hopewell Precision Site
Hopewell Junction, New York

Chemical Name	National Primary Drinking Water Standards (1)			New York State Standards (S) and Guidance (G) Values for Class GA Groundwater (2)			NYSDOH Drinking Water Quality Standards (3)			Site-Specific Groundwater Screening Criteria (SSGWSC)
	Value	Note	G/S	Value	Note	G/S	Value	Note	G/S	Value
Hexachlorobutadiene	NL			0.5		S	5	POC	S	0.5
Hexachlorocyclopentadiene	50		S	5	PC	S	50	UOC	S	5
Hexachloroethane	NL			5	PC	S	50	UOC	S	5
Indeno(1,2,3-cd)pyrene	NL			0.002		G	50	UOC	S	0.002
Isophorone	NL			50		G	50	UOC	S	50
Naphthalene	NL			NL			50	UOC	S	50
Nitrobenzene	NL			0.4		S	50	UOC	S	0.4
N-Nitroso-di-n-propylamine	NL			NL			50	UOC	S	50
N-Nitrosodiphenylamine	NL			50		G	50	UOC	S	50
Pentachlorophenol	1		S	NL			1		S	1
Phenanthrene	NL			50		G	50	UOC	S	50
Phenol	NL			NL			50	UOC	S	50
Pyrene	NL			50		G	50	UOC	S	50
Pesticides and Polychlorinated Biphenyls										
4,4'-DDD	NL			0.3		S	50	UOC	S	0.3
4,4'-DDE	NL			0.2		S	50	UOC	S	0.2
4,4'-DDT	NL			0.2		S	50	UOC	S	0.2
Aldrin	NL			ND		S	50	UOC	S	50
Alpha-BHC	NL			0.01		S	50	UOC	S	0.01
alpha-Chlordane	2	F	S	0.05	F	S	2	F	S	0.05
Aroclor-1016	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1221	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1232	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1242	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1248	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1254	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1260	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1262	0.5		S	0.09	C	S	0.5		S	0.09
Aroclor-1268	0.5		S	0.09	C	S	0.5		S	0.09
Beta-BHC	NL			0.04		S	50	UOC	S	0.04
Delta-BHC	NL			0.04		S	50	UOC	S	0.04
Dieldrin	NL			0.004		S	50	UOC	S	0.004
Endosulfan I	NL			NL			50	UOC	S	50
Endosulfan II	NL			NL			50	UOC	S	50
Endosulfan sulfate	NL			NL			50	UOC	S	50
Endrin	2		S	ND		S	2		S	2
Endrin aldehyde	NL			5	PC	S	50	UOC	S	5
Endrin ketone	NL			5	PC	S	50	UOC	S	5
gamma-BHC (Lindane)	0.2		S	0.05		S	0.2		S	0.05
gamma-Chlordane	2	F	S	0.05	F	S	2	F	S	0.05
Heptachlor	0.4		S	0.04		S	0.4		S	0.04
Heptachlor epoxide	0.2		S	0.03		S	0.2		S	0.03
Methoxychlor	40		S	35		S	40		S	35
Toxaphene	3		S	0.06		S	3		S	0.06
Inorganic Analytes										
Aluminum	NL			NL			NL			NA
Antimony	6		S	3		S	6		S	3
Arsenic	10		S	25		S	50		S	10
Barium	2,000		S	1,000		S	2,000		S	1,000
Beryllium	4		S	3		G	4		S	3
Cadmium	5		S	5		S	5		S	5
Calcium	NL			NL			NL			NA
Inorganic Analytes (continued)										
Chromium	100		S	50		S	100		S	50
Chromium (hexavalent)	NL			50		S	NL			50

Table 1-3
Groundwater Screening Criteria
Hopewell Precision Site
Hopewell Junction, New York

Chemical Name	National Primary Drinking Water Standards (1)			New York State Standards (S) and Guidance (G) Values for Class GA Groundwater (2)			NYSDOH Drinking Water Quality Standards (3)			Site-Specific Groundwater Screening Criteria (SSGWSC)
	Value	Note	G/S	Value	Note	G/S	Value	Note	G/S	Value
Cobalt	NL			NL			NL			NA
Copper	1,300	TT	S	200		S	1,300		S	200
Cyanide	200		S	200		S	200		S	200
Iron	NL			NL			300	A	S	300
Lead	15	TT	S	25		S	15		S	15
Magnesium	NL			35,000		G	NL			35,000
Manganese	NL			NL			300	A	S	300
Mercury	2		S	0.7		S	2		S	0.7
Nickel	NL			100		S	NL			100
Potassium	NL			NL			NL			NA
Selenium	50		S	10		S	50		S	10
Silver	NL			50		S	100		S	50
Sodium	NL			20,000		S	NL			20,000
Thallium	2		S	0.5		G	2		S	0.5
Vanadium	NL			NL			NL			NA
Zinc	NL			2,000		G	5		S	5

Notes:
All VOC, SVOC, P/PCB and Inorganic values are in micrograms per liter (μg/L)
(1) EPA National Primary Drinking Water Standards (web page http://www.epa.gov/safewater/contaminants/index.html), last updated November 28, 2006.
(2) NYSDEC. June 1998. TOGS 1.1.1. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Includes April 2000 and June 2004 Addendum values. (http://www.dec.ny.gov/regulations/2652.html)
(3) New York State Department of Health Drinking Water Standards, NYCRR Title 10, Part 5, Subpart 5-1 Public Water Systems, Effective November 23, 2005 (Statutory authority: Public Health Law 225, Effective May 26, 2004). (http://www.health.state.ny.us/environmental/water/drinking/part5/subpart5.htm)

A - If iron and manganese are present, the total concentrations of both should not exceed 0.5 mg/L.
C - Value applies to the sum of the PCB compounds
F - Value applies to the sum of alpha- and gamma-Chlordane
G - Guidance Value
S - Standard Value
PC - Principal Organic Contaminant
POC - Principal Organic Contaminant (total of POC and UOC contaminants can not exceed 100 ug/L)
T - Value applies to total trihalomethanes (bromodichloromethane, bromoform, chloroform, dibrimochloromethane)
TT - Treatment Technique
UOC - Unspecificed Organic Contaminant (total of PC and UC contaminants can not exceed 100 ug/L)

NA = not available
ND = Not detected
NL = chemical name not listed or screening value of this type not listed for the chemical
NYSDEC = New York State Department of Environmental Conservation
NYSDOH = New York State Department of Health
SSGWSC = site-specific groundwater screening criteria
TTHMs = total trihalomethanes
ug/l = microgram per liter

Table 2-1

Chemical-Specific ARARs, Criteria, and Guidance
Hopewell Precision Site
Hopewell Junction, New York

Regulatory Level	ARAR Identification	Status	Requirement Synopsis	FS Consideration
Federal	National Primary Drinking Water Standards-Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs)	Applicable	Establishes health-based standards for public drinking water systems. Also establishes drinking water quality goals set at levels at which no adverse health effects are anticipated, with an adequate margin of safety.	The MCLs and MCLGs will be used in the development of the PRGs.
State	New York State Department of Health Drinking Water Standards (10NYCRR Part 5)	Applicable	Sets maximum contaminant levels (MCLs) for public drinking water supplies.	The standards will be considered in the development of the PRGs.

NYCRR – New York Codes, Rules and Regulations
PRG – Preliminary remediation goal

Table 2-2

Location-Specific ARARs, Criteria, and Guidance
Hopewell Precision Site
Hopewell Junction, New York

Regulatory Level	ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
Federal	Statement on Procedures on Floodplain Management and Wetlands protection (40 CFR 6 Appendix A)	Applicable	This Statement of Procedures sets forth Agency policy and guidance for carrying out the provisions of Executive Orders 11988 and 11990.	Alternatives will take into consideration floodplain management and wetland protection.
Federal	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-12, 1985)	To Be Considered	Superfund actions must meet the substantive requirements of E.O. 11988, E.O. 11990, and 40 CFR part 6, Appendix A.	Alternatives will take into consideration floodplain management and wetland protection.
Federal (Non-Regulatory)	Floodplains Executive Order (EO 11988)	To Be Considered	Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	The potential effects of any action will be evaluated to ensure that the planning and decision making reflect consideration of flood hazards and floodplains management, including restoration and preservation of natural undeveloped floodplains.
Federal (Non-Regulatory)	Wetlands Executive Order (EO 11990)	To Be Considered	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance natural and beneficial values of wetlands.	Remedial alternatives that involve construction must include all practicable means of minimizing harm to wetlands. Wetlands protection considerations must be incorporated into the planning and decision making of remedial alternatives.

Table 2-2

Location-Specific ARARs, Criteria, and Guidance
Hopewell Precision Site
Hopewell Junction, New York

Regulatory Level	ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
Federal	National Environmental Policy Act (NEPA) (42 USC 4321; 40 CFR 1500 to 1508)	Relevant and Appropriate	This requirement sets forth EPA policy for carrying out the provisions of the Wetlands Executive Order (EO 11990) and Floodplain Executive Order (EO 11988).	This requirement will be considered during the development of alternatives.
Federal	Clean Water Act (CWA) Section 404 (40 CFR 404)	Applicable	Under this requirement, no activity that adversely affects a wetland is permitted if a practicable alternative that does not affect wetlands is available. If no other practicable alternative exists, impacts on wetlands must be mitigated.	The effects on wetlands will be evaluated during the identification, screening, and evaluation of alternatives. Permits may be required for some alternatives.
State	Endangered and Threatened Species of Fish and Wildlife (Part 182)	Applicable	Standards for the protection of threatened and endangered species	The potential effects of any action will be evaluated to ensure that any endangered or threatened species and their habitat will not be affected.
General	National Historic Preservation Act (40 CFR 6.301)	Applicable	This requirement establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	The effects on historical and archeological data will be evaluated during the identification, screening, and evaluation of alternatives.

CFR – Code of Federal Regulations
OSWER - Office of Solid Waste and Emergency Response
USC – United States Code

Table 2-3

Action-specific ARARs for Site Remediation
Hopewell Precision Site
Hopewell Junction, New York

ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
Common to All Alternatives			
OSHA—Record keeping, Reporting, and Related Regulations (29 CFR 1904)	Applicable	This regulation outlines the record keeping and reporting requirements for an employer under OSHA.	These regulations apply to the company(ies) contracted to implement the remedy. All applicable requirements will be met.
OSHA—General Industry Standards (29 CFR 1910)	Applicable	These regulations specify an 8-hour time-weighted average concentration for worker exposure to various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	Proper respiratory equipment will be worn if it is not possible to maintain the work atmosphere below the 8-hour time-weighted average at these specified concentrations.
OSHA—Construction Industry Standards (29 CFR 1926)	Applicable	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	All appropriate safety equipment will be on site, and appropriate procedures will be followed during remediation activities.
RCRA Identification and Listing of Hazardous Wastes (40 CFR 261)	Applicable	Describes methods for identifying hazardous wastes and lists known hazardous wastes.	Applicable to the identification of hazardous wastes that are generated, treated, stored, or disposed during remedial activities.
RCRA Standards Applicable to Generators of Hazardous Wastes (40 CFR 262)	Applicable	Describes standards applicable to generators of hazardous wastes.	Standards will be followed if any hazardous wastes are generated onsite.
RCRA—Standards for Owners/Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10–164.18)	Relevant and Appropriate	This regulation lists general facility requirements including general waste analysis, security measures, inspections, and training requirements.	Facility will be designed, constructed, and operated in accordance with this requirement. All workers will be properly trained.
RCRA—Preparedness and Prevention (40 CFR 264.30–264.31)	Relevant and Appropriate	This regulation outlines the requirements for safety equipment and spill control.	Safety and communication equipment will be installed at the site. Local authorities will be familiarized with the site.

Table 2-3

Action-specific ARARs for Site Remediation
Hopewell Precision Site
Hopewell Junction, New York

ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
RCRA—Contingency Plan and Emergency Procedures (40 CFR 264.50–264.56)	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Emergency Procedure Plans will be developed and implemented during remedial design. Copies of the plans will be kept on site.
New York Hazardous Waste Management System – General (6 NYCRR Part 370)	Applicable	This regulation provides definition of terms and general standards applicable to hazardous wastes management system.	The regulations will be applied to any hazardous waste operation during remediation of the site.
New York Identification and Listing of Hazardous Waste (6 NYCRR Part 371	Applicable	Describes methods for identifying hazardous wastes and lists known hazardous wastes.	Applicable to the identification of hazardous wastes that are generated, treated, stored, or disposed during remedial activities.
Off-Site Disposal			
Waste Transportation			
Department of Transportation (DOT) Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171, 172, 177, 179)	Applicable	This regulation outlines procedures for the packaging, labeling, manifesting, and transporting hazardous materials.	Any company contracted to transport hazardous material from the site will be required to comply with this regulation.
RCRA Standards Applicable to Transporters of Hazardous Waste (40 CFR 263)	Applicable	Establishes standards for hazardous waste transporters.	Any company contracted to transport hazardous material from the site will be required to comply with this regulation.
New York Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (6 NYCRR Part 372)	Applicable	Establishes record keeping requirements and standards related to the manifest system for hazardous wastes.	Any company contracted to transport hazardous material from the site will be required to comply with this regulation.
New York Waste Transporter Permit Program (6 NYCRR Part 364)	Applicable	Establishes permit requirements for transportations of regulated waste.	Must use permitted waste transporters when shipping wastes.

Table 2-3

Action-specific ARARs for Site Remediation
Hopewell Precision Site
Hopewell Junction, New York

ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
RCRA Land Disposal Restrictions (40 CFR 268)	Relevant and Appropriate	This regulation identifies hazardous wastes restricted for land disposal and provides treatment standards for land disposal.	This regulation identifies hazardous wastes restricted for land disposal and provides treatment standards for land disposal.
New York Standards for Universal Waste (6 NYCRR Part 374-3) and Land Disposal Restrictions (6 NYCRR Part 376)	Applicable	These regulations establish standards for treatment and disposal of hazardous wastes.	Hazardous wastes must comply with the treatment and disposal standards.

Table 2-4
Preliminary Remediation Goals for Drinking Water
Hopewell Precision Site
Hopewell Junction, New York

Contaminants of Concern	National Primary Drinking Water Standards[1] (µg/L)	NYSDOH Drinking Water Quality Standards[3] (µg/L)	PRGs[4] (µg/L)
Volatile Organic Compounds			
Trichloroethene (TCE)	5	5	5
1,1,1-Trichloroethane (1,1,1-TCA)	200	5	5
1,1-dichloroethene	7	5	5
Chloromethane	NS	5	5
cis-1,2-dichloroethene (cis-1,2-DCE)	70	5	5
Tetrachloroethene (PCE)	5	5	5
Methyl ethyl ketone (MEK) (1)	NS	50	50

Notes:

1. EPA National Primary Drinking Water Standards (web page), EPA 816-F-03-016, June 2003
2. New York Surface Water and Ground Water Quality Standards (6NYCRR Part 703), August 4, 1999
3. New York State Department of Health Drinking Water Standards (10NYCRR Part 5)
4. The PRGs are selected based on NYS Groundwater Quality Standards and drinking water standards

Bold figures indicate detected concentrations exceed PRGs
NYSDOH = New York State Department of Health
PRG = Preliminary Remedial Goal
µg/L = micrograms per liter

Table 5-1
Alternative AWS-2: Installation and Operation of Point-of-Entry Treatment Systems - Cost Estimate Summary
Hopewell Precision Site
Hopewell Junction, New York

Item No.	Item Description	Alternative AWS-2	
CAPITAL COSTS			
Construction Costs			
1.	Work Plans/HASP/CQCP	$	70,600
2.	Mobilization/Demobilization	$	15,000
3.	Construction Management	$	191,750
4.	Installation of POET Systems	$	1,917,500
	SUBTOTAL CONSTRUCTION COSTS	$	2,194,850
	General contractor Fee (10% construction)	$	219,485
	Design Engineering (10% construction)	$	219,485
	Resident Engineering/Inspection (10% construction)	$	219,485
	Contingency (20%)	$	438,970
	Total Capital Costs	**$**	**3,292,275**
ANNUAL OMM COSTS			
5.	Annual Maintenance	$	401,569
6.	Project Planning and Organizing	$	9,600
7.	Field Sampling Labor	$	149,292
8.	Sampling Equipment, Shipping, Consumable Supplies	$	62,800
9.	Sample Analysis and Data Validation	$	329,600
10.	Data Evaluation and Reporting	$	25,200
	Total Annual OMM Costs	**$**	**978,061**
FIVE YEAR REVIEW			
11.	Five Year Review Report	**$**	**8,400**
PRESENT WORTH OF COSTS			
12.	Total Capital Costs	$	3,292,275
13.	Annual OMM Costs (30 year duration)	$	12,136,754
14.	Five Year Review Costs (30 year duration)	$	18,126
	TOTAL PRESENT WORTH	**$**	**15,448,000**

Table 5-2
Alternative AWS-3: Provision of Alternate Water Supply - Cost Estimate Summary
Hopewell Precision Site
Hopewell Junction, New York

Item No.	Item Description	Alternative AWS-3
CAPITAL COSTS		
Construction Costs		
1.	Work Plans/HASP/CQCP	$ 70,600
2.	Mobilization/Demobilization	$ 72,000
3.	Construction Management	$ 932,413
4.	Extension of Existing Water Supply	$ 9,324,130
	SUBTOTAL CONSTRUCTION COSTS	$ 10,399,143
	General contractor Fee (10% construction)	$ 1,039,914
	Design Engineering (10% construction)	$ 1,039,914
	Resident Engineering/Inspection (10% construction)	$ 1,039,914
	Contingency (20%)	$ 2,079,829
	Total Capital Costs	**$ 15,598,714**
ANNUAL OMM COSTS		
5.	Annual Maintenance	$ -
6.	Project Planning and Organizing	$ -
7.	Field Sampling Labor	$ -
8.	Sampling Equipment, Shipping, Consumable Supplies	$ -
9.	Sample Analysis and Data Validation	$ -
10.	Data Evaluation and Reporting	$ -
	Total Annual OMM Costs	$ -
FIVE YEAR REVIEW		
11.	Five Year Review Report	**$ 8,400**
PRESENT WORTH OF COSTS		
12.	Total Capital Costs	$ 15,598,714
13.	Annual OMM Costs (30 year duration)	$ -
14.	Five Year Review Costs (30 year duration)	$ 18,126
	TOTAL PRESENT WORTH	**$ 15,617,000**

Table 5-3
Summary of Comparative Analysis of Remedial Alternatives
Hopewell Precision Site
Hopewell Junction, New York

EVALUATION CRITERIA	ALTERNATIVE AWS-1	ALTERNATIVE AWS-2	ALTERNATIVE AWS-3
Summary of Components	• No action	• Installation of Point-of-Entry Treatment (POET) Systems, including ongoing Operation, Maintenance, and Monitoring (OMM) • Periodic site reviews	• Pre-design Investigation • Connection to Existing Public Water Supply • Periodic site reviews
Overall Protection of Human Health and the Environment	Does not provide overall protection of human health and the environment; because no remedial action (RA) would be implemented under this alternative, no means would be available to prevent current and future exposure.	Protective of human health through removal of contaminants from drinking water and through restriction of the exposure pathway with institutional and engineering controls, including provision of an alternate water supply.	Protective of human health through provision of an alternate drinking water supply and restriction of the exposure pathway through institutional and engineering controls.
Compliance with ARAR	Would not achieve PRGs due to continued presence of COCs within drinking water.	Would meet chemical specific ARAR at point of use as extracted groundwater would be treated to below MCLs.	Would meet chemical specific ARAR at point of use as water supply meets MCLs.
Long-term Effectiveness and Permanence	Not effective in the long term as the risk to human health remains and there are no mechanisms to prevent future exposure or monitor contaminant migration and degradation.	This alternative is considered a permanent remedy with long-term effectiveness, to be assessed via performance monitoring and five-year reviews. Requires access to private properties on a continual basis. OMM costs increase over time. Monitoring and service would be cumbersome and require highly coordinated efforts.	This alternative is considered a permanent remedy with long-term effectiveness, to be assessed via performance monitoring and five-year reviews. Requires initial and possible future infrequent access to private properties.
Reduction of Toxicity, Mobility, or Volume (TMV) Through Treatment	No reduction in TMV through treatment.	Reduction in toxicity through treatment of extracted groundwater at its point-of-use, albeit not on the order of a full-scale groundwater treatment system. Mobility could be increased to some extent via the operation of over 300 private wells.	No reduction in TMV through treatment, yet the alternate water supply provided to residents is potable.
Short-term Effectiveness	There is no short-term impact to workers or the community as there are no RA activities under this alternative.	Limited work at private properties would have minimal and short-term impact to the communities and workers. Would be performed without significant health risk to the community. Use of PPE by workers would minimize exposure.	Limited work at private properties would have minimal and short-term impact to the communities and workers. Would be performed without significant health risk to the community. Limited disruptions to traffic would be involved. Operational controls would be established to minimize any impacts. Use of PPE by workers would minimize exposure.
Implementability	Could be easily implemented.	Could be easily implemented in approximately four months.	Readily implemented using standard construction equipment and services. Obtaining required access may prove lengthy.
Cost	$0	$15.4 million	$15.6 million

Table 5-4
Cost Comparison of Water Supply Alternatives
Hopewell Precision Site
Hopewell Junction, New York

Item No.	Item Description	Alternative AWS-1	Alternative AWS-2	Alternative AWS-3
CAPITAL COSTS				
Construction Costs				
1.	Work Plans/HASP/CQCP	$ -	$ 70,600	$ 70,600
2.	Mobilization/Demobilization	$ -	$ 15,000	$ 72,000
3.	Construction Management	$ -	$ 191,750	$ 932,413
4.	Construction: PW2 POET Installation/PW3 System Extension	$ -	$ 1,917,500	$ 9,324,130
	SUBTOTAL CONSTRUCTION COSTS	$ -	$ 2,194,850	$ 10,399,143
	General contractor Fee (10% construction)	$ -	$ 219,485	$ 1,039,914
	Design Engineering (10% construction)	$ -	$ 219,485	$ 1,039,914
	Resident Engineering/Inspection (10% construction)	$ -	$ 219,485	$ 1,039,914
	Contingency (20%)	$ -	$ 438,970	$ 2,079,829
	Total Capital Costs	$ -	**$ 3,292,275**	**$ 15,598,714**
ANNUAL OMM COSTS				
5.	Annual Maintenance	$ -	$ 401,569	$ -
6.	Project Planning and Organizing	$ -	$ 9,600	$ -
7.	Field Sampling Labor	$ -	$ 149,292	$ -
8.	Sampling Equipment, Shipping, Consumable Supplies	$ -	$ 62,800	$ -
9.	Sample Analysis and Data Validation	$ -	$ 329,600	$ -
10.	Data Evaluation and Reporting	$ -	$ 25,200	$ -
	Total Annual OMM Costs	$ -	**$ 978,061**	$ -
FIVE YEAR REVIEW				
11.	Five Year Review Report	$ -	**$ 8,400**	**$ 8,400**
PRESENT WORTH OF COSTS				
12.	Total Capital Costs	$ -	$ 3,292,275	$ 15,598,714
13.	Annual OMM Costs (30 year duration)	$ -	$ 12,136,754	$ -
14.	Five Year Review Costs (30 year duration)	$ -	$ 18,126	$ 18,126
	TOTAL PRESENT WORTH	$ -	**$ 15,448,000**	**$ 15,617,000**

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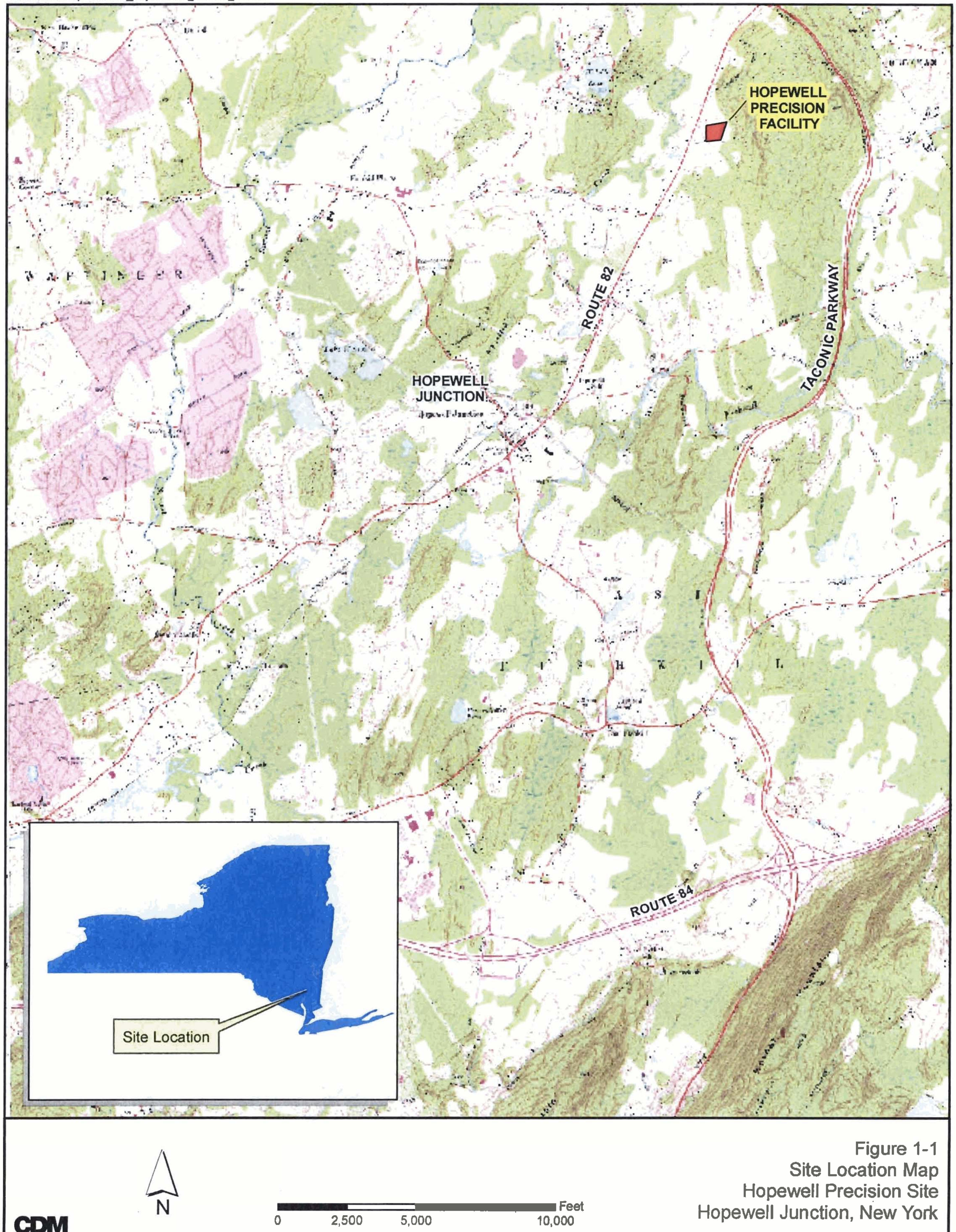

Figure 1-1
Site Location Map
Hopewell Precision Site
Hopewell Junction, New York

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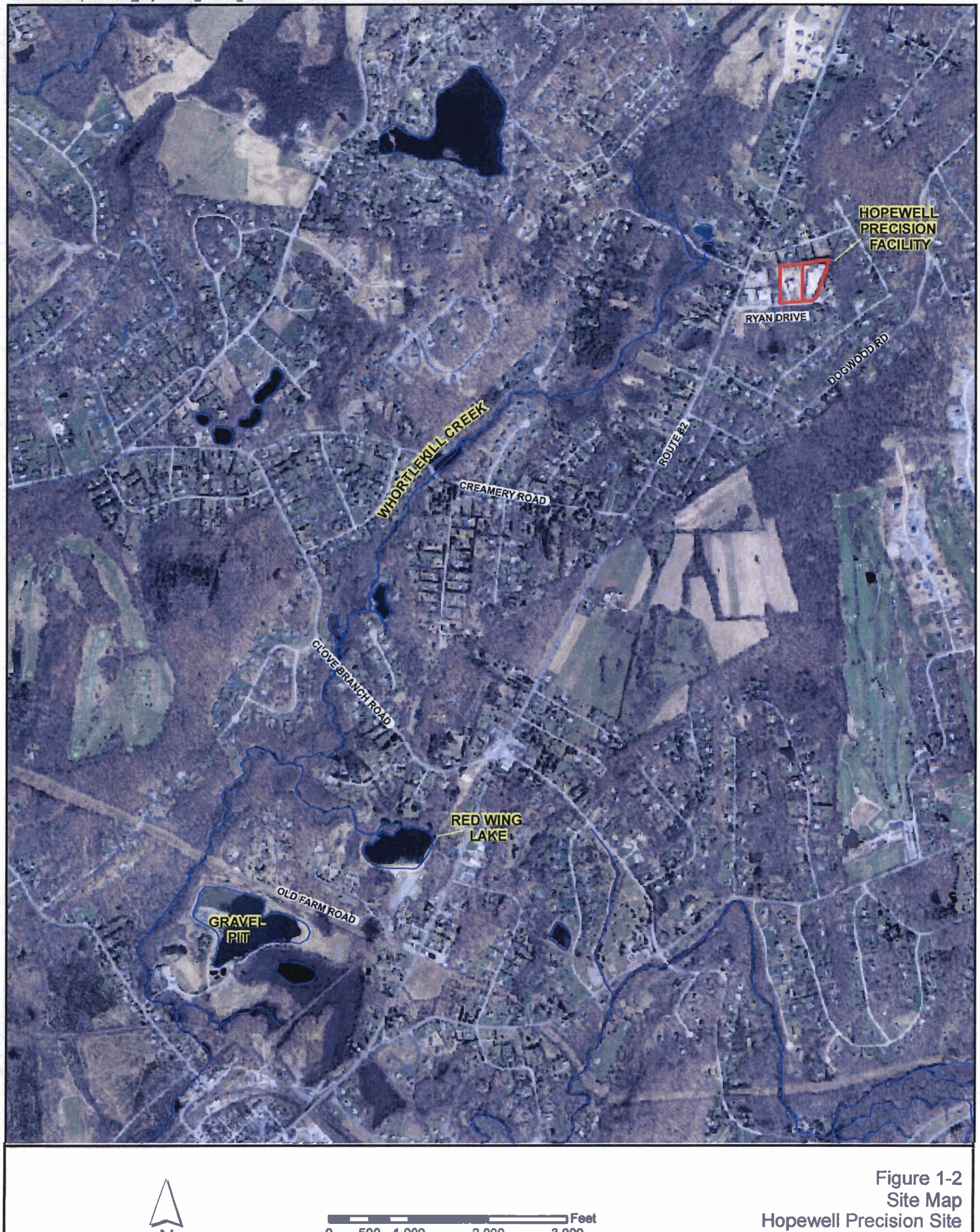

Figure 1-2
Site Map
Hopewell Precision Site
Hopewell Junction, New York

CDM

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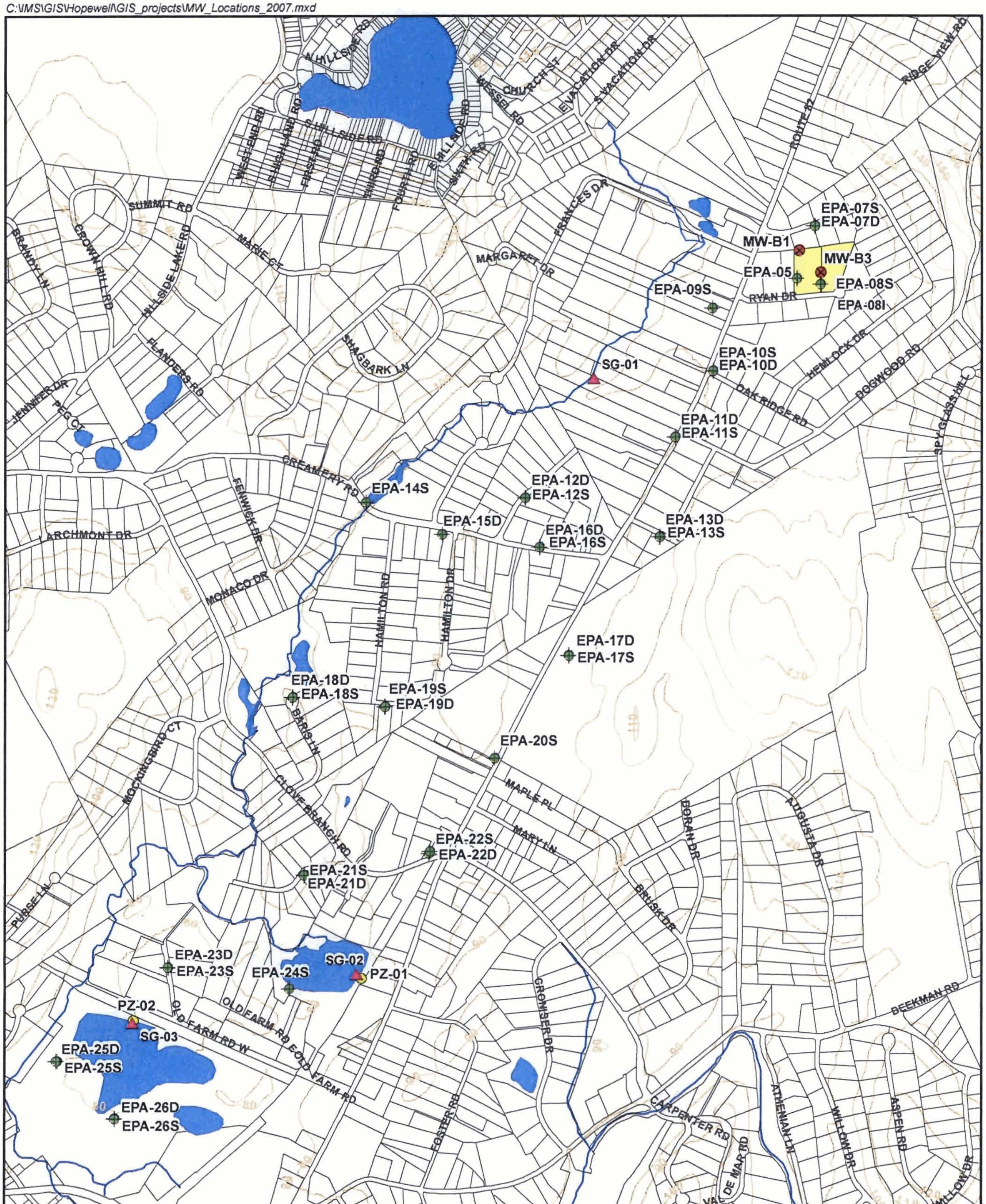


- ▲ Staff Guages
- EPA Monitoring Well
- Previous Investigation Monitoring Well
- Piezometer
- Parcel Boundary
- Topographic Contours - Feet amsl

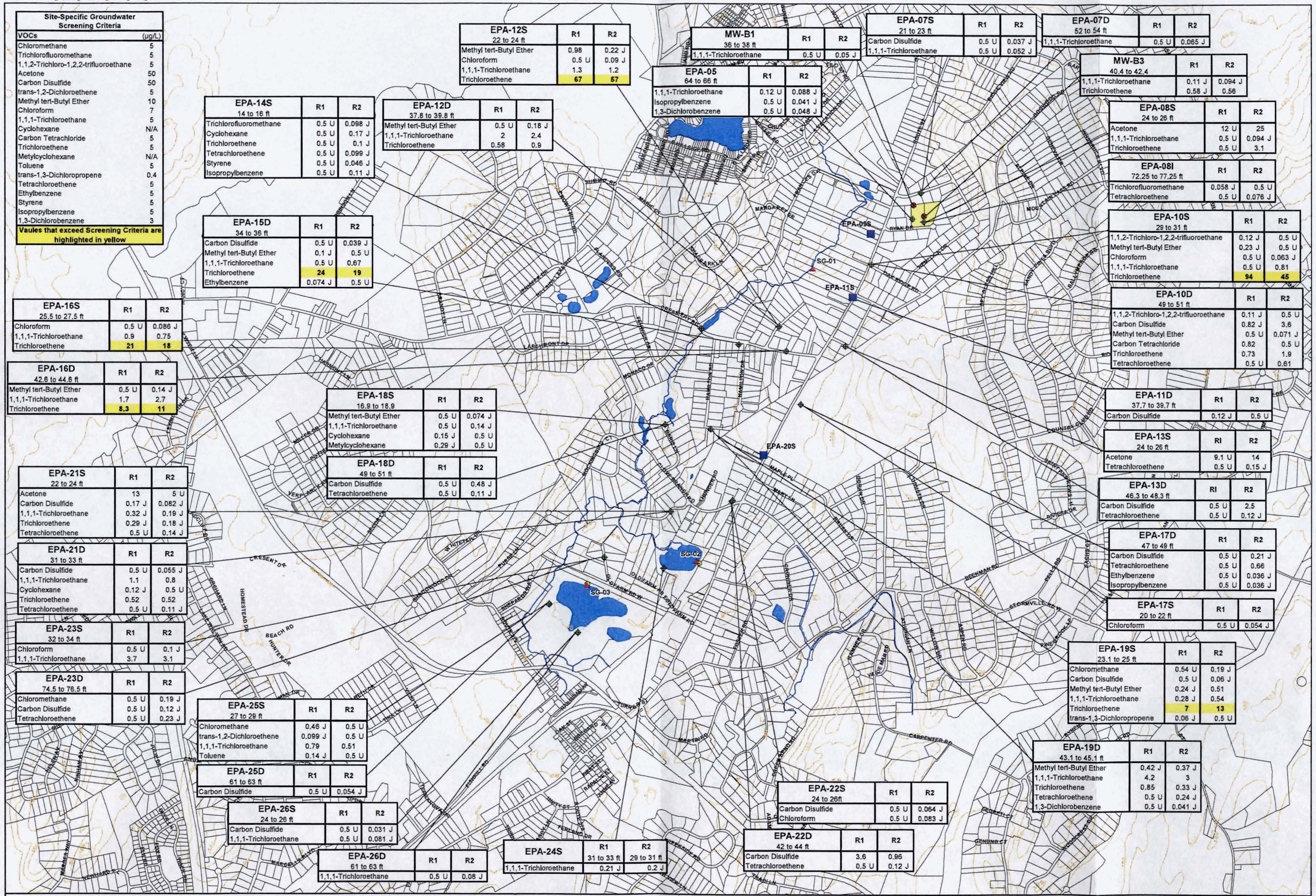
N

0 500 1,000 2,000 Feet

amsl = above mean sea level

Figure 1-3
Monitoring Well and Piezometer Locations
Hopewell Precision Site
Hopewell Junction, New York

CDM



Site-Specific Groundwater Screening Criteria

VOCs	(µg/L)
Chloromethane	5
Trichlorofluoromethane	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5
Acetone	50
Carbon Disulfide	50
trans-1,2-Dichloroethene	5
Methyl tert-Butyl Ether	10
Chloroform	7
1,1,1-Trichloroethane	5
Cyclohexane	N/A
Carbon Tetrachloride	5
Trichloroethene	5
Metylcyclohexane	N/A
Toluene	5
trans-1,3-Dichloropropene	0.4
Tetrachloroethene	5
Ethylbenzene	5
Styrene	5
Isopropylbenzene	5
1,3-Dichlorobenzene	3

Values that exceed Screening Criteria are highlighted in yellow

EPA-12S 22 to 24 ft	R1	R2
Methyl tert-Butyl Ether	0.98	0.22 J
Chloroform	0.5 U	0.09 J
1,1,1-Trichloroethane	1.3	1.2
Trichloroethene	67	57

MW-B1 36 to 38 ft	R1	R2
1,1,1-Trichloroethane	0.5 U	0.05 J

EPA-07S 21 to 23 ft	R1	R2
Carbon Disulfide	0.5 U	0.037 J
1,1,1-Trichloroethane	0.5 U	0.052 J

EPA-07D 52 to 54 ft	R1	R2
1,1,1-Trichloroethane	0.5 U	0.065 J

MW-B3 40.4 to 42.4	R1	R2
1,1,1-Trichloroethane	0.11 J	0.094 J
Trichloroethene	0.58 J	0.56

EPA-05 64 to 66 ft	R1	R2
1,1,1-Trichloroethane	0.12 U	0.088 J
Isopropylbenzene	0.5 U	0.041 J
1,3-Dichlorobenzene	0.5 U	0.048 J

EPA-14S 14 to 16 ft	R1	R2
Trichlorofluoromethane	0.5 U	0.098 J
Cyclohexane	0.5 U	0.17 J
Trichloroethene	0.5 U	0.1 J
Tetrachloroethene	0.5 U	0.099 J
Styrene	0.5 U	0.046 J
Isopropylbenzene	0.5 U	0.11 J

EPA-12D 37.8 to 39.8 ft	R1	R2
Methyl tert-Butyl Ether	0.5 U	0.18 J
1,1,1-Trichloroethane	2	2.4
Trichloroethene	0.58	0.9

EPA-08S 24 to 26 ft	R1	R2
Acetone	12 U	25
1,1,1-Trichloroethane	0.5 U	0.094 J
Trichloroethene	0.5 U	3.1

EPA-08I 72.25 to 77.25 ft	R1	R2
Trichlorofluoromethane	0.058 J	0.5 U
Tetrachloroethene	0.5 U	0.076 J

EPA-10S 29 to 31 ft	R1	R2
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12 J	0.5 U
Methyl tert-Butyl Ether	0.23 J	0.5 U
Chloroform	0.5 U	0.063 J
1,1,1-Trichloroethane	0.5 U	0.81
Trichloroethene	94	45

EPA-15D 34 to 36 ft	R1	R2
Carbon Disulfide	0.5 U	0.039 J
Methyl tert-Butyl Ether	0.1 J	0.5 U
1,1,1-Trichloroethane	0.5 U	0.67
Trichloroethene	24	19
Ethylbenzene	0.074 J	0.5 U

EPA-16S 25.5 to 27.5 ft	R1	R2
Chloroform	0.5 U	0.086 J
1,1,1-Trichloroethane	0.9	0.75
Trichloroethene	21	18

EPA-10D 49 to 51 ft	R1	R2
1,1,2-Trichloro-1,2,2-trifluoroethane	0.11 J	0.5 U
Carbon Disulfide	0.82 J	3.6
Methyl tert-Butyl Ether	0.5 U	0.071 J
Carbon Tetrachloride	0.82	0.5 U
Trichloroethene	0.73	1.9
Tetrachloroethene	0.5 U	0.61

EPA-16D 42.6 to 44.6 ft	R1	R2
Methyl tert-Butyl Ether	0.5 U	0.14 J
1,1,1-Trichloroethane	1.7	2.7
Trichloroethene	8.3	11

EPA-18S 16.9 to 18.9	R1	R2
Methyl tert-Butyl Ether	0.5 U	0.074 J
1,1,1-Trichloroethane	0.5 U	0.14 J
Cyclohexane	0.15 J	0.5 U
Metylcyclohexane	0.29 J	0.5 U

EPA-11D 37.7 to 39.7 ft	R1	R2
Carbon Disulfide	0.12 J	0.5 U

EPA-18D 49 to 51 ft	R1	R2
Carbon Disulfide	0.5 U	0.48 J
Tetrachloroethene	0.5 U	0.11 J

EPA-13S 24 to 26 ft	RI	R2
Acetone	9.1 U	14
Tetrachloroethene	0.5 U	0.15 J

EPA-21S 22 to 24 ft	R1	R2
Acetone	13	5 U
Carbon Disulfide	0.17 J	0.082 J
1,1,1-Trichloroethane	0.32 J	0.19 J
Trichloroethene	0.29 J	0.18 J
Tetrachloroethene	0.5 U	0.14 J

EPA-13D 46.3 to 48.3 ft	RI	R2
Carbon Disulfide	0.5 U	2.5
Tetrachloroethene	0.5 U	0.12 J

EPA-17D 47 to 49 ft	R1	R2
Carbon Disulfide	0.5 U	0.21 J
Tetrachloroethene	0.5 U	0.66
Ethylbenzene	0.5 U	0.036 J
Isopropylbenzene	0.5 U	0.036 J

EPA-21D 31 to 33 ft	R1	R2
Carbon Disulfide	0.5 U	0.055 J
1,1,1-Trichloroethane	1.1	0.8
Cyclohexane	0.12 J	0.5 U
Trichloroethene	0.52	0.52
Tetrachloroethene	0.5 U	0.11 J

EPA-17S 20 to 22 ft	R1	R2
Chloroform	0.5 U	0.054 J

EPA-23S 32 to 34 ft	R1	R2
Chloroform	0.5 U	0.1 J
1,1,1-Trichloroethane	3.7	3.1

EPA-19S 23.1 to 25 ft	R1	R2
Chloromethane	0.54 U	0.19 J
Carbon Disulfide	0.5 U	0.06 J
Methyl tert-Butyl Ether	0.24 J	0.51
1,1,1-Trichloroethane	0.28 J	0.54
Trichloroethene	7	13
trans-1,3-Dichloropropene	0.06 J	0.5 U

EPA-23D 74.5 to 76.5 ft	R1	R2
Chloromethane	0.5 U	0.19 J
Carbon Disulfide	0.5 U	0.12 J
Tetrachloroethene	0.5 U	0.23 J

EPA-25S 27 to 29 ft	R1	R2
Chloromethane	0.46 J	0.5 U
trans-1,2-Dichloroethene	0.099 J	0.5 U
1,1,1-Trichloroethane	0.79	0.51
Toluene	0.14 J	0.5 U

EPA-19D 43.1 to 45.1 ft	R1	R2
Methyl tert-Butyl Ether	0.42 J	0.37 J
1,1,1-Trichloroethane	4.2	3
Trichloroethene	0.85	0.33 J
Tetrachloroethene	0.5 U	0.24 J
1,3-Dichlorobenzene	0.5 U	0.041 J

EPA-25D 61 to 63 ft	R1	R2
Carbon Disulfide	0.5 U	0.054 J

EPA-22S 24 to 26ft	R1	R2
Carbon Disulfide	0.5 U	0.064 J
Chloroform	0.5 U	0.083 J

EPA-26S 24 to 26 ft	R1	R2
Carbon Disulfide	0.5 U	0.031 J
1,1,1-Trichloroethane	0.5 U	0.081 J

EPA-22D 42 to 44 ft	R1	R2
Carbon Disulfide	3.6	0.96
Tetrachloroethene	0.5 U	0.12 J

EPA-24S	R1 31 to 33 ft	R2 29 to 31 ft
1,1,1-Trichloroethane	0.21 J	0.2 J

EPA-26D 61 to 63 ft	R1	R2
1,1,1-Trichloroethane	0.5 U	0.08 J

Staff Guages
EPA Monitoring Well with VOC Detections
Previous Investigation Monitoring Well
Piezometer
Parcel Boundary
Topographic Contours - Feet amsl
EPA Monitoring Well with No VOC Detections

Acronyms:
amsl - above mean sea level
ft - feet
J - estimated value
R1 - Round 1
R2 - Round 2
U - not detected over method detection limit
µg/L - microgram per liter
VOCs- Volatile Organic Compounds

Notes:
Round 1 was collected in March, 2007
Round 2 was collected in July, 2007
Sample intervals are in depth below ground surface
All results are in ug/L
Elevations are in ft amsl

N
0 500 1,000 2,000 Feet

Figure 1-4
Monitoring Well Sampling Volatile Organic Compound Detections
Hopewell Precision Site
Hopewell Junction, New York

CDM

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⬚ Hopewell Precision Facility
—— Street Centerline
Contours

1,1,1-TCA Results (ug/L)
Greater than 5
0.5 to 5
Non-Detect

N

0 500 1,000 2,000 Feet

Figure 1-5
1,1,1-Trichloroethane (1,1,1-TCA) Results
Residential Well Sampling Locations (Round 1)
Hopewell Precision Site
Hopewell Junction, New York

CDM

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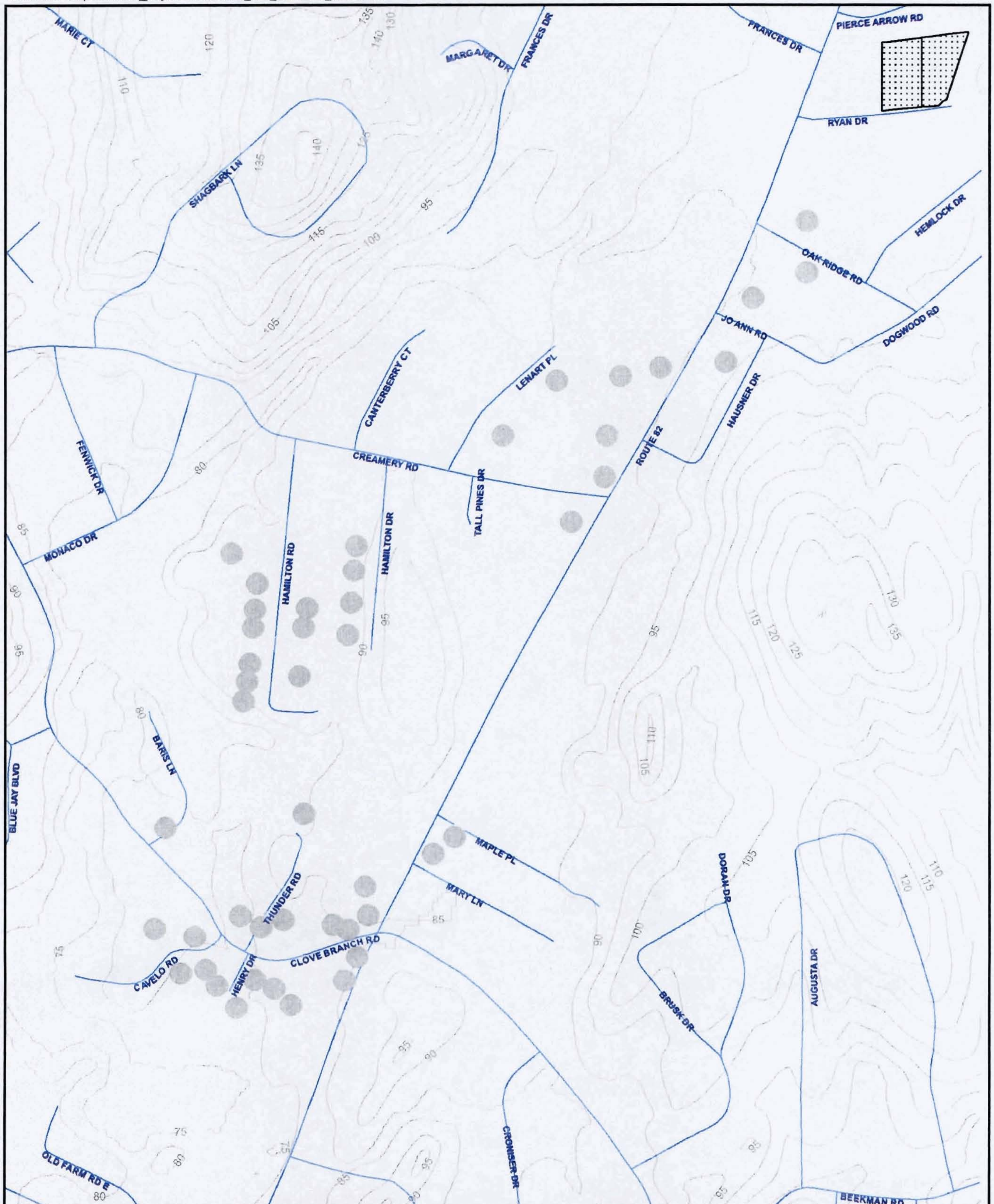

Hopewell Precision Facility
Street Centerline
Contours

Tetrachloroethene (PCE) Results (ug/L)
- Greater than 5
- 0.5 to 5
- Non-Detect

N

0 500 1,000 2,000 Feet

Figure 1-6
Tetrachloroethene (PCE) Results
Residential Well Sampling Locations (Round 1)
Hopewell Precision Site
Hopewell Junction, New York

CDM

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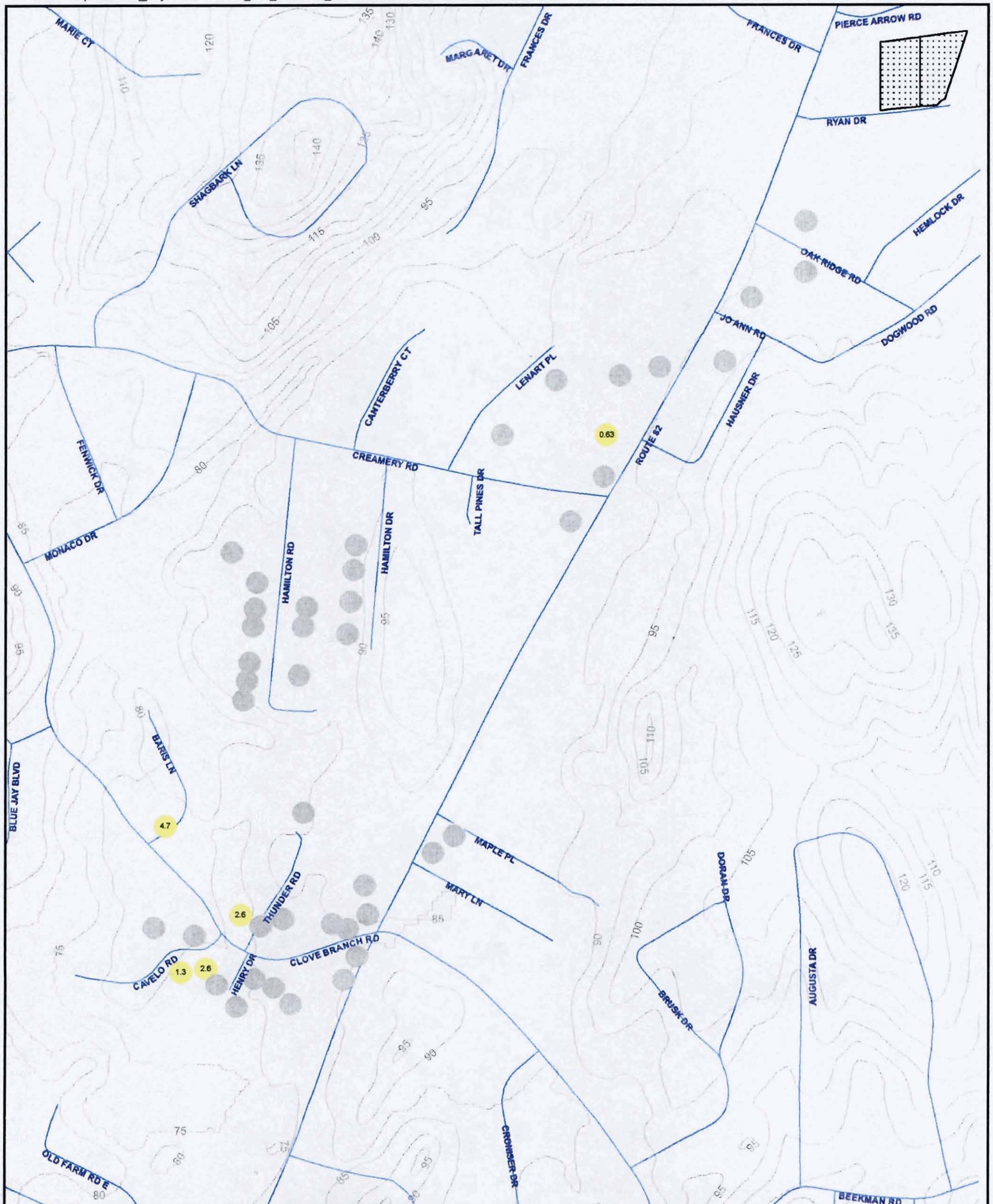

Hopewell Precision Facility
Street Centerline
Contours

TCE Results (ug/L)
Greater than 5
0.5 - 5
Non-Detect

N

0 500 1,000 2,000 Feet

Figure 1-7
Trichloroethene (TCE) Results
Residential Well Sampling Locations (Round 1)
Hopewell Precision Site
Hopewell Junction, New York

CDM

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Hopewell Precision Facility

Street Centerline

Contours

1,1,1-TCA Results (ug/L)

Greater than 5

0.5 to 5

Non-Detect

N

0 500 1,000 2,000 Feet

Figure 1-8
1,1,1-Trichloroethane (TCA) Results
Residential Well Sampling Locations (Round 2)
Hopewell Precision Site
Hopewell Junction, New York

CDM

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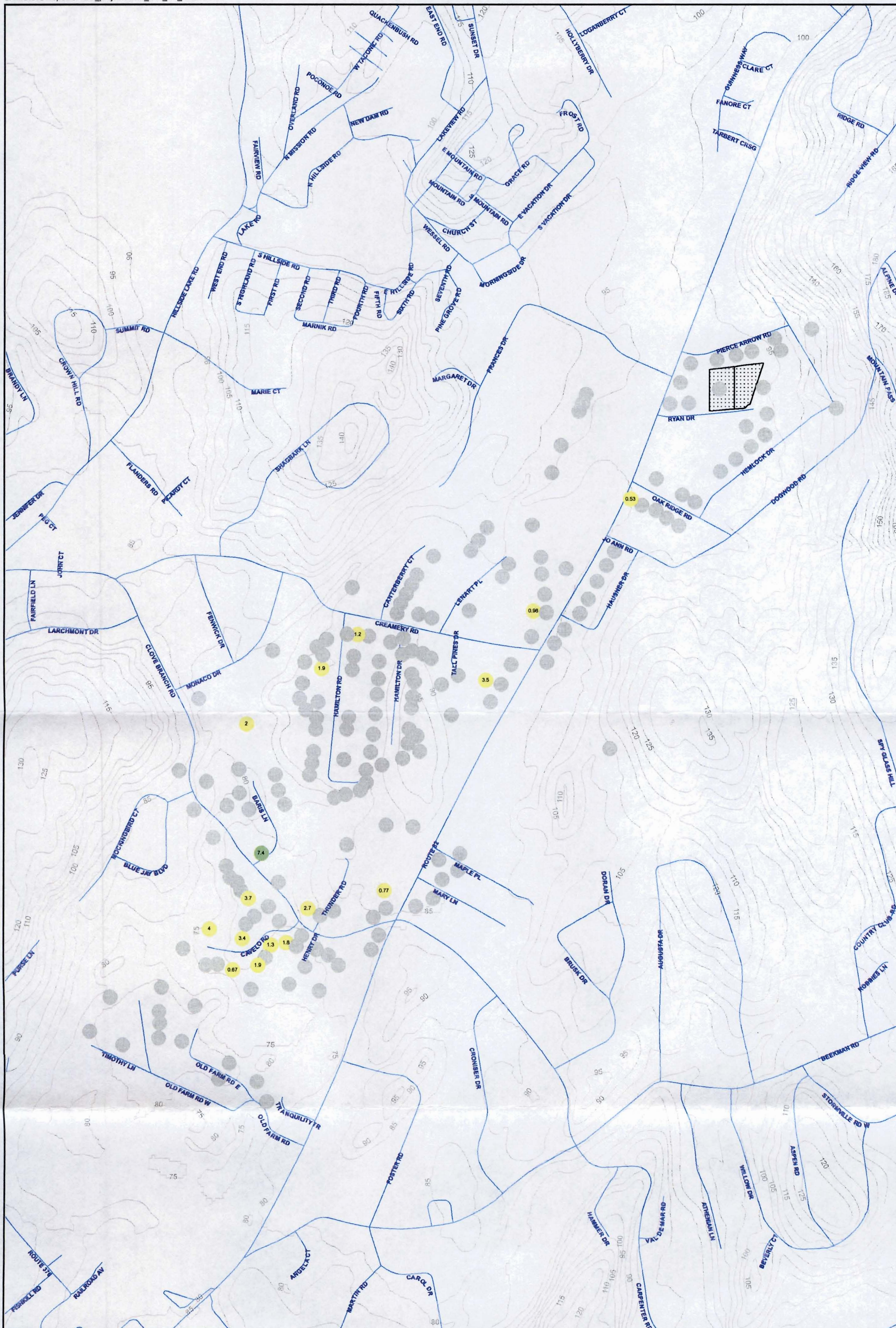

Hopewell Precision Facility

Street Centerline

Contours

Trichloroethene (TCE) Results (ug/L)

Greater than 5

0.5 to 5

Non-Detect

N

Feet

0 500 1,000 2,000

Figure 1-9
Trichloroethene (TCE) Results
Residential Well Sampling Locations (Round 2)
Hopewell Precision Site
Hopewell Junction, New York

CDM

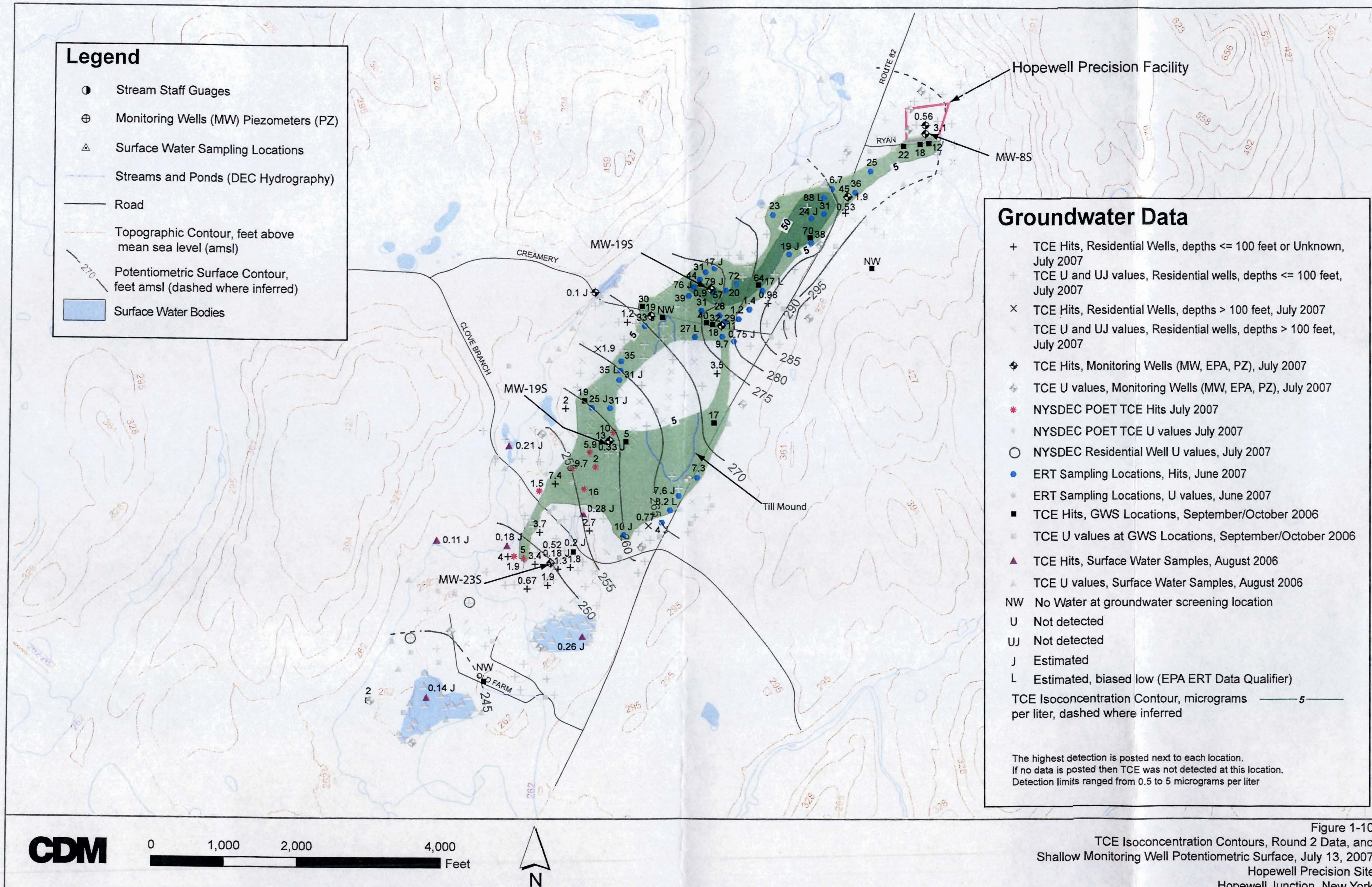

Figure 1-10
TCE Isoconcentration Contours, Round 2 Data, and
Shallow Monitoring Well Potentiometric Surface, July 13, 2007
Hopewell Precision Site
Hopewell Junction, New York

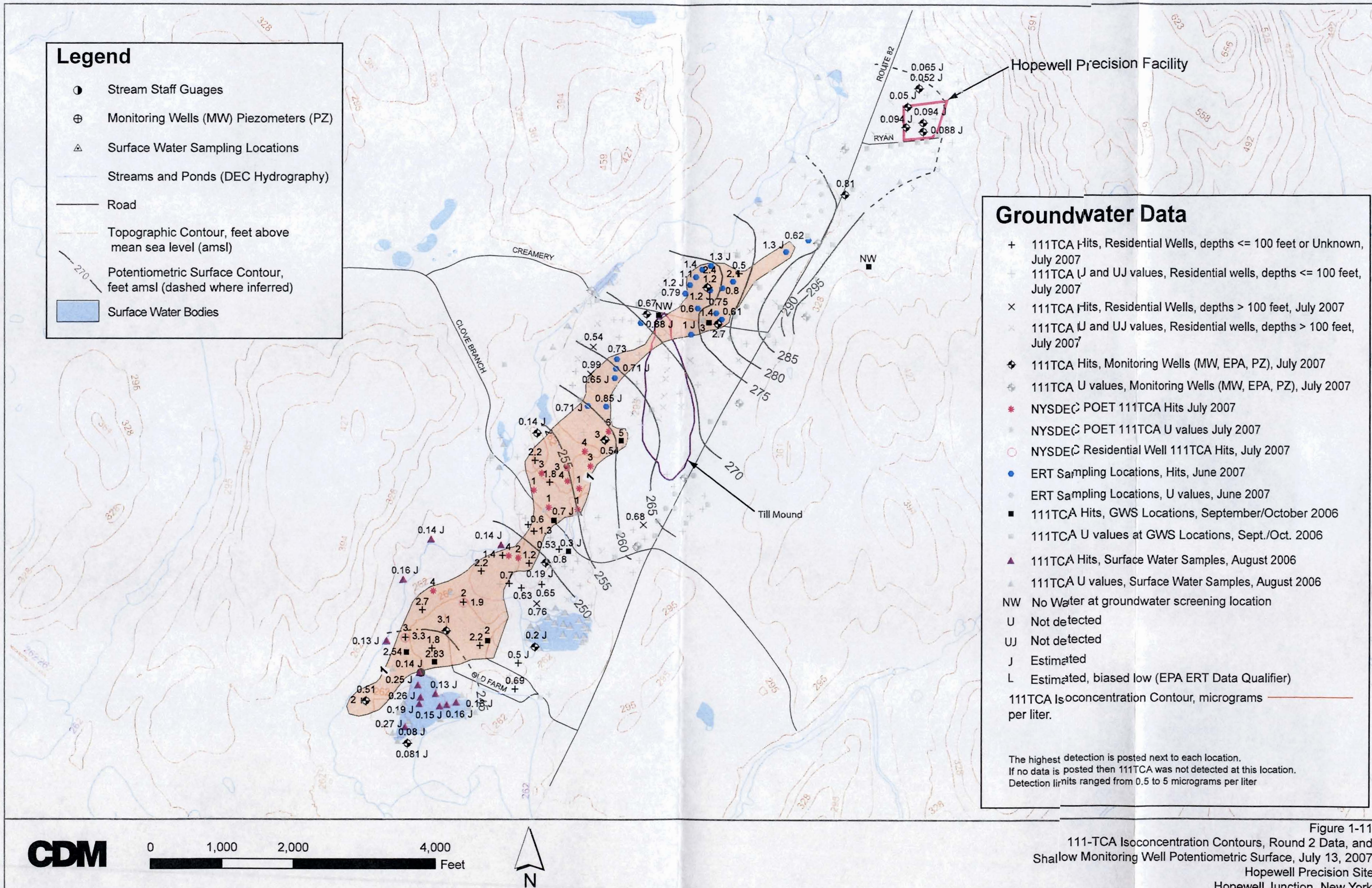

Figure 1-11
111-TCA Isoconcentration Contours, Round 2 Data, and Shallow Monitoring Well Potentiometric Surface, July 13, 2007
Hopewell Precision Site
Hopewell Junction, New York

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Figure 1-12
Focused Feasibility Study (FFS) Area
Hopewell Precision Site
Hopewell Junction, New York

CDM

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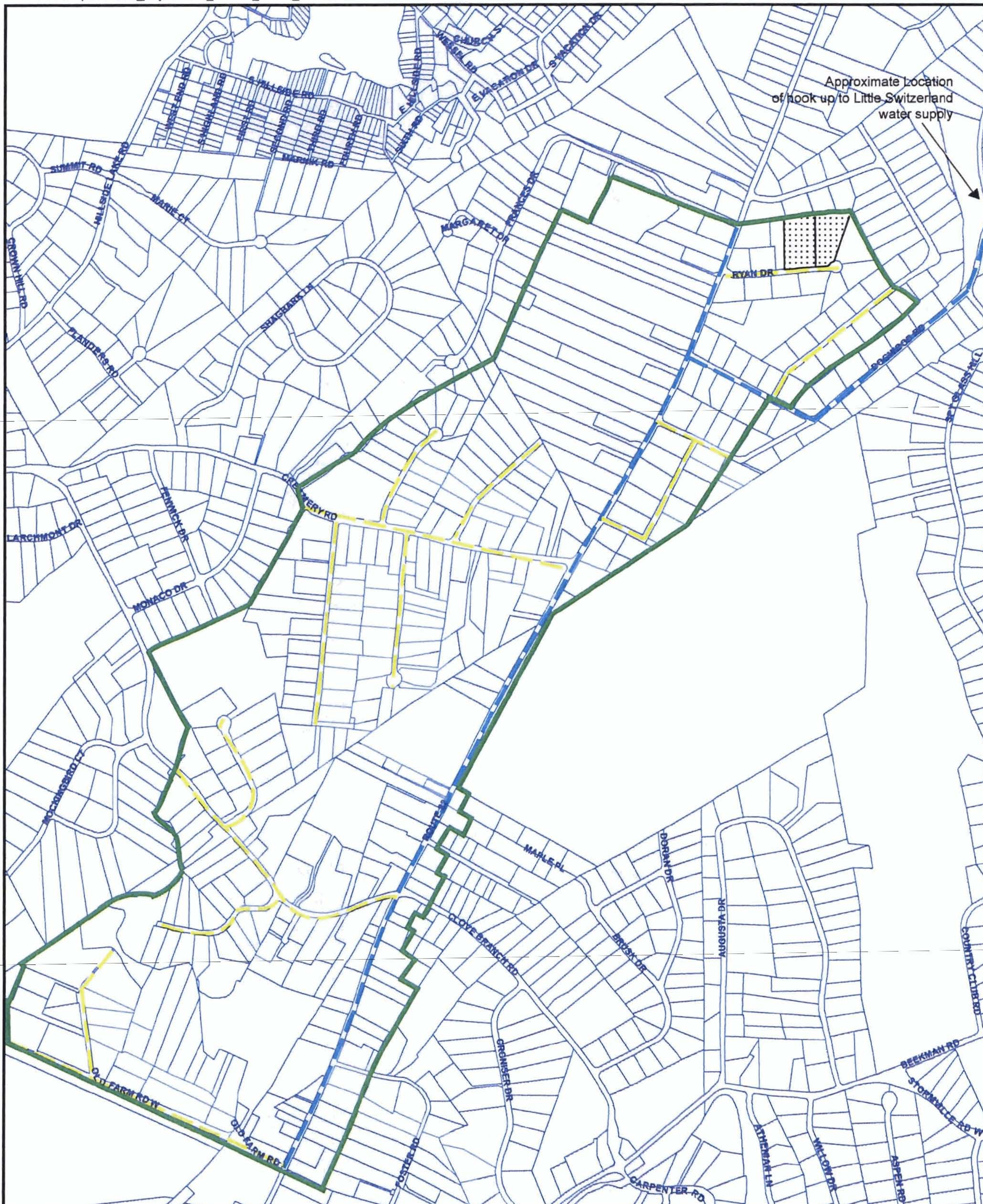


Hopewell Precision Facility
Parcel Boundary
Study Area
Water Supply Delivery Route (8" pipe)
Water Supply Delivery Route (10" pipe)

N

0 500 1,000 2,000 Feet

Figure 3-1
Alternate Water Supply Delivery Route
Hopewell Precision Site
Hopewell Junction, New York

CDM

Computed by: __________
Checked by: __________

No. 1 Work Plan/HASP/CQCP/QAPP Preparation

Assume the following:

Persons:	2
Months:	2
weeks/month:	4.2
Hours/week:	40
Salary Rate:	$35 per hour
Multiplier:	3

No. 1 Total: **$70,600**

No. 2 Mobilization/Demobilization

	Months	Cost per month	
Materials/supplies	5	1000	$ 5,000
Utilities	5	1000	$ 5,000
Temp Facilities	5	1000	$ 5,000

No. 2 Total: **$15,000**

No. 3 Construction Management

PM/construction supervision at 10% of construction cost

No. 3 Total: **$191,750**

No. 4 Installation of Point of entry treatment systems[1]

Price per unit (including delivery, installation, and plumbing to create a turn-key system)	$5,900
Number of potential homes/Commercial for installation	325
Subtotal:	$1,917,500

[1] 52 homes already have an existing individual POET system

No. 4 Total: **$1,917,500**

ANNUAL OMM OF POET SYSTEMS (No. 5-10)

No. 5 Annual Maintenance[2]/Depreciation

[2] Based on existing system OMM costs and vendor pricing

	Homes	cost per property
UV light cleaning, Sediment filter change, and general maintenance	377	$320
Subtotal:		$120,640

Carbon Changeout

Residence

Approximate daily usage	250 gal/day
Approximate Maximum Concentration	88 ug/L
Contaminant removal	83,160 ug/day
Approximate Adsorption Capacity	0.03 lb VOC/lb GAC
Amount of GAC per unit	125 lb GAC
Approximate duration between Changeo	56 years
Approximate number of change outs per year	6 units

Commercial

Approximate daily usage	670 gal/day

Computed by: ______
Checked by: ______

Approximate Maximum Concentration	88	ug/L
Contaminant removal	222,869	ug/day
Approximate Adsorption Capacity	0.03	lb VOC/lb GAC
Amount of GAC per unit	125	lb GAC
Approximate duration between Changeou	20	years
Approximate number of change outs per year	1	units

Total:	
Units to be changed per year	7
Cost per cubic foot	$200
Cubic Feet per unit	5
Cost per change out	$1,000
	$7,000

Replacement of Equipment Costs

Life Expectancy of system	7	years
Percentage of capital costs per year	14.29%	
Subtotal:	$273,929	

No. 5 Total: **$401,569**

No. 6 Organization of Sampling Event (e.g., Staffing, Lab Procurement, Obtaining Equipment)

Events per year: 4

Per Sampling Event

	Hours	Hourly wage	Multiplier	Subtotals
1 Project Manager	4	$ 40	3	$ 480
1 Engineer	16	$ 30	3	$ 1,440
1 Purchasing specialist	8	$ 20	3	$ 480
salary multiplier of 3				$ 2,400

No. 6 Total: **$9,600**

No. 7 Sampling Labor

Events per year: 4

Per Sampling Event

	Persons	Days	Hrs/day	Hourly Wage	homes/day
2 person sampling crew	2	19	11	30	20
salary multiplier of 3					$37,323

No. 7 Total: **$149,292**

No. 8 Sampling Equipment

Events per year: 4

Assume sample shipping cost of $200 per day
Assume sampling equipment @ $100 per day
Assume PPE @ $20 per day
Assume miscellaneous materials @ $100 per day

	Cost	Days	Subtotals
Shipping	$ 200	19	$ 3,770
Sampling Equipment	$ 100	19	$ 1,885
Monitoring Equipment	$ 25	19	$ 471
PPE	$ 20	19	$ 377
Vehicle Rental	$ 70	19	$ 1,320
Per Diem	$ 320	19	$ 6,032
Misc	$ 100	19	$ 1,885
			$ 15,700

No. 8 Total: **$62,800**

Computed by: ___________
Checked by: ___________

No. 9 Sampling Analysis and Validation

Events per year: 4

Analyzed for VOCs, Quarterly effluent, annual influent from each POET

Samples		472
Field duplicate		24
Trip Blanks		19
Total Samples		515
Cost per sample	$	115
Sample cost	$	59,225

Samples validated per hour	Hourly Wage	Hours	Multiplier
2	30	258	3
Validation cost			$ 23,175

No. 9 Total: **$329,600**

No. 10 Data Review & Reporting (Quarterly Monitoring)

	Hours	Hourly wage	Multiplier
1 Engineer	240	35	3
Subtotal			$25,200

No. 10 Total: **$25,200**

No. 1 Work Plan/HASP/CQCP/QAPP Preparation

Assume the following:

Persons:	2
Months:	2
weeks/month:	4.2
Hours/week:	40
Salary Rate:	$35 per hour
Multiplier:	3

No. 1 Total: **$70,600**

No. 2 Mobilization/Demobilization

	Months	Cost per month	Subtotals
Materials/supplies	24	$1,000	$ 24,000
Utilities	24	$1,000	$ 24,000
Temp Facilities	24	$1,000	$ 24,000

No. 2 Total: **$72,000**

No. 3 Construction Management

PM/construction supervision at 10% of construction cost

No. 3 Total: **$932,413**

No. 4 ALTERNATE WATER SUPPLY

A.) EXCAVATION

Excavation and creation of water main within FFS study area

Assumed Dogwood Road contains bedrock instead of soil

Trenching of water main within in street	
Assume trench depth	6 ft
Assume trench width	4 ft
Estimated Length of Trenching	38,350 ft
Estimated volume of soil to be excavated	30,311 CY
Estimated volume of rock to be excavated	3,778 CY

Excavation from water main to residence

Number of well to be hooked up to public water:	377 homes
* Assume 65% larger properties	245 homes
Length from home to water main:	200 ft
* Assume 35% small properties	132 homes
Length from home to water main:	100 ft

Large properties

Trenching from water main to residence	
Assume trench depth	6 ft
Assume trench width	2 ft
Estimated Length of Trenching	200 ft
Total Length	49,000 ft
Estimated volume of soil to be excavated	21,778 CY

Small Properties

Trenching from water main to residence	
Assume trench depth	6 ft
Assume trench width	2 ft
Estimated Length of Trenching	100 ft
Total Length	13,200 ft
Estimated volume of soil to be excavated	5,867 CY

Cost of Excavation

Assume 1 foot depth of asphalt

Assume additional 10 LF for each property

Excavation of asphalt:	
02220-360-0020	14.54 per LF
Total Length	42,120 LF
Subtotal:	$612,291

Excavation of Soil underneath roadway:

Trenching 6' deep 4' wide, slope 1 to 1 (G1030-805-3860)		27.28 per LF		
Subtotal:		$930,280		
Excavation of rock underneath Dogwood Road:				
Drilling and blasting rock, trenches over 1,500 CY (02315-416-2000)		$122.79 per CY		
Excavate and load boulders, 3 CY power shovel (02315-416-5200)		1.72 per CY		
Subtotal:		$470,344		
Excavation from Property to water main				
Trenching 6' deep 2' wide, slope 1 to 1 (G1030-805-3560)		21.27 per LF		
Subtotal:		$1,323,110		
TOTAL EXCAVATION COSTS:				**$3,336,025**

D.) PIPING

Water Main Piping

Assumed:

10" piping along Route 82 and Dogwood Road	14,250 LF			
8" piping for remaining areas	24,100 LF			
Pipe Bedding		14,250 LF	$4,607	
6' deep 4' wide, slope 1 to 1		$9 per LF		
10" ductile iron piping		14,250 LF	$666,000	
10" ductile iron (02510-730-2080)		$47 per LF		
10" gate valves (1 per 1,000 ft)		14 valves	$22,407	
02510-600-9060		$1,600 each		
8" ductile iron piping		24,100 LF	$896,700	
8" ductile iron (02510-730-2060)		$37 per LF		
8" gate valves (1 per 1,000 ft)		24 valves	$28,196	
02510-600-9040		$1,175 each		
Subtotal:			$1,617,910	

Fittings	Estimated Quantity	Unit Price	
10" 45° Elbows	8	$400	$3,200
10" 90° Elbows (02510-730-8060)	3	$915	$2,746
10" Tees (02510-730-8260)	16	$1,035	$16,564
Subtotal:			$22,509

Large Properties

Piping from the main to the house

Approximate distance from water main to house:		200 ft
Number of homes		245
3/4" copper pipe (02510-780-2000)		4.00 per LF
90° bend or elbows (2 per home) (15107-460-0120)		$25.20 each
Subtotal:	$	208,407

Small Properties

Piping from the main to the house

Approximate distance from water main to house:		100 ft
Number of homes		132
3/4" copper pipe (02510-780-2000)		4.00 per LF
90° bend or elbows (2 per home) (15107-460-0120)		$25.20 each
Subtotal:	$	59,469

Assumed 1 per property	Qty	Unit Price	
Curb Stops 3/4" (02510-780-7160)	377	$77	
Corporation stops 3/4" (02510-780-7020)	377	$48	
Curb Boxes 3/4" (02510-780-7200)	377	$111	
Subtotal:		$89,109	
TOTAL PIPING COSTS:			**$1,997,404**

D.) SERVICE CONNECTIONS

Service connections per house

Number of wells to be hooked up to town water:	377 homes		
Installation of meters	$60.00 ea.		
Tapping fee	$1,240.00 ea.		
Meter test	$10.00 ea.		
Service Connection cost per resident	**$1,310.00**		
TOTAL SERVICE CONNECTION COSTS:			**$493,870**

E.) RESTORATION AND BACKFILL

Restoration of property due to trenching

Water Main Backfill

Backfill with the excavated materials	28,400 CY	$780,977	
Backfill by hand, heavy soil (02315-110-0100)	$27.50 per CY		
Compacted soil with 6" lifts	28,400 CY	$208,261	
Roller Compaction plate (02315-110-0400)	$7.33 per CY		
Asphaltic Concrete Pavement, Lots & Driveways	153,400 SF	$363,807	
6" Stone base, 2" binder course, 1" topping	$2.37 per SF		
Subtotal:		$1,353,045	
Large properties			
Backfill with the excavated materials	21,778 CY	$470,542	
Backfill by hand, light soil (02315-110-0015)	$21.61 per CY		
Top Soil, 12" Lifts	21,778 CY	$106,466	
Compaction, operator walking (02315-110-0900)	$4.89 per CY		
Sodding	2.25 acre	$79,923	
MS 18 05 0404	$35,525 per acre		
Other misc. landscape items ($250 per home):		$61,250	
Subtotal:		$718,180	
Small properties			
Backfill with the excavated materials	5,867 CY	$126,758	
Backfill by hand, light soil (02315-110-0015)	$21.61 per CY		
Top Soil, 12" Lifts	5,867 CY	$28,681	
Compaction, operator walking (02315-110-0900)	$4.89 per CY		
Sodding	0.61 acre	$21,530	
MS 18 05 0404	$35,525 per acre		
Other misc. landscape items ($250 per home):		$33,000	
Subtotal:		$209,969	
TOTAL RESTORATION AND BACKFILL COSTS:			**$2,281,194**

F.) OFFSITE DISPOSAL OF SOIL

Assume all soil will be removed as non-hazardous soil
Volume of soil will be estimated to be 1 ft of depth multiplied by length of trenches
Assume 1.35 ton/CY

	Depth (ft)	Length (ft)	Width (ft)	
	1	38,350	4	
Subtotal:			5,700 CY	
Offsite Disposal - Non-hazardous Soil				
MS 33 19 7269			$82.50 per ton	
TOTAL OFFSITE DISPOSAL OF SOIL				**$634,838**

G.) ADDITIONAL STORAGE TANK

	Qty	Unit Price	
250,000 gallon storage tank	1	$480,000	
TOTAL ADDITIONAL STORAGE TANK COSTS:			**$480,000**

H.) POLICE DETAIL DURING ROAD CONSTRUCTION

Police Detail	No.	hourly wage	hours/day	days	
Traffic directors	2	35	8	180	
	Subtotal:			$100,800	
TOTAL POLICE DETAIL COSTS:					**$100,800**

No. 4 Total: **$9,324,130**

No. 5 Five Year Review

Assume 5-year reviews will be conducted every 5 years for 30 years.

Work includes: 5-year review of groundwater monitoring data
Preparation of report

Assume 1 person for 2 weeks
Assume salary rate of $35/hour.
Assume multiplier of 3

Persons	Hourly Wage	Hours	Multiplier
1	35	80	3
Subotal:			$8,400

No. 5 Total: **$8,400**

Present Worth Calculations

Assume discount rate is 7%:

Total Annual O&M Costs

This is a recurring cost every year for 30 years

This is a problem of the form find (P given A, i, n) or (P/A,i,n)

P = Present Worth
A= Annual amount
i = interest rate
Assume 7%

Looking up the interest rate tables for i = 7% and n = 30 years
The multiplier for (P/A) = **12.409**

Total 5-year review costs

This cost occurs every 5 years.

need to calculate the effective interest rate i_e

Given i = 7% (nominal interest rate)	0.07	
m= # of compounding periods = 5 years	5	
$i_e = (1+i)^m - 1$	0.403 =	40% / 5 years

$$\mathbf{P = A^*} \frac{(1+i)^n - 1}{i(1+i)^n}$$

in this case there are 6 - 5yr periods

n = 6	6
i =	0.403
The multiplier is =	**2.158**

SUBURBAN WATER TECHNOLOGY, INC.

800-525-6464

1697 SWAMP PIKE
GILBERTSVILLE, PA 19525

FAX 610-367-4950

QUOTATION

November 29, 2007

E-MAIL: LeeJ@CDM.com

TO: CDM Inc
ATTENTION: Jonathan Lee

RE: Granulated Activated Carbon treatment system for TCE in New York

EQUIPMENT: One ¾" 5-micron sediment filter, one totalizing brass water meter, two 2 ½ cubic feet each carbon tanks, two 7 gpm ultraviolet sterilizers

SPECIFICATION: Supply, deliver, and install the above listed equipment at each home including all plumbing and electric to create a turn key installation

PRICE: $4,500.00 for budgetary purpose

OPTION PRICE: If the post UV light is required by New York DEP to be NSF certified add $1,400.00

QUOTE GOOD: 30 Days

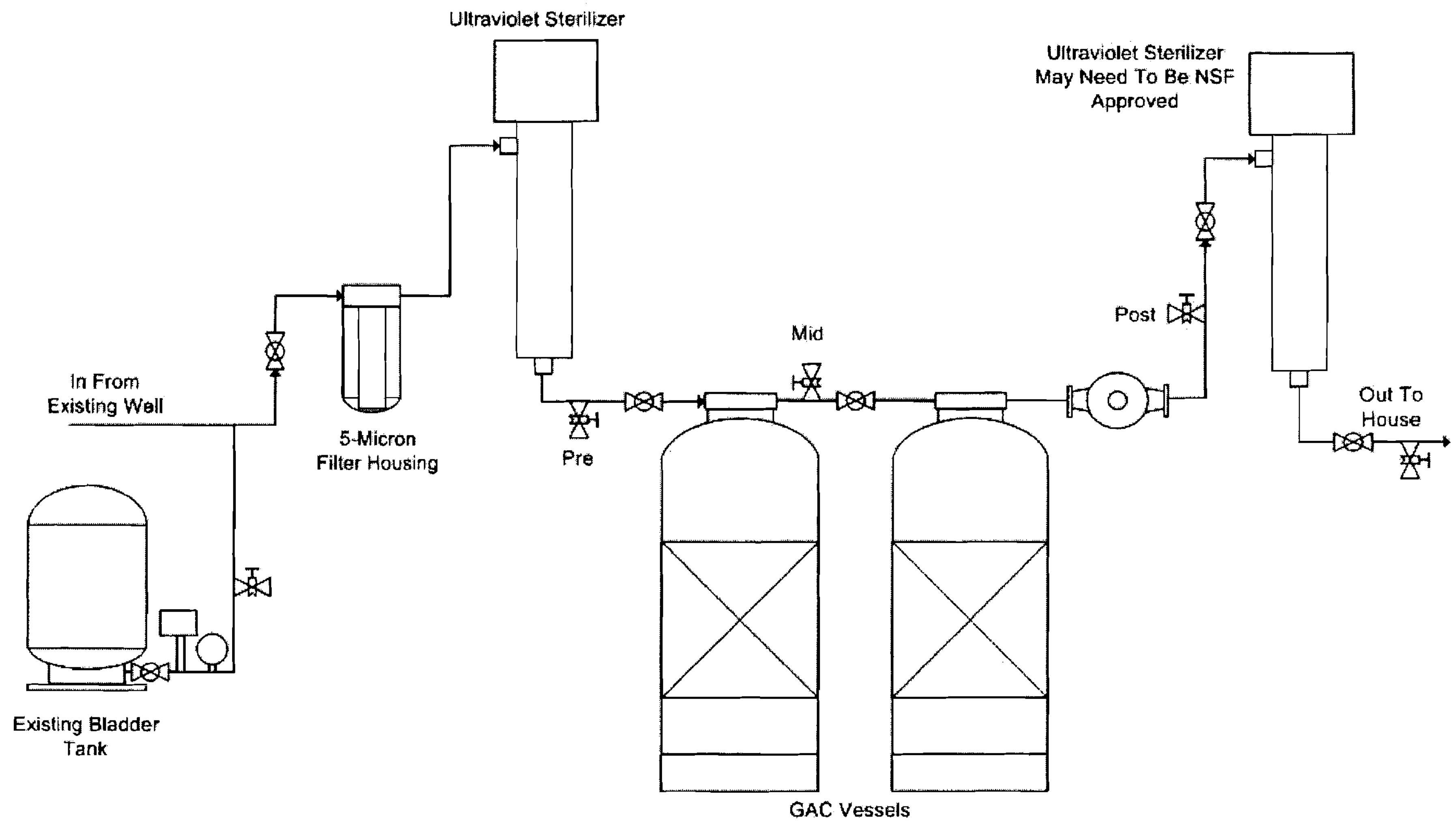
All material is guaranteed to be as specified. All work to be completed in a workmanlike manner according to standard practices. Any alteration or deviation from stated specifications, involving extra costs, will be executed only upon written orders, and will become an extra charge over and above the original quotation. All agreements are contingent upon strikes, accidents or delays beyond our control. Owner is to carry fire, tornado, and other necessary insurance. Our workers are fully covered by Workmen's Compensation Insurance.

SIGNATURE: ____
(for seller) (title)

ACCEPTANCE OF PROPOSAL – The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified.

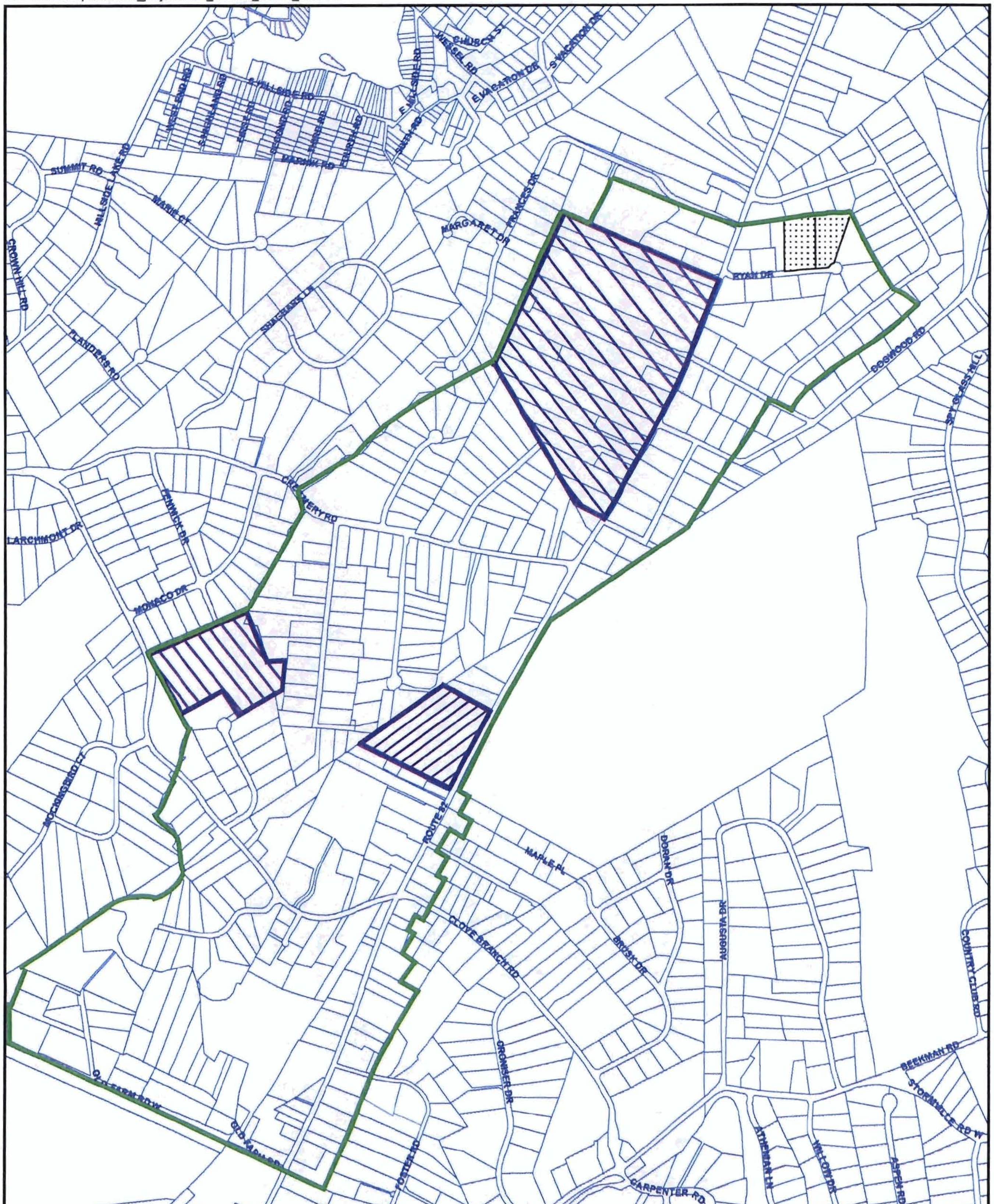
SIGNATURE: ____
(for purchaser) (title)

DATE: ______________________ **PURCHASE ORDER #** ____________________



www.wefixwater.com	CDM Inc.			
	TCE Reduction Whole House Treatment System			
SWT-RSE	SIZE A	FSCM NO	DWG NO 07-2911	REV
November 29, 2007	SCALE NTS		SHEET 1 OF 1	

C:\IMS\GIS\Hopewell\GIS_projects\Res_subslab_results_R2.mxd



Hopewell Precision Facility
Parcel Boundary
Study Area
Proposed Additional Parcels
Parcels Assumed to be Divided

N

0 500 1,000 2,000 Feet

Appendix C
Locations of Assumed Additional Residences
Hopewell Precision Site
Hopewell Junction, New York

CDM

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

Trichloroethene (TCE) concentrations in the range of 5 µg/L are in groundwater just to the north of Clove Branch Road (Figure 1). The time required for groundwater with a concentration of 5 µg/L of TCE to move to the vicinity of West Old Farm Road was estimated as follows.

Distribution Coefficient

$$K_d = K_{oc} * f_{oc}$$

Where:

K_d = distribution coefficient (mL_{water}/g_{soil})
K_{oc} = partition coefficient, ($mL_{water}/g_{organic\ carbon\ (oc)}$)
f_{oc} = fraction of organic carbon (g_{oc}/g_{soil})

Retardation Factor for TCE

$$R = 1 + \frac{\rho K_d}{\phi}$$

Where:

R = retardation factor (dimensionless)
ρ = bulk density of aquifer material in g/cm^3
K_d = distribution coefficient (mL_{water}/g_{soil})
ϕ = aquifer porosity

Values:

Parameter	Value	Source
K_{oc} for TCE	94.3mL/g	EPA (2005)
f_{oc}	9.79×10^{-4} g_{oc}/g_{soil}	Geometric mean of soil sample TOC analyses[1]
ρ	1.8 g/cm^3	Estimate based on site lithologic logs
ϕ	0.25	Estimate based on site lithologic logs

[1] During the RI field investigation 79 soil samples were collected primarily from the vadose zone at the Hopewell Precision and analyzed for total organic carbon. Forty three of these samples were collected from depths greater than or equal to eight feet. Because these samples are below the soil horizon they were used to estimate f_{oc} for the aquifer materials. The geometric mean of TOC in these 43 samples was 979 mg/kg. This value was converted to f_{oc} by dividing it by 10^{-6} to convert units from mg/kg to g/g.

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

Results:

$$K_d = (94.3\, mg/L)(9.79 \times 10^{-4}\, g_{oc}/g_{soil})$$
$$K_d = 0.092\, mL/g$$

$$R = 1 + \frac{(1.8\, g/cm^3)(0.092\, mL/g)}{0.25}$$
$$R = 1.7$$

Travel Time Estimate

Contaminant (TCE) Velocity

$$V_c = \frac{Ki}{n_e} \Big/ R$$

Where:

V_c = contaminated groundwater flow velocity (feet/day)
K = hydraulic conductivity (feet/day)
i = hydraulic gradient (dh/dl)
n_e = effective porosity (dimensionless) = 0.25
R = retardation factor (dimensionless) = 1.7

Hydraulic Gradient

Water level elevation data, 13 July 2007

EPA-21S	249.75 feet
PZ-02	243.92 feet
Change in head (*dh*)	5.83 feet

Distance (*dl*) from EPA-21S to PZ-02: 2,300 feet

Gradient: $dh/dl = \frac{5.83\, feet}{2{,}300\, feet} = 0.00253$

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

Hydraulic Conductivity

Assume a value of 33.41 feet/day for the area between Creamery Road and West Old Farm Road based on the results of slug testing at EPA-23S (which is in the vicinity of West Old Farm Road). In other part of the site a different hydraulic conductivity might be appropriate. Results of slug tests conducted at the site and the lithology encountered in the screened interval of each well tested are included in Table 1. Analysis of the historical movement of groundwater contamination at the site indicates that this value is reasonable. In addition, this value is consistent with published values for the silty sand and gravel type sediments encountered in borings and wells at the site. (Freeze and Cherry 1979).

Results

Horizontal groundwater flow rate, V_x:

$$V_x = \frac{33.41\,(0.00253)}{0.25}$$
$$V_x = 0.34\,feet/day$$
$$V_x = 124\,feet/year$$

TCE flow rate, V_c, assuming a retardation factor of 1.7:

$$V = \frac{33.41(0.00253)}{0.25}\Big/1.7$$
$$V = 0.2\,feet/day$$
$$V = 73\,feet/year$$

Travel Time

The distance from Clove Branch Road to monitoring wells EPA-23S/EPA-23D near West Old Farm Road is 2,300 feet (along the groundwater flow path, based on the 13 July 2007 shallow potentiometric surface). The estimated travel time for TCE contaminated groundwater to move along this path is:

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

$$Time = \frac{2{,}300\,feet}{73\,feet\,/\,year}$$

$$Time = 32\,years$$

Note that this result is sensitive to the hydraulic conductivity. For example, if the conductivity is less than 30 feet/day than the travel time would approach 40 years. Conductivities less than 30 feet/day were observed in many slug tests (Tables 1 and 2). On the other hand, increasing the conductivity to 60 feet/day would cut the travel time to about 18 years. A value of 60 feet/day is plausible based on the nature of the unconsolidated material (silty sand and gravel) and the results of slug tests (conductivities in this range were observed in some individual tests, see Table 2). The analysis of the historical plume movement suggests that hydraulic conductivity ranges from 30 to 65 feet/day (hydraulic conductivity is implied by the current extent of the plume and the history of the site).

This analysis provides a reasonable estimate of contaminant velocity using groundwater flow velocity and retardation. Other factors (e.g., dispersion, degradation, sink location, residential well pumping, etc.) also control contaminant movement. However, these factors can be considered in a more detailed evaluation (e.g., numerical model). The current analysis provides a reasonable estimate to use as a guide for planning and evaluating additional site activities.

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

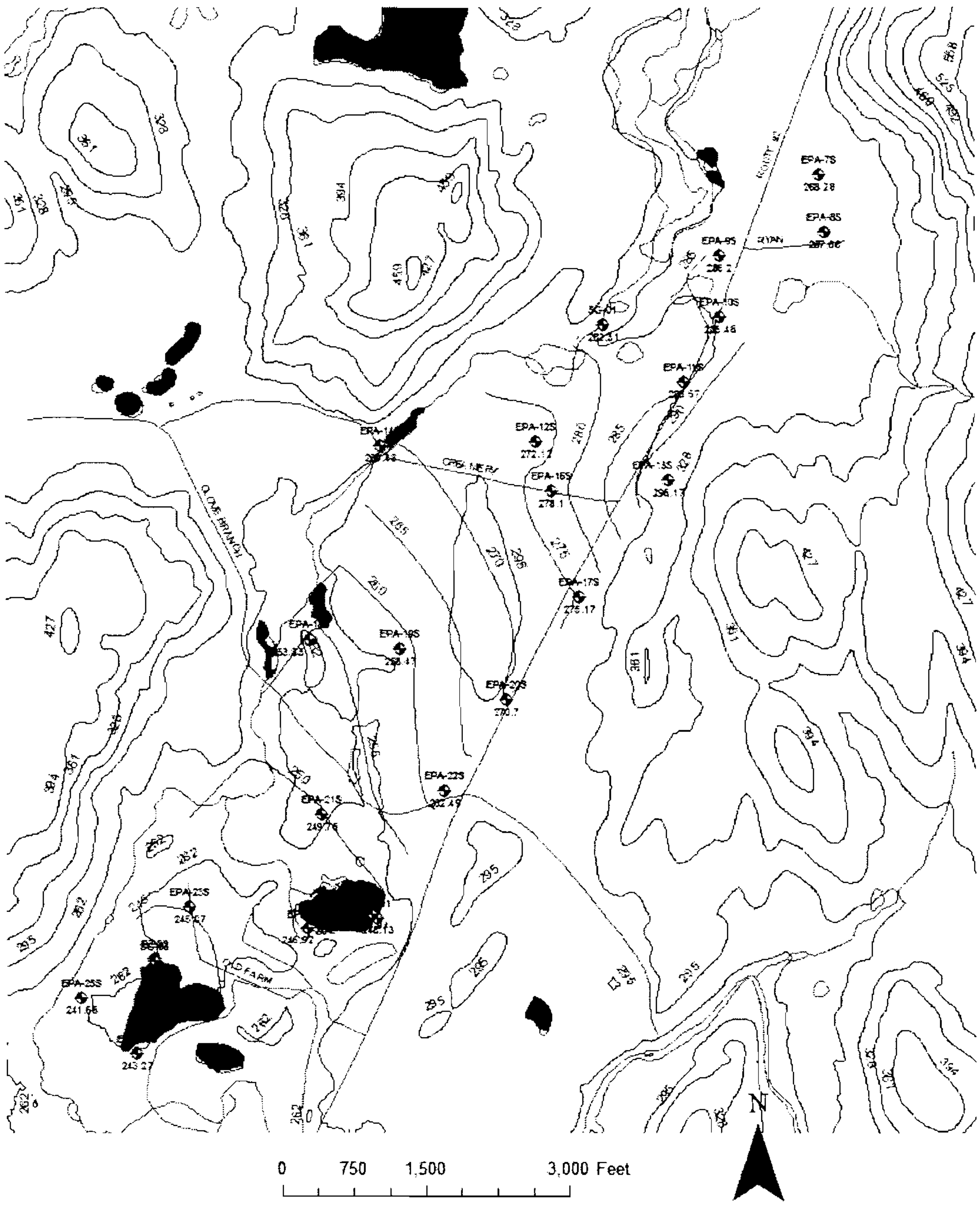


Figure 1: Shallow monitoring well potentiometric surface, 13 July 2007

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

Table 1

Well	Hydraulic Conductivity (K) (ft/day)[2]	Median K(ft/day)	Minimum K (ft/day)	Maximum K(ft/day)	Number of Slug Tests	Radius Tested (feet)	Comments	Top of Screen[3]	Bottom of Screen	Screened Interval Lithology
MW-13S	n/a[4]	n/a	0.02	0.02	1	5.26		20	30	Silt, little medium gravel
MW-13D	n/a	n/a	0.01	0.01	1	12.20		43	53	Silt, stiff, some gravel, trace shale fragments
MW-23D	0.1	0.1	0.07	0.14	2	13.29		70	80	Silt, trace thin lenses of fine sand
MW-8I	0.49	0.48	0.42	0.61	4	13.85		70	80	Black shale rock fragments, clayey silt, trace f-c gravel
MW-8S	0.62	0.85	0.25	1.5	4	4.05		20	30	Fine sand, med. Sand, f-c gravel, trace silt
MW-12D	1.6	1.6	1.5	1.7	4	10.58		35	45	Sand and fine gravel at top of interval, most of screened zone is clay and gravel, some sand, some silt
MW-15D	1.81	1.9	1.2	2.8	7	8.72		30	40	Silt, stiff, some medium to coarse gravel
MW-21D	2.18	2.4	0.98	4.2	4	6.68		33	38	Very fine to fine sand, some silt, some medium gravel
MW-11D	11.41	11	10	14	4	10.5		35	45	Silt and medium to coarse gravel, some fine gravel, trace sand
MW-18D	20.29	21	18	22	6	11.15	Early Data	45	55	At top: fine to medium sand, trace silt, trace fine gravel, trace

[2] geometric mean of all tests conducted at well
[3] Top and bottom screen depths are in feet below ground surface
[4] n/a – not applicable

DRAFT

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

Table 1

Well	Hydraulic Conductivity (K) (ft/day)[2]	Median K(ft/day)	Minimum K (ft/day)	Maximum K(ft/day)	Number of Slug Tests	Radius Tested (feet)	Comments	Top of Screen[3]	Bottom of Screen	Screened Interval Lithology
										silt, trace c. grained sand, most of interval is clayey silt, trace to little fine to coarse gravel
MW-18D	26.29	21	18	55	9	11.15	All data	45	55	At top: fine to medium sand, trace silt, trace fine gravel, trace silt, trace c. grained sand, most of interval is clayey silt, trace to little fine to coarse gravel
MW-23S	33.41	40	18	62	2	3.37		25	35	Fine to medium sand and fine to coarse gravel; well sorted fine sand, trace silt; fine to med sand and fine to c gravel; well sorted fine grained sand
MW-18D	44.11	40	39	55	3	11.15	Late Data	45	55	At top: fine to medium sand, trace silt, trace fine gravel, trace silt, trace c. grained sand, most of interval is clayey silt, trace to little fine to coarse gravel

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

Table 2

No.	Well	Test	K(feet/day)	Comments
1	MW-8S	mw-8s-fh	0.25	
2	MW-8S	mw-8s-rh	1.4	
3	MW-8S	mw-8s-fh2	0.29	
4	MW-8S	mw-8s-rh2	1.5	
5	MW-8I	mw-8i-fh	0.48	
6	MW-8I	mw-8i-rh	0.42	
7	MW-8I	mw-8i-fh2	0.48	
8	MW-8I	mw-8i-rh2	0.61	
9	MW-11D	mw-11d-fh	11	
10	MW-11D	mw-11d-rh	14	xd disturbed
11	MW-11D	mw-11d-fh2	10	
12	MW-11D	mw-11d-rh2	11	xd disturbed
13	MW-12D	mw-12d-fh	1.7	
14	MW-12D	mw-12d-rh	1.6	
15	MW-12D	mw-12d-fh2	1.6	
16	MW-12D	mw-12d-rh2	1.5	
17	MW-13S	mw-13S-rh	0.02	
18	MW-13D	mw-13d-rh	0.01	
19	MW-15D	mw-15d-fh	1.2	early data
20	MW-15D	mw-15d-fh	1.9	late data when flow into well increased
21	MW-15D	mw-15d-rh	1.6	early data
22	MW-15D	mw-15d-fh2	1.4	early data
23	MW-15D	mw-15d-fh2	2	late data when flow into well increased
24	MW-15D	nw-15d-rh2	2.8	used later data when flow rate into well was higher
25	MW-18D	mw-18d-fh	20	early data
26	MW-18D	mw-18d-fh	39	late data when flow into well increased
27	MW-18D	mw-18d-rh	21	good test, no double curves
28	MW-18D	mw-18d-fh2	18	early data
29	MW-18D	mw-18d-fh2	40	late data when flow into well increased
30	MW-18D	mw-18d-rh2	22	good test, no double curves
31	MW-18D	mw-18d-fh3	20	early data
32	MW-18D	mw-18d-fh3	55	late data
33	MW-18D	mw-18d-rh3	21	good test, no double curves
34	MW-21D	mw-21d-fh	1.9	early data
35	MW-21D	mw-21d-fh	4.2	late data when flow into well increased
36	MW-21D	mw-21d-rh	2.9	early data, test terminated early, xd moved
37	MW-21D	mw-21d-fh2	0.98	
38	MW-23S	mw-23s-fh	62	
39	MW-23S	mw-23s-rh	18	
40	MW-23D	mw-23d-fh	0.14	
41	MW-23D	mw-23d-rh	0.07	

Estimate of TCE travel time from the vicinity of Clove Branch Road to the vicinity of West Old Farm Road

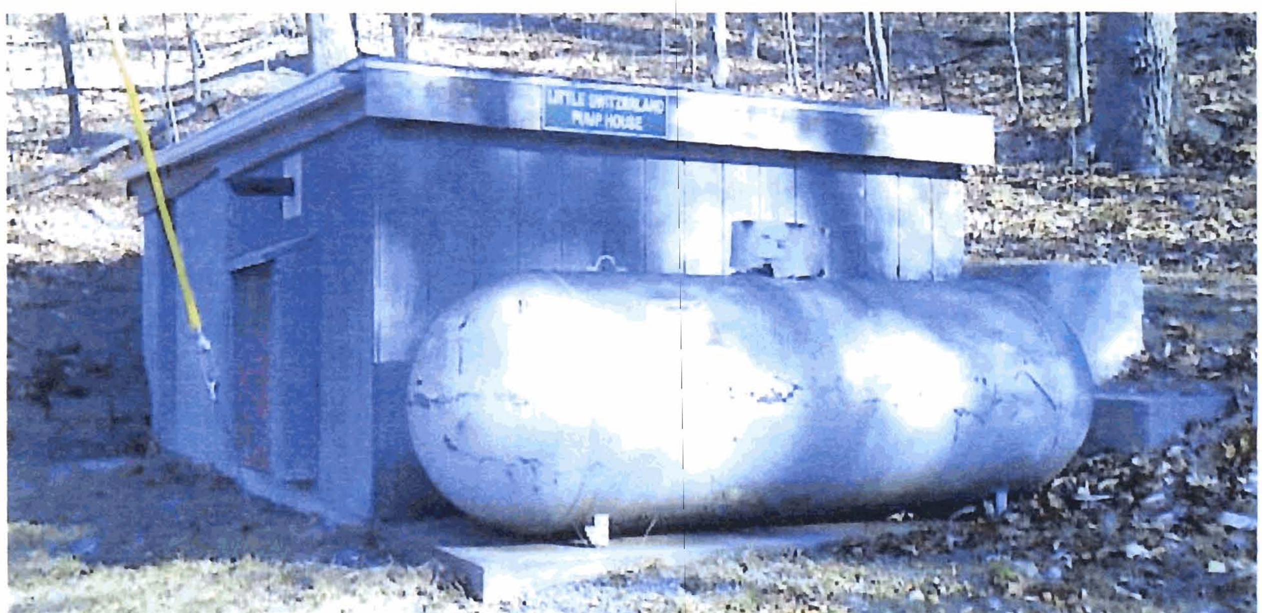
References

Freeze, Allan R. and John A. Cherry 1979. *Groundwater*. Englewood Cliffs, New Jersey: Prentice Hall, Inc. p. 29.

EPA 2005. Human Heath Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Support Materials. Chemical-Specific Data. EPA 530-R-05-006. September. HHRAP Companion Database. (http://www.epa.gov/epaoswer/hazwaste/combust/riskvol.htm#volume2)

The former and current Little Switzerland Storage Tanks.

One of the two Little Switzerland supply wells.



The Little Switzerland Pump House.