360023 F 3-05

DRAFT FINAL
REMEDIAL INVESTIGATION

BALDWIN PLACE MALL
SOMERS, NEW YORK

Volume 1
Text and Tables

RECEIVED
JUN 26 2001
NYS - DEC
REGION 3 - NEW PALTZ

Prepared for
Big V Supermarkets, Inc.
Florida, New York

AUGUST 1994

VINCENT UHL ASSOCIATES, INC.
1078 Taylorsville Road
Washington Crossing, Pennsylvania 18977

EXECUTIVE SUMMARY

The Remedial Investigation (RI) at the Baldwin Place Mall (BPM) in Somers, New York was conducted in partial fulfillment of the requirements of the Order on Consent concerning the development and implementation of an RI/FS under Article 27, Title 13 of the New York Environmental Conservation Law entered into by Big V Supermarkets, Inc. and the New York State Department of Environmental Conservation on August 4, 1992. Vincent Uhl Associates, Inc. was retained by Big V Supermarkets, Inc. to lead the investigative effort with the assistance of expert firms in particular aspects. Environmental Standards, Inc., Valley Forge, Pennsylvania performed the data quality assurance review (validation) and Baseline Risk Assessment. The Fish and Wildlife Impact Analysis was conducted by J. Fain & Associates, Westport, Connecticut.

The BPM is an approximately 28-acre site with retail space in three mall buildings that were constructed in 1965. Most of the remaining area is paved for parking. A dry cleaner has always been present in the mall, and until at least May 1991, dry cleaning processing was performed onsite.

The RI field programs were performed during the period from July 1992 through December 1993. Nineteen RI monitoring wells were installed and sampled, and a 2-day constant-rate pumping test was conducted utilizing a BPM production well (PW-1). Other elements of the RI included a soil gas survey, a test boring/soil sampling program, sampling of nearby offsite residential and commercial wells, and surface-water and sediment sampling in nearby streams and drainageways. Further, in November and December 1993, an Additional Data Collection Program was conducted, comprised of a second test boring/soil sampling program in the confirmed onsite tetrachloroethylene (PCE) source area at the dry cleaners and the installation and sampling of two source area monitoring wells.

A residual PCE source area is present in the alleyway near the backdoor of the dry cleaners. Residual PCE concentrations are present in both the unsaturated and saturated soil in this area. Elevated PCE concentration in the unsaturated zone (soil above the water table) appears to be limited to an approximate 15 by 15 foot area directly behind the dry cleaners. The top of the zone of saturation in this area is about 3 feet below ground surface (bgs). As such, the volume of unsaturated material in the source area is small (approximately 25 cubic yards). Elevated PCE concentration extends below the water table to a maximum depth of 15 feet at the most highly impacted location (approximately 5 feet from the backdoor of the dry cleaners). The area of elevated PCE concentration in the saturated zone extends approximately 5 to 10 feet further east than the source area above the water table. The shallow groundwater within the source area exhibits 24,000 ug/L PCE concentration. The PCE concentrations that are in the onsite and nearby offsite groundwater, and which have been observed in the BPM production wells since 1979, have emanated from this residual source area.

The site and vicinity are underlain by glacial till, weathered bedrock and bedrock. The glacial till comprises the uppermost geologic and water-bearing unit. The till is very thin near the western and northwestern site boundaries and thickens to the south/southeast. The weathered bedrock is approximately 15 to 30 feet thick and there is a gradation from highly weathered (decomposed) bedrock to competent bedrock. The depth to competent bedrock (biotite gneiss) ranges from 35 feet bgs in the western part of the site to about 100 feet bgs in the east/southeast.

The saturated glacial till materials range in thickness from less than 1 foot in the northwest to as much as 76 feet in the southeast. Therefore, the weathered bedrock/bedrock system is unconfined over the extreme western and northwestern portion of the site, and over the main body of the site is overlain/confined by the glacial till water bearing unit. The weathered bedrock/bedrock aquifer underlying the site behaves as a leaky artesian system whereby the overlying glacial till materials serve as a leaky confining unit (source bed). Leakage through the glacial till is the principal source of recharge to the weathered bedrock/bedrock system. A vertical (downward) component to groundwater flow is present over the portion of the site wherein saturated glacial till materials overlie the bedrock. Flow in the weathered bedrock/bedrock unit on the western part of the site (unencumbered by a saturated lower permeability glacial till) has less of a downward flow component.

The transmissivity of the weathered bedrock/bedrock aquifer is in the range from 750 to 1,500 gpd/ft which is characteristic of a moderately permeable bedrock system. Storativity is in the range from 1.7 x 10-4 to 2.5 x 10-3 reflective of leaky artesian conditions. The vertical permeability of the glacial till confining unit is in the range from 0.043 to 0.050 gpd/ft2.

The RI included a characterization of groundwater flow for the following conditions: (1) normal operation of the BPM production wells at approximately 3.8 gpm; (2) following shutdown of the BPM production wells for approximately 2 weeks; and (3) after BPM Production Well PW-1 had been operative for 42 hours at a sustained pumping rate of 39 gpm.

An onsite shallow groundwater divide is oriented in a southwest to northeast direction in the vicinity of the main mall building (and dry cleaners). This divide is evident under normal BPM pumping conditions (average 3.8 gpm), and also when the mall wells have been shutdown for an extended period. Groundwater flow from the divide is to the southeast and west/northwest. The water-level drawdown response during the 2-day pumping test indicates that sustained pumping of PW-1 (beyond the 2-day pumping test) may begin to capture shallow groundwater in the weathered bedrock over the western portion of the site.

The regional water-level contour map for the bedrock system confirms the presence of a deeper groundwater divide onsite under non-pumping conditions with flow components to the southeast and west/northwest. Under present BPM pumping conditions, the mall wells are capturing deeper groundwater over a portion of the site with a component of groundwater flow offsite to the southeast. Under sustained pumping conditions (2 days at 39 gpm), BPM Production Well PW-1 effectively captures deeper groundwater over the site.

The dry-cleaner related compounds (PCE and its breakdown products trichloroethylene (TCE) and 1,2-dichloroethylene (1,2-DCE)) are the constituents of concern in groundwater at the BPM site, and their concentration distribution is consistent with a sole contaminant source at the dry cleaners. As a result of the groundwater divide, these compounds are emanating in both the southeasterly and westerly directions from the dry cleaners proximity. Comparable PCE concentrations are present in onsite monitoring wells located to both the southeast and west of the shallow groundwater divide near the dry cleaners. The highest PCE concentration detected in the RI monitoring wells (outside of the source area) was 910 ug/L. TCE was detected up to 190 ug/L and 1,2-DCE was detected up to 61 ug/L.

Over the southeast portion of the site, where the glacial till materials are thick and there is a significant vertical component to groundwater flow, the lateral extent of contaminant migration in the shallow glacial till materials appears to be somewhat limited. The contaminants are migrating into weathered bedrock within a very short distance from the source area. As such the principal migration pathway to the south/southeast is in the deeper weathered bedrock/bedrock system. On the western portion of the site, where the glacial till materials are thinner, the shallow groundwater system is comprised of weathered bedrock. There is less of a downward component to groundwater flow, and contaminant migration occurs in the shallow as well as the deeper system.

Two offsite areas have been impacted by the BPM site-related constituents: part of the commercial area along Route 6 to the west and part of the Meadow Park Road community to the southeast. The impacted Meadow Park Road area extends approximately 1,200 feet, begins southeast of the dry cleaners and does not reach south beyond Meadow Park Road where it rejoins Tomahawk Street. PCE concentrations in the eleven wells within the impacted area range from 1.3 to 300 ug/L, TCE from non-detectable to 10 ug/L, and 1,2-DCE from non-detectable to 0.5 ug/L (as of May 1994). In nine of these wells, PCE concentration consistently or intermittently exceeds the 5 ug/L NYSDEC/NYSDOH Maximum Contaminant Level (MCL) and Big V Supermarkets, Inc. maintains GAC filter systems on each of these wells. The concentration distribution indicates that PCE levels decline within a short distance in the southeast (downgradient) direction within the Meadow Park Road area. The general trend of the five year database from late 1988 through 1993 was one of very gradually increasing concentrations in the Meadow Park Road area. In the first two quarters of 1994, a more marked increase has been observed in the four most northerly impacted wells within this area.

The Route 6 area impacted by the site-related constituents also extends approximately 1,200 feet, begins west of where the western stream crosses under Route

6, and does not extend to where the ground surface begins to rise markedly towards Mahopac Avenue to the west. In the four commercial wells within the impacted area, PCE concentrations up to 80 ug/L have been detected, TCE up to 4.0 ug/L, and 1,2-DCE up to 1.4 ug/L (as of May 1994). Two of these wells are equipped with GAC filter systems maintained by the owners. Big V Supermarkets, Inc. maintains filter systems on the other two wells.

The impact by service stations (Exxon (formerly Mobil), Texaco and Citgo) in the vicinity of the Baldwin Place Mall intersection extends into the areas both immediately south and north of the western stream. The four Route 6 commercial wells south of the western stream equipped with filter systems due to PCE concentration, and the McDonalds well, also contain MTBE. The leakage from the service stations has also resulted in a dispersion of low levels of MTBE (from 1 to 15 ug/L) over wide areas of the BPM property.

Drainage from the BPM is to the northwest and southeast. The western/northwestern portion of the site drains to an unnamed south-to-north flowing stream (western stream) that heads to the south of the mall, is diverted under the mall and parking lot, and empties into a relatively steep ravine and valley just north of Route 6. The western stream flows through two ponds and Lake Baldwin prior to its confluence with the Muscoot River approximately 3,500 feet from the site. Drainage over the eastern portion of the site is to an unnamed north-to-south flowing stream (eastern stream) that heads just north of the site, is parallel to the eastern site boundary, and lies between the site and the Meadow Park Road residential community. The eastern stream is also tributary to the Muscoot River, and its confluence with the river lies approximately 1 mile south of the site.

The RI results indicate that limited areas within the western stream and in a tributary drainageway to the western stream (which runs west of the site along the south side of Route 6) are the only surface water areas that have been impacted to a slight degree by site-related constituents. Low PCE concentrations are present in surface water (up to 2 ug/L) and sediment (up to 4 mg/Kg) in these areas near the site but not at sampled downstream locations..

The Baseline Risk Assessment provides an analysis of potential risks to human health and the environment associated with exposures to site-related constituents under current and potential future conditions. The current-use scenario considers potential risks posed to nearby residents. The potential future-use scenarios consider the risks posed to site construction workers, office workers (in a future building constructed over the source area), children, and nearby residents.

Under future conditions, construction workers are estimated to incur an upper bound cancer risk of 1 x 10-5 and a hazard index of 6.0, and office workers in a future building constructed over the area of soil contamination (source area) are estimated to incur a cancer risk of 9 x 10-6 and a hazard index of 2.0. These potential cancer risks and adverse health hazards are all attributable to PCE contamination in the unsaturated soil near the dry cleaners.

At this time all residential and commercial water supplies analyzed during the RI are currently meeting MCLs and are, therefore, adequately protected. This assumes that regular maintenance on the existing GAC filter systems will continue; that the GAC systems will not be dismantled until groundwater has been remediated or an alternate water supply provided; and that if any further residential wells exhibit PCE attributable to the site above the MCL, a GAC filter will be installed or alternate water supply provided. The combined total hazard index for this group of exposed individuals (current residents) is estimated to be 0.08, which is well below unity and indicates no possible health hazards other than the very minimal added risk of cancer (which may be zero). The combined excess cancer risk of 4 x 10-6 was calculated assuming concentrations of both PCE and TCE at the MCL. Assuming the concentrations of PCE and TCE are 5 ug/L is a conservative assumption because for the wells with existing GAC filtration, PCE and TCE are not detected in the treated water, and none of the wells without filter systems exceed the MCL. The upper 95th confidence limit (UCL) is, therefore, more likely to be much lower than 5 ug/L.

Under the assumption that the concentrations of constituents detected in the residential, commercial and onsite deep monitoring wells would be of future domestic use without any treatment, a carcinogenic risk of 5 x 10-5 is estimated, and a combined hazard index for the future residents is estimated to be 1.0.

Children are estimated to incur a combined cancer risk of 5 x 10-7, which is below the de minimis benchmark of 1 x 10-6, and the total combined hazard index is estimated to be 0.2, indicating that no adverse health effects can be anticipated even under reasonable maximum conditions of exposure. This population incorporated soil, sediment and surface water media.

The results of the ecological assessment of surface water in the site vicinity indicate that no chemical analyzed in surface water poses a risk to the freshwater aquatic life or its uses. Results of the ecological analysis of sediment, additionally demonstrated no environmental risk.

The most significant fish and wildlife resource, both within the one-half mile radius and within two miles downstream of the site, is the Muscoot River including the Amawalk Reservoir, and its associated wetlands, open water, and riparian areas. Correspondence with the New York Natural Heritage Program did not identify any resident endangered, threatened, or species of special concern, or significant habitats within the boundaries of the study area. Two wetland communities were found on the BPM; field investigation of these areas did not disclose the presence of any Federal or State listed rare or endangered plant species on the site. The pathway analysis indicated no impact to fish and wildlife resources.

TABLE OF CONTENTS

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1-1

2.0 BACKGROUND 2-1

2.1 SITE DESCRIPTION 2-1
2.2 SITE HISTORY AND PREVIOUS INVESTIGATIONS 2-3

3.0 FIELD INVESTIGATIONS 3-1

3.1 OVERVIEW 3-1

3.1.1 Objectives 3-1
3.1.2 Scope and Chronology 3-2
3.1.3 Drilling Programs 3-4
3.1.4 Surveying 3-5
3.1.5 Sampling and Analysis 3-5
3.1.6 Data Validation and Management 3-6
3.1.7 NYSDEC/NYSDOH Oversight 3-6

3.2 SITE RECONNAISSANCE 3-7

3.2.1 Environmental Setting 3-7
3.2.2 Records Search and Compilation of Previous Data 3-8
3.2.3 Topography, Geology, and Surface Features 3-8
3.2.4 Review of Aerial Photographs and Fracture Trace Survey 3-8

3.3 SOIL GAS SURVEY 3-9

3.4 TEST BORINGS AND SOIL SAMPLING 3-11

3.5 INSTALLATION OF MONITORING WELLS 3-12

3.5.1 Placement of Monitoring Wells 3-13
3.5.2 Drilling and Installation Methodology 3-14

3.5.2.1 Deeper Monitoring Wells 3-14
3.5.2.2 Shallow Monitoring Wells 3-16

3.6 LOCAL/REGIONAL FLOW EVALUATION 3-17

3.7 MONITORING WELL SAMPLING.......... 3-18

3.8 RESIDENTIAL/COMMERCIAL WELL SAMPLING.......... 3-19

3.8.1 Baldwin Place Mall Production Wells.......... 3-19
3.8.2 Meadow Park Road Residential Wells.......... 3-20
3.8.3 Route 6 Commercial Wells.......... 3-21

3.9 SURFACE-WATER AND SEDIMENT SAMPLING.......... 3-22

3.10 HYDROGEOLOGIC TESTS.......... 3-25

3.10.1 Short-Term Pumping Tests.......... 3-25
3.10.2 Step-Drawdown Pumping Test.......... 3-26
3.10.3 Pre-Pumping Background Monitoring.......... 3-26
3.10.4 Constant-Rate Aquifer Pumping Test.......... 3-27
3.10.5 Water-Level Monitoring Equipment and Procedures.......... 3-28

4.0 PHYSICAL CHARACTERISTICS.......... 4-1

4.1 SITE SETTING.......... 4-1

4.1.1 General.......... 4-1
4.1.2 Groundwater Usage.......... 4-2

4.2 GEOLOGY.......... 4-3

4.2.1 Regional Bedrock Stratigraphy and Structure.......... 4-4
4.2.2 Unconsolidated Glacial Deposits.......... 4-5
4.2.3 Onsite Geology.......... 4-5

4.3 HYDROGEOLOGY.......... 4-7

4.3.1 Nature and Occurrence of Groundwater.......... 4-7
4.3.2 Groundwater Flow Conditions.......... 4-8

4.3.2.1 Onsite Shallow Groundwater Flow Conditions.......... 4-9
4.3.2.2 Onsite Deeper Groundwater Flow Conditions.......... 4-10
4.3.2.3 Onsite Vertical Groundwater Flow Conditions.......... 4-12
4.3.2.4 Regional Groundwater Flow Conditions.......... 4-16

4.3.3 Surface Water.......... 4-16
4.3.4 Summary.......... 4-17

4.4 ANALYSIS OF HYDROGEOLOGIC TESTS 4-19

4.4.1 Short-Term Pumping Tests 4-19
4.4.2 Background Water-Level Data 4-21
4.4.3 Step-Drawdown Pumping Test 4-23
4.4.4 Constant-Rate Aquifer Pumping Test 4-24
4.4.5 Summary 4-30

5.0 SOURCE AREA CHARACTERISTICS 5-1

5.1 Remedial Investigation 5-1

5.1.1 Unsaturated Zone 5-1
5.1.2 Saturated Zone 5-3

5.2 Additional Data Collection Program 5-4

5.2.1 Source Area Test Borings and Monitoring Wells 5-5
5.2.2 Perimeter Test Borings 5-6
5.2.3 Test Borings Beneath the Mall Building 5-7
5.2.4 Source Area Hydraulic Characteristics 5-7

5.3 Summary of PCE Source Area Delineation 5-8

6.0 CHEMICAL CHARACTERISTICS OF GROUNDWATER 6-1

6.1 Analytical Results for BPM Site-Related Constituents 6-2

6.1.1 Overview of Monitoring 6-2
6.1.2 Onsite Monitoring Wells 6-3

6.1.2.1 Volatile Organic Compounds 6-3
6.1.2.2 Semi-Volatile Organic Compounds 6-5
6.1.2.3 Pesticides/PCBs 6-6
6.1.2.4 Metals and Inorganics 6-7
6.1.2.5 Summary 6-7

6.1.3 BPM Production Wells 6-8
6.1.4 Meadow Park Road Residential Wells and Northeast Area 6-9
6.1.5 Route 118 and Upgradient Northern Area 6-14
6.1.6 Route 6 Commercial Wells and Western Area 6-14
6.1.7 Kennard Road Residential Wells 6-17
6.1.8 Lake Baldwin Community System 6-18

6.2 Analytical Results for Gasoline Constituents ... 6-19

6.2.1 Overview of Monitoring ... 6-19
6.2.2 Route 6 and Kennard Road ... 6-20
6.2.3 Route 118 and Northern Upgradient Area ... 6-22
6.2.4 Onsite Monitoring Wells and Production Wells ... 6-22

6.3 Recap of Groundwater Impact and Interim Remedial Measures ... 6-23

7.0 CHEMICAL CHARACTERISTICS OF SURFACE WATER AND SEDIMENT ... 7-1

7.1 Eastern Stream ... 7-1
7.2 Western Stream ... 7-2

8.0 CONTAMINANT TRANSPORT MECHANISMS ... 8-1

9.0 FISH AND WILDLIFE IMPACT ANALYSIS ... 9-1

10.0 BASELINE RISK ASSESSMENT ... 10-1

11.0 SUMMARY AND CONCLUSIONS ... 11-1

12.0 REFERENCES ... 12-1

LIST OF TABLES

3-1. Horizontal and Vertical Survey Data.

3-2. Remedial Investigation Sampling and Analytical Testing Summary.

3-3. Analytical Results for Soil Gas Samples in PPMV.

3-4. RI Test Boring Soil Sample PID Screening Results.

3-5. Construction Details of RI Monitoring Wells.

3-6. Depth and Yield from Fractured Intervals Encountered During Drilling.

3-7. Groundwater-Level Measurements and Stream Staff Gauge Readings (June 8, 1993; June 28; 1993 and June 30, 1993).

3-8. Regional Groundwater-Level Measurements and Stream Staff Gauge Readings (August 18, 1993).

3-9. Available Construction Details for Nearby Residential/Commercial Wells.

3-10 . Remedial Investigation Sampling Field Parameters Results Summary.

3-11 . Background Monitoring Schedule for Individual Observation Wells.

4-1. Specific Capacity and Estimated Aquifer Transmissivity Derived From Monitoring Well Short-Term Pumping Tests.

4-2. Baldwin Place Mall Production Wells Record of Pumping.

4-3. Results of Step-Drawdown Test at Production Well PW-1.

4-4. Aquifer Coefficients Derived from the Leaky Artesian Method Analysis.

4-5. Aquifer Coefficients Derived from the Theis Non-Equilibrium Method Analysis.

4-6. Aquifer Coefficients Derived from the Cooper-Jacob Modified Non-Equilibrium Method Analysis.

4-7. Summary of Aquifer Coefficients; PW-1 Aquifer Pumping Test.

5-1. Summary of RI Analytical Results for Volatile Organic Compounds in Soil Borings (Unsaturated Zone).

5-2. Summary of RI Analytical Results for Volatile Organic Compounds in Soil Borings (Saturated Zone).

5-3. Summary of RI Analytical Results for Base/Neutral and Acid Extractable Organic Compounds in Soil Borings (Unsaturated Zone).

5-4. Summary of RI Analytical Results for Pesticides and PCBs in Soil Borings (Unsaturated Zone).

5-5. Summary of RI Analytical Results for Target Analyte List Metals and Inorganics in Soil Borings (Unsaturated Zone).

5-6. Source Area Additional Data Collection Program: Analytical Results for PCE, TCE and 1,2-DCE in Test Borings.

5-7. Source Area Additional Data Collection Program: Analytical Results for PCE, TCE and 1,2-DCE in Source Area Monitoring Wells.

5-8. Source Area Additional Data Collection Program: Test Boring Sample PID Screening Results.

6-1. Summary of RI Analytical Results for Volatile Organic Compounds in Monitoring Wells (First Round).

6-2. Summary of RI Analytical Results for Volatile Organic Compounds in Monitoring Wells (Second Round).

6-3. Summary of RI Analytical Results for Base/Neutral and Acid Extractable Organic Compounds in Monitoring Wells.

6-4. Summary of RI Analytical Results for Pesticides and PCBs in Monitoring Wells.

6-5. Summary of RI Analytical Results for Target Analyte List Metals and Inorganics (Total) in Monitoring Wells.

6-6. Summary of RI Analytical Results for Target Analyte List Metals and Inorganics (Dissolved) in Monitoring Wells.

6-7. Summary of RI Analytical Results for Groundwater Chemistry Parameters in Monitoring Wells.

6-8. Summary of RI Analytical Results for Volatile Organic Compounds in Meadow Park Road Residential Wells and BPM Production Wells.

6-9. Summary of RI Analytical Results for Volatile Organic Compounds in Route 6 Commercial Wells.

6-10. Compilation of Historical Analyses for Baldwin Place Mall Production Wells.

6-11. Compilation of Historical Analyses for Residential Wells On Meadow Park Road.

6-12. Compilation of Historical Analyses for Commercial Wells on Route 6 Between BPM and Mahopac Avenue.

6-13. Compilation of Historical Analyses for Other Nearby Residential, Commercial, and Lake Baldwin Community Supply Wells.

6-14. List of Offsite Residential, Commercial and Community Wells.

6-15. Summary of the Monitoring Results for Meadow Park Road Residences and Route 6 Commercial Establishments With GAC Filter Systems Maintained by Big V Supermarkets.

7-1. Summary of RI Analytical Results for Volatile Organic Compounds in Surface Water and Sediment (First Event).

7-2. Summary of RI Analytical Results for Volatile Organic Compounds in Surface Water and Sediment (Supplemental Event).

7-3. Summary of RI Analytical Results for Base/Neutral and Acid Extractable Organic Compounds in Surface Water and Sediment.

7-4. Summary of RI Analytical Results for Pesticides and PCBs in Surface Water and Sediment.

7-5. Summary of RI Analytical Results for Target Analyte List Metals and Inorganics (Total) in Surface Water and Sediment.

10-1 Summary of Hazard and Risk Calculations.

√ = have figure in micro rolled set of dwgs

LIST OF FIGURES

1-1. Location of the Baldwin Place Mall.

2-1. Baldwin Place Mall and Vicinity.

3-1. Chronology of Remedial Investigation Field Program.

✓ 3-2. Soil Gas Survey Sampling Locations and PCE Concentrations in PPMV.

3-3. Locations of RI Test Borings Behind Dry Cleaners and East of Building.

3-4. Locations of RI Test Borings In Front of Dry Cleaners West of Building and at Background Location.

3-5. Locations of Monitoring Wells, Staff Gauges and Fracture Traces.

3-6. Locations of Residential/Commercial Wells Sampled During the Remedial Investigation.

✓ 3-7. Surface-Water and Sediment Sampling Locations and PCE Concentrations.

✓ 4-1. Surface Water Features in the BPM Area.

4-1A. BPM Site Drainage Features.

✓ 4-2. Lines of Geologic Section.

✓ 4-3. Geologic Cross Section A - A'.

✓ 4-4. Geologic Cross Section B - B'.

✓ 4-5. Geologic Cross Section C - C'.

✓ 4-6. Top of Bedrock Contour Map.

✓ 4-7. Shallow Water-Level Contour Map; BPM Wells Under Normal Operational Conditions (June 8, 1993).

4-8. Shallow Water-Level Contour Map After Shutdown of BPM Production Wells for 13 Days (June 28, 1993).

4-9. Shallow Water-Levels: PW-1 Pumping at 39 GPM for 42 Hours (June 30, 1993).

4-10. Water-Level Changes in Shallow and Deep Monitoring Wells After 42 Hours of Pumping PW-1 at 39 GPM.

4-11. Deeper Water-Level Contour Map; BPM Wells Under Normal Operational Conditions (June 8, 1993).

4-12. Deeper Water-Level Contour Map After Shutdown of BPM Production Wells for 13 Days (June 28, 1993); Strict Interpretation.

4-13. Deeper Water-Level Contour Map After Shutdown of BPM Production Wells for 13 Days (June 28, 1993).

4-14. Deeper Water-Level Contour Map: PW-1 Pumping at 39 GPM for 42 Hours (June 30, 1993).

4-15. Theoretical Capture Zones for Bedrock Aquifer: PW-1 Pumping at 39 GPM.

4-16. Regional Water-Level Contour Map for Bedrock Aquifer (August 18, 1993).

4-17. Vertical Flow Net: Source Area to MW-9S/9D.

5-1. Soil Concentrations in PCE Source Area Behind Dry Cleaners (RI Program).

5-2. Soil Concentrations in PCE Source Area Behind Dry Cleaners (RI and Additional Data Collection Program).

5-3. Profile of PCE Source Area Behind Dry Cleaners.

6-1. Distribution of Site-Related Constituents in Groundwater: PCE, TCE and 1,2-DCE.

6-2. Distribution of Gasoline Constituents in Groundwater: BTEX and MTBE.

6-3. Residential and Commercial Wells Equipped With Point-Of-Use Treatment Systems.

APPENDICES

A. SURVEY BENCHMARKS INFORMATION.

B. VALIDATED RI DATA SPREADSHEETS (ENVIRONMENTAL STANDARDS, INC.) AND DATA USABILITY REPORTS.

C. FIELD RECONNAISSANCE: NOTES ON TOPOGRAPHY, GEOLOGY AND SURFACE DRAINAGE FEATURES.

D. SHALLOW SOIL GAS INVESTIGATION REPORT (TRACER RESEARCH CORPORATION).

E. GEOLOGIC LOGS OF TEST BORINGS.

F. SATURATED SOIL SAMPLES DATA REPORT (ENVIROTEST LABORATORIES).

G. MONITORING WELL CONSTRUCTION DIAGRAMS.

H. GEOLOGIC LOGS OF MONITORING WELLS.

I. BEDROCK CORE LOG.

J. GROUNDWATER CHEMISTRY PARAMETERS DATA REPORT (ENVIROTEST LABORATORIES).

K. SHORT-TERM PUMPING TEST DATA AND PLOTS FOR MONITORING WELLS.

L. AQUIFER PUMPING TEST DATA AND PLOTS.

M. FISH AND WILDLIFE IMPACT ANALYSIS (J. FAIN & ASSOCIATES).

N. BASELINE RISK ASSESSMENT (ENVIRONMENTAL STANDARDS, INC.).

O. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: GEOLOGIC LOGS OF TEST BORINGS AND MONITORING WELL CONSTRUCTION DIAGRAMS.

P. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: SOIL AND GROUNDWATER SAMPLES DATA REPORTS (ENVIROTEST LABORATORIES).

Q. PCE CONCENTRATION VERSUS TIME GRAPHS FOR MEADOW PARK ROAD AND ROUTE 6 RESIDENTIAL AND COMMERCIAL WELLS.

1.0 INTRODUCTION

As authorized by Big V Supermarkets, Inc., Vincent Uhl Associates has performed a Remedial Investigation (RI) of the Baldwin Place Mall (BPM) in Somers, New York (Figure 1-1). The RI for the BPM site was conducted in accordance with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and with the requirements of the National Contingency Plan (NCP, 40 CFR 300). Additionally the RI was conducted in partial fulfillment of the requirements of the Order On Consent concerning the development and implementation of an RI/FS under Article 27, Title 13 of the New York Environmental Conservation Law entered into by Big V Supermarkets, Inc. and the New York State Department of Environmental Conservation on August 4, 1992 (NYSDEC, 1992a).

The scope of work for the RI was specified in a Work Plan (VUA, 1992a) that was appended to the Order On Consent. As required by the Work Plan, operational plans for the performance of the RI were presented in the Sampling and Analysis Plan (VUA, 1992b), which included a Field Sampling Plan, Quality Assurance Project Plan, and Health and Safety Plan. Approval of the Sampling and Analysis Plan was received from NYSDEC on November 17, 1992 (NYSDEC, 1992b).

Vincent Uhl Associates led the investigative effort with the assistance of expert firms in particular aspects. Environmental Standards, Inc. performed the data quality assurance review (validation) and Baseline Risk Assessment. The Fish and Wildlife Impact Analysis was conducted by J. Fain & Associates.

This report presents a compilation of the RI data collection activities, an analysis of the site characteristics, conclusions relative to the risk to public health and the environment posed by the site, and a basis for the evaluation of appropriate remedies in the Feasibility Study by J. Robert Folchetti & Associates. Section 2.0 presents a review of the site history and a summary of previous investigations. The rationale for, and detailed descriptions of the data collection activities undertaken during the RI are presented in Section 3.0. Section 4.0 discusses the findings with respect to the physical characteristics of the site, including geology and hydrogeology. The characteristics of the contaminant source area are discussed in Section 5.0. Sections 6.0 and 7.0 discuss the nature and extent of impact to groundwater and surface water. Section 8.0 brings together the information in previous sections for a summary of contaminant migration mechanisms. The Fish and Wildlife Impact Analysis is summarized in Section 9.0 and provided in Appendix M. Section 10.0 summarizes the Baseline Risk Assessment which is provided in Appendix N. The conclusions of the RI are presented in Section 11.0.

The RI Report is comprised of four volumes. Volume 1 contains the Executive Summary, text, and tables, and Volume 2 the figures. Volume 3 contains Appendices A through L, and Volume 4 contains Appendices M through Q including the Baseline Risk Assessment.

2.0 BACKGROUND

2.1 SITE DESCRIPTION

The BPM is located due south of the Route 6, Route 118, and Baldwin Place Road intersection (Baldwin Place intersection) at the northern edge of the Town of Somers, New York in northern Westchester County (Figure 2-1). The approximately 28-acre site is bounded on the northwest by U.S. Route 6; on the west and south by undeveloped property; on the east by an abandoned railroad embankment; and by a short east-west oriented section of Route 118 on the north which represents the Putnam-Westchester County line.

The mall contains 209,800 square feet of retail space in three separate buildings oriented in an angled line. The front of the mall faces Route 6; the area between the mall and the railroad embankment is referred to as behind. Nearly the entire area in front of the mall is paved for parking. A section behind the mall is also paved. Some of the area east of the pavement is a low quality wetland according to field investigations conducted by a wetlands specialist in December 1990 (Jay Fain & Associates, 1991) and during the RI. The railroad embankment divides an unnamed stream into two separate channels that flow in a general north to south direction along the eastern edge of the site.

Drainage from the BPM is to the northwest and southeast. The western portion of the site, which is comprised of a parking area, drains to a tributary of the Muscoot River (western stream). This tributary stream flows in a northwesterly direction prior to its confluence with the Muscoot River approximately 3,500 feet from the site. The headwaters of this tributary stream are just south of the BPM property. The drainage from the parking area over the western portion of the site is conveyed to the western stream via a stormwater system. The eastern and southeastern portions of the BPM property drain to the small stream that heads a short distance north of the site and flows in a north-to-south direction just east of the site boundary (eastern stream). This stream lies between the site and the Meadow Park Road residential community. The eastern stream is also tributary to the Muscoot River, and its confluence with the river lies approximately 1 mile south of the site (see Figures 2-1 and 4-1).

In addition to the mall buildings, a McDonalds restaurant and an Exxon service station (formerly Mobil service station #06-GDK) are located along Route 6 on the northwest part of the property. Two residences are situated in the northeast corner of the property; one residence is tenanted and the other is unoccupied.

The BPM was constructed in 1965. Prior to the mall, an orchard had been maintained on the property. Big V Supermarkets, Inc. purchased the BPM in July 1986. Most of the mall space is vacant and in need of renovation before it can be utilized. The existing tenants are a post office, commercial offices and various retail stores including a dry cleaners. The dry cleaners came under scrutiny by the Westchester County Health Department (WCHD) in the late 1970s as a result of the discovery of dry cleaning chemicals in the mall water supply. A previous consultant has stated that their review of mall tenants records indicated that "there always has been a dry cleaner on the premises" (JRFA, 1989). Until at least May 1991, dry cleaning processing was performed on the BPM property. Presently, the dry cleaners' processing is performed offsite.

The mall water supply is comprised of two production wells located beyond the fenced-in area on the southern part of the property. These wells are 260 feet deep (Production Well PW-1) and 400 feet deep (Production Well PW-2), and can reportedly provide a combined capacity of 115 gallons per minute (gpm). The water supply is treated by a granular activated carbon (GAC) filter system that was installed in April 1989 (JRFA, 1989). The filter system has been effective in removing the contaminants in the BPM production wells: tetrachloroethylene (PCE) and trichloroethylene (TCE). The two on-site residences are also connected to the mall water-supply system (Leggette, Brashears & Graham, 1988).

The sanitary wastewater from the mall is handled by an on-site treatment plant located beyond the fenced area on the southeast part of the property (SPEDES Permit No. 0067741). The treatment plant effluent is routed through two subsurface sand filters, collected by an underdrain assembly, chlorinated and re-aerated before discharge to the eastern stream.

The Exxon (formerly Mobil) service station has an operating groundwater remediation system installed by Technical Environmental Specialists Corporation (TES) for Mobil Oil Corporation. The remediation system consists of two recovery wells, one shallow and one in bedrock, to recover groundwater containing dissolved petroleum hydrocarbon compounds (BTEX) and an additive (MTBE). The groundwater pumped from the recovery wells is treated by carbon filtration before discharge into the same storm-water system that drains the parking area in the western portion of the BPM (TES, 1991).

The McDonalds restaurant well is reportedly 650 feet deep and cased to 31 feet below ground surface (bgs) (TES, 1991). This well was temporarily taken out of service in 1989 as a result of water quality problems; both MTBE and PCE were detected. This well is presently equipped with a GAC filter system maintained by Mobil Oil Corporation.

2.2 SITE HISTORY AND PREVIOUS INVESTIGATIONS

The BPM water supply was initially sampled by the Westchester County Health Department (WCHD) in 1979 as part of a county-wide investigation of water supplies vulnerable to dry cleaning chemical contamination. This early result indicated the presence of tetrachloroethylene (PCE) in the BPM water supply at 37 micrograms per liter (ug/L), below the prevailing New York State Department of Environmental Conservation (NYSDEC) guideline concentration for VOCs of 50 ug/L (WCHD, 1989). Subsequently, in 1979, WCHD conducted an inspection of the dry cleaning establishment on the BPM property. Evidence of chemical dumping or spillage, or unacceptable disposal practices, was not noted at the time of this inspection (WCHD, 1989).

The BPM and surrounding area wells were resampled by WCHD in 1984, at the time of the fire at Lloyd's Lumber on Route 6 north of the BPM. The levels of VOCs in the BPM water supply samples (35 to 39 ug/L PCE in July 1984) had not significantly changed from those found in 1979 (WCHD, 1989).

In 1988, Leggette, Brashears & Graham, Inc. (LBG) conducted an environmental assessment of the BPM for the mall management firm, Hampton Management Company. The assessment was based on a review of land-use history of the site and adjacent property, local and state records, and examination of aerial photographs, and involved a limited onsite field program. The field program included a site inspection; collection of samples from the BPM production wells (an initial and confirmatory sample) and from the water-supply wells for McDonalds and the Mobil service station; and the installation and sampling of two shallow monitoring wells directly beneath the sand filters of the BPM sanitary wastewater treatment system. The results of this program indicated concentrations of PCE and TCE in the BPM production wells that were comparable to the previous WCHD testing. The PCE concentrations were noted to be above the lowered New York State Department of Health (NYSDOH) guideline for PCE in drinking water of 5 ug/L that was accepted by the Public Health Board on July 22, 1988 and was shortly to become effective as a standard on January 9, 1989. In addition, the McDonalds well also exhibited PCE above the 5 ug/L guideline (21 ug/L). Neither PCE, TCE, or any other VOCs were detected in the water-supply well for the Mobil service station. The results of both soil and groundwater sampling at the sand filters did not implicate the wastewater system area as the source of the PCE and TCE in the groundwater. LBG concluded that there was insufficient data to define a source of the PCE on the BPM property (LBG, 1988).

The WCHD and NYSDEC resampled the McDonalds and BPM wells in October and November 1988, to confirm the LBG investigation findings. In addition to PCE, the gasoline additive methyl tertiary butyl ether (MTBE) was detected in the McDonalds well at 320 ug/L. McDonalds was directed by WCHD to use a new source of water (WCHD, 1989), and for several years McDonalds brought in bulk water from an off-site source. The well resumed service in 1993 after being equipped with a GAC filter system by Mobil Oil Corporation.

WCHD subsequently reinspected the BPM dry cleaning establishment and initiated an extensive sampling program to investigate if other water sources in the area were affected. The reinspection of the BPM dry cleaners in January 1989, like the 1979 inspection, did not indicate that current disposal practices were contributing to the groundwater contamination. From November 1988 through early 1989, 38 area wells (32 residential and 6 commercial) were sampled either by WCHD or by NYSDEC which was investigating an apparent petroleum spill in the same area. Several residential wells on Meadow Park Road east/southeast of the BPM exhibited PCE concentrations; in two of these wells PCE concentrations above 5 ug/L were detected. Also, four commercial wells along Route 6 to the west of the BPM exhibited PCE concentrations; PCE was detected above 5 ug/L in three of these wells. MTBE was detected in two commercial wells along Route 6 at up to 220 ug/L, and was not detected in the Meadow Park Road residential wells. Neither PCE or MTBE were detected in residential wells on Lounsbury

Drive and Cornelius Lane east of Meadow Park Road, and in residential wells on Mahopac Avenue (WCHD, 1989).

As part of this study, WCHD also tested the BPM wastewater treatment plant influent and effluent. The influent sample exhibited a low PCE concentration below levels detected in the BPM wells. This provided the basis for WCHD's stated opinion that the PCE concentration in the influent represented the ambient level in the water (that came from the production wells rather than resulting from a PCE-laden discharge to the sewer). PCE was not detected in the wastewater system effluent (WCHD, 1989).

In the week of February 20, 1989, WCHD resampled the residential wells on Meadow Park Road that exhibited positive results in the initial samples. The owner of one of the two residential wells that exceeded the maximum contaminant level (MCL) for PCE installed a GAC filter system that was tested after installation and found to be effective (WCHD, 1989).

Big V Supermarkets, Inc. installed a GAC filter system on the BPM production wells. The system design, by J. Robert Folchetti & Associates (JRFA), was approved by WCHD in November 1988, and the system came on-line in April 1989 (JRFA, May 1989). This system is effective at removing PCE and TCE concentrations in the drinking water to non-detectable levels. The filter system is designed for 60 gallons per minute (gpm); current BPM water usage is on the order of 3.8 gpm. Starting in September 1990 and continuing to present, the firm of Landau & Heyman, Inc. has maintained the BPM water-supply treatment system for Big V Supermarkets. Landau & Heyman conducted monthly monitoring through January 1992. In and after February 1992, a quarterly monitoring program has been implemented by VUA and Big V Supermarkets.

In April 1989, the WCHD issued an Interim Report on Groundwater Volatile Organic Chemical Contamination at and in the BPM proximity (WCHD, 1989). This report summarized WCHD's investigative efforts and findings, and recommended the evaluation of water treatment and/or supply alternatives for the area and continuation of a groundwater monitoring program. WCHD also forwarded their findings to the NYSDEC for consideration in a remedial action program.

In May 1989, JRFA prepared a report for Big V Supermarkets, Inc. that summarized the water quality of wells proximate to the BPM and identified potential sources (JRFA, 1989). JRFA compiled data for 57 wells in the area, some of which had detectable levels of PCE and/or MTBE. JRFA stated that they were not able to substantiate from this investigation any locations where PCE was entering the environment on the BPM site.

NYSDEC notified Big V Supermarkets, Inc. of the inclusion of the BPM in the Registry of Inactive Hazardous Waste Disposal Sites (Site Classification 2) in a letter dated October 31, 1989. The Inactive Hazardous Waste Disposal Report enclosed with the notification letter indicated that the NYSDEC viewed the WCHD Interim Report as an equivalent Phase I investigation, and that PCE in the BPM wells and four residential wells in the area appeared to originate from the dry cleaners in the mall (NYSDEC, 1989).

On December 7, 1989, Malcolm Pirnie conducted a soil gas survey for Big V Supermarkets, Inc. on the BPM property. Soil gas readings were taken at 24 locations in the area behind (east and southeast of) the mall. These locations were spaced along the length of the mall, with particular focus on the central area between the dry cleaners and Meadow Park Road. The soil gas readings (HNu photoionization detector measurements at 3-foot sample depths) were uniformly low and ranged from 0 to 4.4 parts per million (ppm) (Malcolm Pirnie, 1990).

An Order On Consent concerning the performance of a limited investigation to include further soil gas and soil sampling was entered into by Big V Supermarkets, Inc. and NYSDEC on June 3, 1991 (NYSDEC, 1991a). The second soil gas investigation on the BPM property was performed by Tracer Research Corporation under subcontract to Malcolm Pirnie on June 4, 1991. This investigation primarily addressed a broad area behind the dry cleaners. A total of ten locations (3-foot sample depths) were tested for PCE, TCE and 1,1,1-trichloroethane (TCA) using a gas chromatograph equipped with an electron capture detector. An elevated PCE concentration of 94 ppm was detected at one location; the one closest to and directly behind the dry cleaners, approximately 5 feet from the building. The remainder of the locations tested exhibited much lower PCE concentrations (at and below 0.3 ppm) (Malcolm Pirnie, 1992).

The soil gas investigation was followed by a limited soil boring program to assess soil quality conditions. From July 12 through 16, 1991, Malcolm Pirnie drilled five soil borings in the area behind the mall buildings. PCE concentrations were detected in the unsaturated soil from the boring right behind the dry cleaners; however, the PCE levels detected were relatively low at 1.6 to 1.7 mg/kg. (Malcolm Pirnie, 1992).

As part of this field program, on May 23, 1991, Malcolm Pirnie collected an air sample from the vent outside the backdoor of the BPM dry cleaners. The PCE concentration at the vent exhaust was reported at 350 parts per million (ppm). Based on the measured air flow velocity, and an assumed typical time of (dryer) operation, Malcolm Pirnie estimated an annual PCE emission of approximately 350 gallons. Malcolm Pirnie additionally noted that the vent was located about 8 feet above the ground and was venting downward (Malcolm Pirnie, 1992).

During the period from February 1989 through August 1991, WCHD collected at least one and typically several samples (up to eight samples) from each of the 18 residential wells on Meadow Park Road. The results for samples collected in August 1991 indicated that four of these wells (besides the well with the filter system installed by the owner) exhibited PCE concentrations greater than 5 ug/L, accompanied by lower concentrations of TCE. Six other wells on Meadow Park Road also exhibited PCE at lower concentrations (below 5 ug/L).

A second Order On Consent concerning Interim Remedial Measures was entered into by Big V Supermarkets, Inc. and NYSDEC on September 12, 1991 (NYSDEC, 1991b). In accordance with the provisions of this Order, Big V Supermarkets installed GAC filter/ultraviolet (UV) disinfection systems on the four Meadow Park Road residential wells that exhibited PCE concentrations greater than 5 ug/L in the August 1991 samples. Big V Supermarkets, Inc. also assumed maintenance and monitoring responsibilities for the GAC filter at the fifth residence that was previously installed by the owner, and agreed to implement a quarterly monitoring program that included all 18 residential wells on Meadow Park Road.

The initial quarterly monitoring event under this program was conducted in late October/early November 1991. Split samples of water from points before and after treatment at selected residences were also collected by the New York State Department of Health (NYSDOH). All five GAC systems were found to be providing effective treatment. A sixth residential well on Meadow Park Road exhibited a PCE concentration above 5 ug/L, and this residence was fitted with a GAC/UV system by Big V Supermarkets, Inc. in December 1991.

A third Order On Consent concerning the implementation of a Remedial Investigation/Feasibilty Study at the BPM was entered into by Big V Supermarkets, Inc. and NYSDEC on August 4, 1992 (NYSDEC, 1992a).

During and after the RI investigative period, in March and April 1993 and in March 1994, three additional residential wells on Meadow Park Road (nine total) and two commercial wells on Route 6 to the west of the BPM were fitted with GAC/UV systems by Big V Supermarkets, Inc.

RI

3.0 FIELD INVESTIGATIONS

3.1 OVERVIEW

The RI site characterization elements are described in this section. The program objectives, scope and chronology are provided, followed by discussions of general program aspects and the details of each element.

3.1.1 Objectives

The specific objectives of the site characterization program as stated in the RI/FS Work Plan were:

To develop an in-depth understanding of groundwater flow conditions in the shallow groundwater and in the bedrock aquifer system.

To delineate the horizontal and vertical extent of the PCE and TCE concentrations in groundwater that exceed the New York State groundwater quality criteria (5 ug/L), and assess if concentrations of these constituents are present in the nearby stream[s].

To determine if other site-related constituents are present in the onsite shallow groundwater and bedrock aquifer system; and, if present, to delineate the extent of concentrations of these constituents.

To determine the extent to which site-related constituents may be impacting off-site groundwater quality.

To assess if the PCE and TCE concentrations in the groundwater are attributable to the suspected source area near the dry cleaners or if any other onsite sources of these and/or any other groundwater contaminants are indicated.

To assess the impact on onsite groundwater quality from the Mobil [now Exxon] service station leakage and [other] potential degradation sources on surrounding properties [Citgo and Texaco service stations].

To delineate the magnitude and extent of the suspected source area near the dry cleaners, and any other onsite sources, if indicated.

[To provide a basis] to determine the risks to human health and the environment posed by the site-related constituents.

3.1.2 Scope and Chronology

The RI/FS Work Plan specified the original outline of the field program. This program included investigative components to address the potential source area(s), groundwater and surface water:

- Seismic refraction survey.
- Soil gas survey.
- Test boring and soil sampling program.
- Installation and sampling of thirteen monitoring wells.
- Sampling of Meadow Park Road and BPM production wells.
- Surface-water and sediment sampling in nearby streams and storm drainages.

As described in the following paragraphs, this program was subsequently modified and expanded as appropriate to satisfy the study objectives.

The chronology of the RI field program is shown on Figure 3-1. Due to timing constraints associated with business considerations on the part of the property owner, the thirteen monitoring wells specified in the RI/FS Work Plan were installed in July/August 1992 and initially sampled in September 1992 ahead of the Work Plan schedule. Information concerning the installation and sampling of these monitoring wells was submitted to NYSDEC (VUA 1992c and e), and provided the basis for a preliminary assessment of the site hydrogeologic and groundwater quality conditions that was presented in an Interim Site Characterization Report prepared in December 1992 (VUA 1992f).

The Interim Site Characterization Report identified the major remaining data gaps with respect to groundwater flow and quality conditions and presented recommendations for the work necessary to address them. In 1993, NYSDEC accepted the work which had been conducted and concurred with the recommended supplemental RI work items. These items included:

- The installation of six supplemental monitoring wells.
- A second complete round of monitoring well sampling.
- Sampling of commercial wells along Route 6.
- Performance of an aquifer pumping test on a BPM production well.

The remaining original RI/FS Work Plan and supplemental groundwater elements of the RI field program were implemented over a 10-month period, beginning in December 1992. Appropriate detailed plans and specifications for the supplemental elements and those that were left flexible in the Work Plan (i.e. the test boring and soil sampling program), were prepared during this timeframe. These included the letter regarding the proposed soil sampling/test boring locations, et. al. (VUA, 1993c), and the Technical Specification for Aquifer Pumping Test (VUA, 1993d).

Two other modifications were made in 1993 to the scope of the RI field program. The seismic refraction survey proposed in the Work Plan was eliminated as being of minimal usefulness in a joint decision by VUA and NYSDEC (VUA, 1993a). The surface-water/sediment sampling program was expanded with the collection of supplemental samples in October and December 1993 (see Section 3.9).

In August 1993, a Work Plan for Additional Data Collection in the PCE Source Area was developed based on the results of the test boring and soil sampling program (VUA, 1993f). The objective of this program was to provide additional data considered necessary for the evaluation, selection and design of source area remedial alternatives. The Source Area Additional Data Collection Program was approved (NYSDEC, 1993), and implemented in November and December 1993.

3.1.3 Drilling Programs

Three drilling programs were conducted as part of the RI site characterization: (1) the installation of the original thirteen RI monitoring wells in July/August 1992; (2) the installation of the six supplemental RI monitoring wells in April 1993, and (3) also in April 1993, the RI test boring and soil sampling program. A fourth drilling program was conducted in November/December 1993 as part of the Source Area Additional Data Collection Program, comprised of a test boring and soil sampling program and the installation of two source area monitoring wells. Samuel Stothoff Company, Inc. of Flemington, New Jersey performed the drilling and well installation services under the supervision of VUA hydrogeologists.

The water used during the drilling programs was obtained from the BPM water supply system. This water is pumped from two onsite production wells and routed through a granular activated carbon (GAC) filter system. The treated water is tested quarterly and does not contain VOCs. In addition, for confirmation purposes, a sample was collected on July 7, 1992 prior to the drilling programs, and was found to be free of Target Compound List (TCL) organic compounds with acceptable metals concentrations.

Prior to the drilling programs in July/August 1992, April 1993, and November/December 1993, provisions were made to contain generated water. A shallow plastic-lined sump was constructed at the decontamination station for heavy equipment. The drilling water, well development water, decontamination water, and the water from well evacuation during sampling, was stored in tank trucks staged onsite. At the conclusion of the field programs, the water was sampled and transported to the E. I. Dupont deNemours Company Chamber Works facility in Deepwater, New Jersey for disposal.

The drill cuttings from the RI monitoring well installation programs were temporarily stockpiled onsite, on and covered by plastic sheeting. NYSDEC has agreed that these soils may remain onsite based on the test results for representative samples (VUA, 1992d and 1993i; NYSDEC, 1992c).

The drill cuttings from the test borings and source area monitoring wells near the dry cleaners were segregated and placed in DOT-approved drums. These materials were disposed at the Chemical Waste Management Trade Waste Incinerator facility in Sauget, Illinois.

3.1.4 Surveying

In 1992, Ward Carpenter Engineers, Inc. of White Plains, New York performed the surveying services for the thirteen original RI monitoring wells and five stream staff gauges. In 1993, Terry Bergendorff-Collins, Inc. of Brewster, New York surveyed the six supplemental RI monitoring wells and selected offsite wells including those used in the regional water-level survey. In 1993, the vertical elevations of several of the original RI monitoring wells were also re-surveyed, to confirm agreement between the two firms' measurements.

Horizontal coordinates were determined within the New York State Plane Coordinate System (East Zone). The ground surface and marked measuring point elevations of each monitoring well were determined to the nearest 0.01 foot relative to the United States Coast and Geodetic Survey sea level datum. The horizontal and vertical survey data are presented on Table 3-1. Appendix A provides information concerning the monument and benchmark for the survey.

3.1.5 Sampling and Analysis

The samples collected during the RI site characterization program were submitted to Envirotest Laboratories, Inc. of Newburgh, New York for analytical testing. Table 3-2 summarizes the individual RI samples collected and the analytical parameters.

Unsaturated and saturated zone soil, groundwater, surface water and sediment were sampled. With the exception of the saturated zone soil samples, all of the samples were analyzed for the TCL/TAL parameters or the VOC portion thereof by New York State (NYS) Contract Laboratory Program Analytical Services Protocols (CLP ASP). Standard testing and reporting format was utilized for the VOC analyses of saturated zone soils, and also for several additional "groundwater chemistry" parameters tested in selected monitoring wells as these analyses were not used for risk assessment purposes.

Given the site-related constituents of concern (PCE and TCE) and the nearby service stations leakage, the analytical program emphasized VOC analysis. NYS Method 91.1 was used for the unsaturated zone soil samples, surface water and sediment samples, and groundwater samples from the onsite monitoring wells. NYS Method 91.4 (low-level analysis) was used for the groundwater samples collected from the BPM production wells and from offsite residential and commercial wells. MTBE was analyzed as an additional targeted parameter in all the RI VOC samples.

No preservatives were used for the TCL VOC, semi-VOC and pesticides/PCBs samples in accordance with NYSDEC protocol. Nitric acid was used to preserve the TAL metals and inorganics water samples.

3.1.6 Data Validation and Management

The RI data were validated by Environmental Standards, Inc. (ESI) of Valley Forge, Pennsylvania. ESI prepared a Quality Assurance Review report for each data set (ESI, 1993a through h) and Envirotest Laboratories prepared responses to the identified deficiencies. The Quality Assurance Review reports and laboratory responses were submitted to the NYSDEC Investigation Support Section as they became available (VUA, 1993k). Appendix B contains the ESI validated data spreadsheets and a Data Usability Report for each set of RI samples. In general, the RI data were valid and usable, and met the project data quality objectives.

For the results reported in standard format, for which ESI spreadsheets are not available, the Envirotest Laboratories analytical data packages are provided in Appendices F and J.

3.1.7 NYSDEC/NYSDOH Oversight

Communication with the NYSDEC Case Manager was maintained during the RI site characterization program. Throughout, preliminary data and interim reports describing the conduct and results of the field program elements were submitted to and discussed with NYSDEC. A NYSDEC representative was onsite during a portion of the original monitoring wells installation program, for all of the supplemental monitoring wells installation and the test borings, and during the second round of groundwater sampling.

The NYSDOH's primary area of concern on this project are the nearby offsite wells used for water supply purposes. NYSDOH oversees the routine quarterly monitoring of the residential wells in the Meadow Park Road community; the RI samples were collected in partial place of the routine samples in the first quarter 1993. NYSDOH also was instrumental in gaining access to commercial wells along Route 6 for RI sampling, and continues to oversee the monitoring of two Route 6 wells that have been fitted with GAC filter systems based on the RI data.

3.2 SITE RECONNAISSANCE

The site reconnaissance entailed activities related to characterization of the BPM site and its environmental setting. These included the compilation of reports, literature, maps and aerial photographs, and inquiries to NYSDEC and County agencies, municipalities, private parties and consultants concerning the service station spills and historical/current groundwater monitoring data for wells used for water supply in the site vicinity. Field components included identification and verification of land use, geologic, topographic, surface water and ecologic features.

3.2.1 Environmental Setting

The United States Geological Survey (USGS) Mohegan Lake and Croton Falls 7.5-minute quadrangle topographic maps were reviewed for pertinent features, including streams, ponds, pipelines, wells, commercial facilities and residences. Regional geologic and hydrogeologic literature included University of the State of New York (Prucha J.J. et. al., 1968) and State of New York Department of Conservation, Water Power and Control Commission (1955) publications, and the Westchester County 208 Study (1977).

Topographic and covertype (land use and habitat) maps were prepared as part of the Fish and Wildlife Impact Analysis. Resources relied on include the Westchester County Environmental Atlas, the NYSDEC stream segment map, federal, state and local wetlands maps (NWI, NYSDEC and Town of Somers), the NYSDEC significant habitiat unit, and other general references. Indigenous wildlife and plants were noted during field surveys conducted from January to June 1993 by Jay Fain & Associates.

3.2.2 Records Search and Compilation of Previous Data

Available records were pursued from regulatory and private sources. NYSDEC records were obtained through FOIL requests for the (1) Baldwin Place hazardous waste remediation site and (2) petroleum product spill #88-07084 files. Visits were made to the Westchester County Health Department in November 1991 (VUA, 1991) and to the Putnam County Health Department, Division of Environmental Health Services in September 1993 (VUA, 1993g) to review and reproduce County records related to monitoring of wells used for water supply purposes for dry cleaner-related and petroleum constituents. The NYSDEC Spills Management Section was also directly contacted for information regarding the conditions and status of remediation at the Mahopac Village Center (VUA, 1993h).

Other parties contacted included Spain Oil, the firm which operates several of the service stations at and near the Baldwin Place intersection, and their consultant, ERM, for current monitoring results, well construction details and access to wells for water-level measurements. Putnam County Health Department and the Town of Carmel provided current monitoring data and well information for the Lake Baldwin community water supply system (VUA, 1993g and j).

3.2.3 Topography, Geology and Surface Features

Field reconnaissances were conducted on December 12, 1992, March 10, 1993, and November 11, 1993 to compile information regarding the topography, geology and surface drainage on and in the BPM vicinity. Pertinent features were noted and inspected. The stream channels to the east and west of the BPM were walked, and the only bedrock exposure noted within the vicinity of the BPM (approximately 2 miles southwest of the site along Route 6) was inspected and measured for strike and dip orientations. The field reconnaissance notes are provided in Appendix C.

3.2.4 Review of Aerial Photographs and Fracture Trace Survey

Fracture traces, identified from a stereographic analysis of aerial photographs, are documented in the Westchester County 208 Study (1977). In addition, a review of historical low-altitude aerial photographs (stereo coverage) was conducted to examine present and past land uses, topography, drainage and identify fracture traces. Photographs included in this review were from 1962 to 1990.

Aerial photograph enlargements on a 1 inch equals 100 feet scale were also obtained for the years 1962, 1984 and 1990. These photographs were reviewed for details of land use and conditions at and in the neighborhood of the BPM before and after the mall development, and the 1990 photograph was used to prepare the base maps of the site.

3.3 SOIL GAS SURVEY

The soil gas survey was performed on January 20, 21 and 22, 1993 by Tracer Research Corporation, Inc. of Tucson, Arizona. Thirty-nine soil gas samples (SG-1 through SG-39) were collected in an approximate 5-foot, then 10-foot and 20-foot grid pattern extending outward from the alleyway behind the dry cleaners (see Figure 3-2). Flooded water and ice from snowmelt to the east of the dry cleaners area required some adjustment to the sampling locations; the outermost points on the east side of the grid were moved in from 50 to approximately 35 feet. Also, a water main and electrical conduits to the south of the area posed a constraint to the outermost points in the survey grid in this direction.

The soil gas samples were collected primarily at a depth of 2 feet below ground surface (bgs); shallower samples (10-inches bgs minimum) were collected due to high groundwater levels encountered at a few locations. The samples were collected by inserting a sampling probe to the target depth and drawing soil gas into the probe by a vacuum pump. The sample was collected with a syringe needle after two to five probe volumes of soil gas were evacuated. The samples were analyzed in the Tracer Research analytical van using a gas chromatograph (GC) equipped with flame ionization and electron capture detectors (FID and ECD). The sampling and analytical methodologies are discussed in detail in the Shallow Soil Gas Investigation report prepared by Tracer Research Corporation provided in Appendix D.

The soil gas samples were tested for the dry cleaner-related compounds (PCE and TCE), methylene chloride, and gasoline constituents (benzene, toluene, ethylbenzene and xylene (BTEX)). Total volatile hydrocarbon concentrations (TVHC) were also reported. Tracer Research Corporation reported the results in micrograms per liter (ug/L) (Appendix D). Table 3-3 provides the sample concentrations converted into parts per million by volume (ppmv).

The survey results indicated elevated soil gas PCE concentrations within the very limited area of several sample points just outside of the backdoor of the dry cleaners (see Figure 3-2). The highest PCE concentrations were found in Samples SG-1 (55.5 ppmv) and SG-3 (51.0 ppmv). Adjacent samples SG-2, SG-6 and SG-4 exhibited concentrations from 2.5 to 8.4 ppmv. Samples collected outside of this area exhibited trace levels, up to and typically much lower than 1 ppmv, that are not indicative of a source area and may reflect the groundwater quality.

Significant TCE, methylene chloride and BTEX concentrations were not detected throughout the survey area. The methylene chloride was included in the soil gas survey at NYSDEC's request based on the detection of this compound in the August/September 1992 monitoring well samples. Subsequent to the soil gas survey, the second monitoring well sampling event in May 1993 confirmed the absence of this very common laboratory contaminant in the onsite groundwater.

Elevated TVHC concentrations were detected at several points within the survey area. The highest concentrations (754 ppmv at SG-38, 312 to 364 ppmv at SG-33/34/39, and 119.6 ppmv at SG-9) appeared to be distributed close to the underground natural gas conduits which criss-cross the survey area. During the soil gas survey, a natural gas leak from the main conduit which traverses the area was evident by the observation of venting in the puddled water at the location noted on Figure 3-2. This leak was fixed by Consolidated Edison personnel on April 12, 1993.

In summary, the soil gas survey results indicated a residual PCE source area in the alleyway near the backdoor of the dry cleaners. The subsequent test boring and soil sampling program, described in the following section, was designed with a primary focus in this area.

3.4 TEST BORINGS AND SOIL SAMPLING

From April 12 through 14, 1993, fourteen test borings were drilled and 23 subsurface soil samples were collected, primarily to investigate the residual PCE source area behind the dry cleaners that was indicated by the results of the soil gas survey. Figures 3-3 and 3-4 show the test boring locations. The placement of these test borings was as follows:

> Five test borings (TB-1, TB-2, TB-7, TB-8 and TB-9) were drilled within an approximately 10 by 20 ft. area directly behind the dry cleaners. A sixth test boring (TB-3) was located near MW-5S approximately 30 feet southeast of this area.
>
> Two test borings (TB-4 and TB-11) were drilled opposite the dry cleaners next to the front of the building, and a third test boring (TB-5) was located approximately 100 feet further west adjacent to MW-7S.
>
> Four test borings (TB-12 through TB-15) were drilled next to soil gas survey points SG-38, SG-33/34/39, SG-9, and west of SG-36 near the apparent leak in the gas pipeline to investigate these remote locations where total volatile hydrocarbon concentrations, but not PCE, were reported in the soil gas.
>
> One test boring (TB-6) was drilled near MW-8S at the northeastern corner of the property to provide background soil quality data.
>
> Note: There was no Test Boring TB-10.

Test Borings TB-2 through TB-5, and TB-7 through TB-9 were drilled to refusal (total depths from 6.5 to 19.5 feet bgs.). A decision was made to end Test Boring TB-1 before refusal so as not to penetrate a clay layer encountered in this highly impacted borehole at 15 feet bgs. Background Test Boring TB-6 was drilled to 6 feet bgs., approximately 3 feet below the water table. The remainder of the test borings, TB-11 through TB-15, were drilled to the water table. The geologic logs of the test borings are presented in Appendix E.

The test borings were continuously sampled in two-foot intervals, and each sample was screened in the field with an HNu photoionization detector (PID) upon initial collection and in the headspace. The PID field screening results are provided on Table 3-4; these results were used to select the samples for laboratory analyses.

A soil sample from both the unsaturated and saturated zones within the TB-1 through TB-9 boreholes was submitted for laboratory analysis. An unsaturated zone soil sample was submitted to the laboratory from TB-11 through TB-15. The unsaturated zone soil samples from Test Borings TB-1, TB-4 and TB-6 were tested for the standard CLP parameters: TCL VOCs, TCL semi-VOCs, TCL pesticides/PCBs, and TAL metals and inorganics. The remainder of the unsaturated and saturated zone soil samples were tested for TCL VOCs. Table 3-2 lists the individual samples collected and the analytical parameters. The ESI validated data spreadsheets for the unsaturated zone soil samples and the Envirotest Laboratories analytical data package for the saturated zone soil samples are respectively provided in Appendices B and F.

3.5 INSTALLATION OF MONITORING WELLS

The nineteen RI monitoring wells include eight monitoring well clusters (MW-1S/1D, MW-2S/2D, MW-3S/3D/3DD, MW-4S/4D, MW-5S/5D, MW-7S/7D, MW-9S/9D and MW-10S/10D) and two additional shallow wells (MW-6S and MW-8S). Nine of the ten shallow (S) monitoring wells were completed in the shallow glacial till/weathered bedrock materials, screened at or near the water table, and range in total depth from 14 to 30 feet bgs. MW-10S was completed from 31 to 51 feet bgs based on water strikes during drilling in this interval. The eight deeper monitoring wells (D) were completed with an approximate depth interval from 60 to 90 feet bgs, and are either of open-hole construction or screened, depending on whether relatively competent or weathered bedrock conditions were encountered at the targeted depth interval. Monitoring Well MW-3DD was completed with an open-hole interval from 170 to 200 feet bgs. At the MW-3DD location, a continuous 100-foot long bedrock core was obtained from the approximate top of competent bedrock to the bottom depth of the monitoring well.

The monitoring well construction details are summarized on Table 3-5, and well construction diagrams are provided in Appendix G. Appendix H contains the geologic logs of the monitoring wells, and the bedrock core log is provided in Appendix I.

3.5.1 Placement of Monitoring Wells

The location of the nineteen RI monitoring wells are shown on Figure 3-5. The rationale for placement of these wells was as follows:

Monitoring Well Cluster MW-1S/1D: To provide data for the northwest portion of the site between the mall and the Mobil [now Exxon] service station and in the area that drains to the western stream which flows in a northwest direction to the Muscoot River.

Monitoring Well Cluster MW-2S/2D: To provide data for the southwest portion of the site.

Monitoring Well Cluster MW-3S/3D/3DD: To provide data for the onsite area between the dry cleaners in the mall and the residential wells on Meadow Park Road that exhibit PCE concentrations.

Monitoring Well Cluster MW-4S/4D: To provide data in the upgradient site area near to the service stations north of Route 6 and Route 118 concerning possible groundwater quality impacts.

Shallow Wells MW-5S, 6S and 7S: To provide data for the shallow groundwater in the vicinity of the dry cleaners. Specifically, to determine the location of the groundwater divide that was indicated by the configuration of surface drainage; and to address conditions between the residential wells on Meadow Park Road and the dry cleaners.

Deeper Wells MW-5D and 7D: To provide groundwater quality at depth proximate to the dry cleaners, and also to assess whether a groundwater divide is present in the deeper groundwater flow system.

Monitoring Well MW-8S: To provide data for the upgradient location near the northeastern site boundary to evaluate possible contributions from upgradient land uses over this part of the study area.

Monitoring Well Clusters MW-9S/9D and MW-10S/10D: To provide data for the western part of the property and to characterize groundwater flow and quality conditions near the Route 6/western site boundary.

Monitoring well clusters were situated along fracture traces or at fracture trace intersections, where applicable (see Figure 3-5). Prior to establishing the exact well locations, the orientation of the fracture traces were surveyed in and marked in the field.

3.5.2 Drilling and Installation Methodology

The RI monitoring wells were drilled using the air-rotary/hammer method of drilling. The deeper monitoring well in a shallow/deep well cluster was drilled first to collect hydrogeologic information. Samples of formation materials were collected during the drilling process to characterize the subsurface with respect to stratigraphy, groundwater occurrence and yield, and to screen the samples with a photoionization detector (PID).

The formation samples were collected continuously through the glacial till and highly weathered bedrock materials with a standard 2-inch diameter by 2-foot long split-spoon sampler to the top of the saturated zone (water table), and then at 5-foot intervals to the top of bedrock or refusal. Formation samples were then collected and described from the drill cuttings returning in the air stream while drilling in bedrock. Fractures and fractured or friable intervals were observed by examining the drill cuttings and by measuring groundwater yields through drilled intervals. Groundwater blowout yields were measured during drilling by channeling water through a Parshall flume. Table 3-6 summarizes the depth and yields of fractured intervals encountered in bedrock.

3.5.2.1 Deeper Monitoring Wells

Five deeper monitoring wells (MW-1D, MW-4D, MW-7D, MW-9D, and MW-10D) were drilled using a down-the-hole air hammer through the glacial till, weathered bedrock into competent bedrock. Initially, a 10-inch diameter borehole was drilled to a depth of 60 feet bgs into the competent bedrock. When necessary, the borehole diameter was enlarged to 12-inches to accommodate temporary surface casing installed through relatively loose and unstable unconsolidated materials. At 60 feet bgs, 6-inch diameter steel casing was lowered into the borehole and grouted in place with a five percent bentonite/cement slurry mixture. A 1-inch diameter tremie pipe was used to pressure grout the mixture between the borehole annulus and the 6-inch steel casing from the bottom of the borehole to ground surface. After the grout was allowed to cure for a minimum of 12 hours, the level of the hardened grout was measured and additional grout was added to bring the level to within 2 feet of ground surface. A 6-inch diameter open borehole was then drilled to the total well depth of 90 feet.

The deeper monitoring wells were finished by either extending the 6-inch steel casing approximately 2-feet above ground surface or installing steel flush-mount covers. Locking covers/caps were provided and concrete pads were constructed around all of the monitoring wells.

At three deeper monitoring well locations (MW-2D, MW-3D, and MW-5D) the thickness of the glacial till and weathered bedrock materials exceeded 60 feet. These wells were drilled with an 8-inch diameter down-the-hole air hammer to a total depth of 90 feet bgs. A 30-foot length of 4-inch diameter PVC screen was installed in the 8-inch diameter borehole. A screen slot size of 0.020-inch was used in monitoring wells MW-2D and MW-3D, and 0.010-inch slot was used in MW-5D. The well casing was then extended to land surface with 4-inch diameter PVC riser pipe. The annulus between the 8-inch diameter borehole and the 4-inch diameter PVC screen was filled with clean, well-graded silica sand to approximately 3 feet above the top of the well screen. Two feet of bentonite pellets were placed on top of the sand and the remaining annulus was filled with a five percent bentonite/cement grout mixture. A tremie pipe was used to pressure grout from the top of the bentonite pellets to ground surface.

At the remaining deep well location (MW-3DD), a 10-inch diameter borehole was drilled through approximately 88 feet of unconsolidated and highly weathered bedrock materials. A 10-inch diameter surface casing was installed, and a 6-inch diameter borehole was drilled to approximately 101 feet bgs. A temporary 4-inch diameter steel casing was installed in the 6-inch diameter borehole. The bottom annulus between the 6-inch diameter borehole and the 4-inch diameter temporary casing was sealed with bentonite pellets. An Acker drill rig was used to continuously core the bedrock from approximately 101 feet bgs to 200 feet bgs using a 10-foot NQ wireline core barrel.

Core sections were retrieved in 10-foot intervals and the cores placed in a wooden core trough. Individual pieces of the core were aligned in the trough and two marked lines, one red and one black, were drawn from the bottom to the top of the cored interval. Descriptions of the core were recorded, including texture, color, length of individual competent core pieces, orientation and intensity of fractures, petrographic composition and changes in the petrographic composition of the bedrock. A Rock Quality Designation (RQD) was determined for each of the cored intervals. The log of the bedrock core is provided in Appendix I.

Once the coring was complete, a 10-inch diameter down-the-hole air hammer was used to ream the previously drilled 6-inch diameter borehole interval and 4-inch diameter cored interval to a total depth of 170 feet bgs. Six-inch diameter steel casing was installed in the borehole and a five percent bentonite/cement mixture was pressure grouted through a tremie pipe from the bottom of the borehole to ground surface. The grout was allowed to set for a minimum of 12 hours. A 6-inch diameter open borehole was then drilled to a total depth of 200 feet bgs.

3.5.2.2 Shallow Monitoring Wells

Seven of the ten shallow monitoring wells are completed in the unconsolidated glacial till materials (MW-2S, MW-3S, MW-4S, MW-5S, MW-6S, MW-7S, and MW-8S). The remaining three shallow monitoring wells (MW-1S, MW-9S, and MW-10S) are completed in weathered bedrock materials. With the exception of MW-2S and MW-10S, these wells are screened over an approximate 20-foot interval across the water table. Monitoring Well MW-2S was adjusted to suit the encountered hydrogeological conditions and is screened over a 13-foot interval, also across the water table. MW-10S, was also adjusted and is screened from 31 to 51 feet bgs based on water strikes in this interval.

The shallow monitoring wells were installed by first drilling an 8-inch diameter borehole with a down-the-hole air hammer to the targeted well depth. Four-inch diameter PVC well screen (0.010 or 0.020 inch slot) and casing was then installed in the borehole. The well casing was extended to ground surface with 4-inch diameter PVC riser pipe. The annulus between the 8-inch diameter borehole and the 4-inch diameter

PVC screen was filled with clean, well-graded silica sand to approximately 3 feet above the top of the well screen. Two feet of bentonite pellets were placed on top of the sand and the remaining annulus was filled with a five percent bentonite/cement grout mixture. A tremie pipe was used to pressure grout from the top of the bentonite pellets to ground surface.

Monitoring Wells MW-2S, MW-3S, and MW-6S were fitted with 6-inch diameter protective steel casing. The remaining wells were finished at ground surface with steel flush mount covers. Locking caps/covers were provided and concrete pads were constructed around all of the monitoring wells.

3.6 LOCAL/REGIONAL FLOW EVALUATION

Synoptic water-level measurement events were conducted at intervals during the RI field programs. These events included the two BPM production wells, the nineteen RI monitoring wells, five stream staff gauges (SG-1 through SG-5), and two existing monitoring wells (LBG-1 and LBG-2). The data from three events on June 8, 1993, June 28, 1993 and June 30, 1993 are presented on Table 3-7, and were used to prepare the water-level contour maps that depict shallow and deeper flow conditions (Section 4.3.2). The June 8, 1993 data represent conditions under normal BPM production well(s) operation; the June 28, 1993 data represent conditions after the BPM production wells had been shut down for approximately two weeks; and the June 30, 1993 data represent conditions after BPM Production Well PW-1 had been pumping continuously for 42 hours (2520 minutes) at a rate of 39 gpm.

On August 18, 1993, a regional water-level survey was conducted, which utilized thirteen offsite residential and commercial wells, the onsite monitoring wells and the stream staff gauges. The regional water-level survey data are shown on Table 3-8. The vertical elevations of the measuring points of the offsite wells were determined by the surveyor. Available details of the offsite wells that were measured and used in preparing a regional water-level contour map are summarized on Table 3-9.

3.7 MONITORING WELL SAMPLING

On August 31 through September 2, 1992, the thirteen RI monitoring wells installed in July and August 1992 were sampled (Monitoring Wells MW-1S/1D, MW-2S/2D, MW-3S/3D/3DD, MW-4S/4D, MW-5S, MW-6S, MW-7S and MW-8S). Table 3-2 lists the individual samples collected and the analytical parameters.

The purpose of this initial sampling event was to test the groundwater samples for a wide range of constituents in addition to the dry cleaner-related compounds for which the site was listed (PCE and TCE). The August-September 1992 samples from Monitoring Wells MW-1S/1D, MW-2S/2D, MW-3S/3D/3DD, MW-4S/4D and MW-8S were therefore analyzed for the standard CLP parameters: TCL VOCs, TCL semi-VOCs, TCL pesticides/PCBs, and TAL metals and inorganics (total). Dissolved TAL metals and inorganics were also tested in samples from six selected wells, and five wells were tested for a set of groundwater chemistry parameters (alkalinity, chloride, nitrate/nitrite, sulfate, total dissolved solids and total hardness). Monitoring Wells MW-5S, MW-6S and MW-7S near the dry cleaners were analyzed for TCL VOCs only.

On May 18 through 21, 1993, the second groundwater sampling event was conducted. The six supplemental RI monitoring wells that were installed in April 1993 (Monitoring Wells MW-5D, MW-7D, MW-9S/9D and MW-10S/10D) were sampled, and the thirteen original wells were resampled. Based on the 1992 findings, the samples were analyzed for TCL VOCs (see Table 3-2).

Newly-installed monitoring wells were sampled at least two weeks after they were installed and developed. Immediately prior to the collection of each sample, a submersible centrifugal pump or dedicated PVC bailer was used to evacuate at least three well casing volumes from the well, where possible. In some cases, it was impractical to remove three casing well volumes of water due to low well yield. In this event, the well was pumped dry and recovery was monitored. If the well recovered to within 75 percent of the static level within 15 minutes, two additional well volumes were evacuated. If the well did not recover within this time frame, the sample was collected. The field measurements for pH, specific conductance and temperature are summarized on Table 3-10.

Samples were collected using laboratory-cleaned (first round) and dedicated new (second round) PVC bailers and transferred directly into laboratory containers. The samples were immediately placed on ice in secure coolers and delivered to the laboratory either the day or morning after collection. Chain-of-custody procedures were followed.

For quality control purposes, two field replicate samples and two field blank samples were collected during each monitoring well sampling event. The field blank samples were collected by routing laboratory-supplied blank water through a bailer. A trip blank sample was submitted with each delivery of samples.

The ESI validated spreadsheets for the TCL/TAL parameters for the two sampling events are provided in Appendix B. The Envirotest Laboratories analytical data package for the groundwater chemistry parameters is provided in Appendix J.

3.8 RESIDENTIAL/COMMERCIAL WELL SAMPLING

The RI residential/commercial well sampling events included: (a) samples from the two BPM production wells; (b) samples from 17 residential wells along Meadow Park Road; and (c) samples from six commercial wells on the north side of Route 6 between the Baldwin Place intersection and Mahopac Avenue.

3.8.1 Baldwin Place Mall Production Wells

The RI samples were collected from the two BPM production wells (PW-1 and PW-2) on February 24, 1993. Before sampling, the wells were flushed: 500 gallons were pumped from PW-1 and 700 gallons from PW-2. The samples were collected from points before the GAC filter system as close to the wellheads as possible. The sampling procedures were similar to those for the residential wells (see Section 3.8.2). The RI samples were analyzed for TCL VOCs using NYS Method 91.4 (low-level analysis). Appendix B contains the ESI validated data spreadsheets for these samples.

3.8.2 Meadow Park Road Residential Wells

The RI samples were collected from the Meadow Park Road community residential wells on February 24, 1993. This community includes nineteen homes that are served by eighteen individual wells (see Figure 3-6). These wells have been designated as RW-01 through RW-18 in the routine monitoring program, and these designations were retained in the RI for sample identification and historical data compilation purposes.

The Meadow Park Road wells have been monitored quarterly since November 1991. In the quarterly monitoring program at the time of the RI sample collection, three samples (before, between, and after filter samples) were collected from the six residences equipped with GAC filter systems due to PCE concentrations (RW-05, RW-07, RW-08, RW-09, RW-10, and RW-15), and one sample was collected from each of the twelve remaining wells. RW-13 is equipped with a GAC filter system installed by the owner as a precautionary measure and not based on PCE concentration; therefore, one before-filter sample is collected from this well. The routine samples are tested for VOCs by GC Method 502.1.

Since the purpose of the RI sampling event was to assess groundwater quality at these well locations, the RI sample set was comprised of one sample collected at each of the residences. The RI samples replaced the 1st quarter 1993 routine samples collected from the wells without filter systems (and from RW-13), and the routine before-filter samples at the six wells with filter systems. The RI samples were analyzed for TCL VOCs using NYS Method 91.4 (low-level analysis). Appendix B contains the ESI validated data spreadsheets for these samples.

One well (RW-06) was not sampled during the RI since this residence was unoccupied at the time and accessibility was difficult. Also, historical and recent (July 1992) routine sampling data (since confirmed by the August 1993 through May 1994 samples) indicated that PCE and TCE had never been detected in this well.

The wells were flushed for 10 minutes (where the owner permitted) prior to collecting the sample. The field measurements for pH, specific conductance and temperature are shown on Table 3-10. The samples were collected directly into laboratory containers from a tap valve as near to the wellhead as possible. The samples were immediately placed on ice in secure coolers and delivered to the laboratory on the day of sampling. Chain-of-custody procedures were followed. For quality control purposes, two field replicate samples were collected, and a trip blank was delivered with the samples.

3.8.3 Route 6 Commercial Wells

The sampling of commercial wells along Route 6 between the Baldwin Place intersection and Mahopac Avenue was added to the RI scope based on the 1992 preliminary assessment (VUA, 1992f). This assessment indicated that the historical detection of PCE in certain wells within this area was likely related to the BPM, given the northwest component of shallow groundwater flow from the vicinity of the dry cleaners and the detection of PCE and TCE concentrations in onsite monitoring wells in this direction.

Information on the commercial wells within this area was compiled via a well survey questionnaire mailed to the property owners, followed by telephone contacts, and a door-to-door survey on February 24, 1993 to request sampling access during which VUA was accompanied by a NYSDOH representative. Nine commercial wells were identified within this area; these wells were designated as CW-19 through CW-27 for RI sample identification and historical data compilation purposes. At the time of the survey, one of these wells (CW-19) was equipped with a GAC filter system to remove MTBE; NYSDEC installed and maintains this system. Two other wells (CW-22 and CW-23) were equipped with GAC filter systems by the property owners as a result of PCE detection.

Permission to sample six of these wells (CW-19, CW-20, CW-21, CW-23, CW-25 and CW-27) was granted, and the RI samples were collected on March 11 and April 22, 1993. The sampling procedures were similar to those for the residential wells (see Section 3.8.2). At wells with filter systems, before-filter samples were collected. For quality control purposes, a field replicate sample was collected and trip blanks were delivered with the samples. The RI samples were analyzed for TCL VOCs using NYS Method 91.4 (low-level analysis). Appendix B contains the ESI validated data spreadsheets for these samples.

Although VUA did not obtain permission to collect an RI sample at CW-26, the NYSDOH representative collected a sample from this well during the February 24, 1993 door-to-door survey. The CW-26 sample was tested by NYSDOH for VOCs by Method 502. These results are included.

3.9 SURFACE-WATER AND SEDIMENT SAMPLING

On June 2, 1993, the three stream surface-water/sediment (SW/SD) sample pairs from the eastern stream and the catch basin sediment sample that were specified in the RI/FS Work Plan were collected. As part of this sampling event, an additional surface-water/sediment sample pair in the western stream was collected, based on the northwest component of shallow groundwater flow toward this stream that was indicated by the 1992 preliminary assessment (VUA, 1992f). As shown on Figure 3-7, these samples were taken at the following locations:

<u>SW/SD-01</u>: Northern (upstream) point in the eastern stream near the location of Staff Gauge SG-1.

<u>SW/SD-02</u>: Intermediate point in the eastern stream at the BPM wastewater treatment plant outfall.

<u>SW/SD-03</u>: Southern (downstream) point in the eastern stream, near the southern site boundary.

<u>SW/SD-04</u>: Point in the western stream, just north of where the stream crosses under Route 6.

<u>SD-05</u>: Stormwater catch basin on the western part of the BPM.

The eastern stream has two channels, to the west and east of the abandoned railroad embankment (see Figure 3-7). Shortly downstream of the wastewater treatment plant outfall, the eastern channel partially flows under a bridged section of the embankment into the western channel. The eastern stream samples were all collected from the western channel, and SW/SD-3 was collected just south and downstream of the joining of the eastern with the western channel.

On October 15, 1993, a supplemental surface-water/sediment sampling event was conducted during which three sample pairs were collected in segments of the western stream over a 1,500-foot distance, and one sample pair was collected in a tributary drainage pathway that receives contribution from the area northeast of the Baldwin Place intersection. These samples were collected based on the Route 6 commercial well sampling results which indicated offsite PCE migration in groundwater in the western/northwestern direction. As shown on Figure 3-7, four surface-water/sediment sample pairs were collected at the following locations:

SW/SD-06: Point in western stream approximately 350 feet downstream of the SW/SD-4 location (upstream of the first, unnamed, pond).

SW/SD-07: Point in western stream downstream of the first pond and upstream of Kennard Pond.

SW/SD-08: Point in western stream approximately midway between the outlet of Kennard Pond and Lake Baldwin.

SW/SD-09: Near the outlet of the drainage culvert at the intersection of Kennard Road and Baldwin Place Road, in the drainage pathway that joins the western stream approximately 500 feet from this intersection.

On December 9, 1993, a second supplemental surface-water/sediment sampling event was conducted during which two sample pairs were collected in a small drainage ditch on the south side of Route 6 and west of McDonalds. This drainage ditch conveys runoff from the area west of McDonalds to a culvert that crosses under Route 6 just east of the Texaco (former Sunoco) station and ultimately empties into Lake Baldwin (see Figure 3-7). Seepage from the hillside directly west of McDonalds has been noted (less than 0.1 gpm); and serves as a source of flow in this drainageway. As shown on Figure 3-7, the samples were collected at the following locations:

SW/SD-10: Point in drainage ditch 50 feet downstream (west) from where the seepage begins.

SW/SD-11: Point in drainage ditch about 800 feet downstream from where the seepage begins.

The surface-water and sediment samples were collected during dry periods of base flow conditions. During each event, sampling proceeded from downstream to upstream locations. At each sampling location, the surface-water sample was collected first, followed by the sediment sample. During surface-water sampling care was taken to avoid disturbance of the underlying materials.

The surface-water samples were collected by slowly lowering a glass beaker from the water surface to the bottom of the stream channel, where possible. If the water in the stream channel was very shallow, the beaker mouth was positioned in an upstream direction to obtain the water sample. Except for SD-4, the stream and drainageway sediment samples were collected using a stainless steel hand auger. The material at the SD-4 location was too loose to be retained in the hand auger and this sediment sample was collected with a stainless steel trowel. The catch basin sediment sample (SD-5) was also collected with a stainless steel trowel.

The samples were transferred directly into laboratory containers. The samples were immediately placed on ice in secure coolers and delivered to the laboratory the day of collection. Chain-of-custody procedures were followed

For quality control purposes, two field blank samples were collected in the June and October 1993 sampling events. One field blank sample was collected by routing laboratory-supplied blank water through a beaker, and the second was routed over the hand auger and trowel. A surface-water field replicate was collected in June 1993, and a trip blank was submitted with each set of samples.

The June 1993 surface-water/sediment samples were analyzed for the standard CLP parameters: TCL VOCs, TCL semi-VOCs, TCL pesticides/PCBs, and TAL metals and inorganics. The supplemental samples collected from the western stream and tributary drainageways in October and December 1993 were analyzed for TCL VOCs only. Table 3-2 lists the individual samples collected and the analytical parameters. Appendix B provides the ESI validated data spreadsheets for the surface-water and sediment samples.

3.10 HYDROGEOLOGIC TESTS

The hydrogeologic testing program at the BPM site involved: (1) short-term pumping tests on the monitoring wells during pre-sampling evacuation; (2) a step-drawdown pumping test on BPM Production Well PW-1; (3) pre-pumping background water-level monitoring; and (4) a 48-hour constant-rate aquifer pumping test with BPM Production Well PW-1 as the pumping well, and utilizing Production Well PW-2 and deeper Monitoring Wells MW-2D, MW-3D, MW-3DD, MW-5D, and MW-10D as observation wells. Shallow Monitoring Well MW-5S was also monitored during the constant-rate test to assess the degree to which the pumping from a deeper bedrock well (PW-1) influences water levels in the shallow unconsolidated glacial till materials which overlie the bedrock.

3.10.1 Short-Term Pumping Tests

Short-term pumping tests were conducted during monitoring well sampling to develop a preliminary evaluation of hydraulic characteristics for the glacial till, weathered bedrock and bedrock systems. Water-level drawdown in the monitoring wells was measured while the wells were being evacuated at a constant rate of pumping. Pumping rates for individual wells were determined by measuring the volume of water collected in a graduated container over time with a stop watch. Pumping rates for the monitoring wells ranged from 0.5 to 7.5 gallons per minute (gpm) and the test durations ranged from 30 to 160 minutes. Water-level measurements were recorded in one-half minute intervals for the initial 10 minutes of pumping, and thereafter at less frequent intervals.

Estimates of aquifer hydraulic characteristics were derived from the water-level drawdown data. Specific capacity was determined for each monitoring well and the water-level drawdown versus time data were plotted on semi-logarithmic graph paper for estimates of transmissivity, where possible. The results of these analyses are discussed in Section 4.4.1.

3.10.2 Step-Drawdown Pumping Test

A step-drawdown pumping test was conducted on PW-1 on June 18, 1993. The step test involved pumping PW-1 at three successively decreasing pumping rates or steps. In the initial step, PW-1 was pumped at 39 gallons per minute (gpm) for 1 hour, followed by steps at 32 gpm and 25 gpm, each for 30 minutes. During the test, water levels were measured in PW-1 with a electronic water-level indicator. Water levels were also monitored in PW-1 and PW-2 with pressure transducers connected to a two-channel data logger.

The data developed from the step-drawdown pumping test on PW-1 were analyzed by standard analytical methods to determine the magnitude of the well loss and aquifer loss drawdown components at different pumping rates. Further, the step test data were analyzed to arrive at a safe sustained pumping rate for the 48-hour constant rate test. The depth-to-water measurements and drawdown data are provided in Appendix L. The results of the step drawdown test analyses are discussed in Section 4.4.3.

3.10.3 Pre-Pumping Background Monitoring

Prior to the startup of the 48-hour constant-rate aquifer pumping test, background water-level conditions were monitored to assess: (1) natural water-level fluctuations within the aquifer; and (2) the influence on water levels from normal operating conditions of the BPM production wells. Background monitoring was conducted in the two BPM production wells (PW-1 and PW-2) and in observation wells MW-3D, MW-3DD, MW-5D, MW-7D, and MW-10D.

The background monitoring began on June 8, 1993 with the installation of a pressure transducer in Monitoring Well MW-10D for a period of four days. On June 11, 1993 the pressure transducer was removed from MW-10D and installed in MW-7D for a period of seven days. The two BPM production wells were being used to supply the mall storage tanks until they were shut down on June 15, 1993. Two additional transducers were installed in PW-1 and PW-2 on June 16, 1993. On June 18, 1993 the pressure transducer in MW-7D was removed and installed in MW-10D prior to the start up of the step-drawdown pumping test on BPM Production Well PW-1. Two additional transducers were installed in MW-3D and MW-3DD on June 23, 1993. On June 28, 1993 the pressure transducer in MW-3D was removed and installed in MW-5D prior to the start up of the constant-rate aquifer pumping test. In addition, continuous water-level monitoring was continued after the conclusion of the constant-rate aquifer pumping test, at MW-5D from June 30 through July 16, 1993.

Table 3-11 provides a summary of the time period for background water-level monitoring at individual wells. Depth to water versus time plots for the background monitoring are provided in Appendix L.

3.10.4 Constant-Rate Aquifer Pumping Test

On June 28, 1993 at 2:30 pm, a 48-hour constant-rate aquifer pumping test was commenced on PW-1 at a rate of 39 gpm. During the test, water levels were measured in the pumping well (PW-1) and observation wells (PW-2, MW-2D, MW-3D, MW-5D and MW-5S) with water-level indicators. Water levels were also monitored in PW-1, PW-2, MW-3DD, MW-5D, and MW-10D with pressure transducers connected to data loggers. The pumping rate was monitored with the existing totalizing flow meter in the pump house. The depth-to-water measurements were converted to water-level drawdown data (depth to water at time (t) minus the static water level) and these data and the pumping rate were recorded. These data are provided in Appendix L.

During the 48-hour test, two synoptic rounds of water-level measurements were made in all of the on-site monitoring and production wells; staff gauge measurements were also collected at the five staff gauge locations. The first synoptic round was made after 1440 minutes (24 hours) of pumping PW-1; the second after 2520 minutes (42 hours) of pumping.

Following the 48-hour pumping period, the pump was shut down and water-level recovery was monitored in PW-1 and the observation wells with water-level indicators for a period of about 8-hours. The pressure transducers remained in PW-1, PW-2, MW-3DD, MW-5D and MW-10D for approximately 20-hours after the pump was shut down.

The aquifer test discharge water was pumped through the existing GAC filter system and into the 170,000 gallon BPM water-supply tanks.

3.10.5 Water-Level Monitoring Equipment and Procedures

As described above, pressure transducers were installed in wells PW-1, PW-2, MW-3D, MW-3DD, MW-5D, MW-7D and MW-10D for varying periods of time during the background monitoring period as indicated on Table 3-11. During the 48-hour aquifer pumping test the pressure transducers were utilized in PW-1, PW-2, MW-3DD, MW-5D, and MW-10D for recording water-level drawdown and recovery.

The pressure transducers consisted of one 100 psi transducer to monitor the pumping well (PW-1) and four 30 psi transducers installed in the observation wells. The pressure transducers were connected to In-Situ, Inc. Hermit 1000 (2-channel) Data Loggers. Due to the spatial distribution of the wells, individual data loggers were used at the PW-1/PW-2 locations, the MW-3DD/MW-5D locations and the MW-10D location.

The data loggers were programmed to collect background water-level readings according to a linear sample collection mode whereby the data logger would record one water-level reading from each transducer at a sample collection rate of 10-minutes. Once the background monitoring was complete, the data loggers were programmed to record water-level data in a log sampling mode for the drawdown and recovery phases of the 48-hour aquifer pumping test. This was done to allow measurements for the characteristically rapid changes in water levels during the first few minutes of pumping (particularly in the pumping well), and to optimize memory storage within the data logger for the latter periods of the test.

4.0 PHYSICAL CHARACTERISTICS

4.1 SITE SETTING

4.1.1 General

The BPM is located due south of the Route 6, Route 118 and Baldwin Place Road intersection (Baldwin Place intersection). Land use to the east of the site is residential (Meadow Park Road); to the north and northwest commercial (Route 118 and Route 6), and to the west and south undeveloped (see Figure 2-1).

The BPM site is located in a relative topographic high area. Drainage over the eastern portion of the site is to an unnamed north-to-south flowing stream (eastern stream) that is tributary to the Muscoot River. A defunct (plugged) underground storm drain system traverses the eastern part of the site (see Figure 4-1A). Presently, some of the drainage in this direction ponds just north of the wastewater treatment plant building. The eastern stream heads just north of Route 118, is parallel to the eastern site boundary, and lies between the site and the Meadow Park Road residential community. In the Meadow Park residential area, this eastern stream is routed through a series of man-made ponds and has a fairly gentle gradient. A parallel stream drainage system is present to the east of Tomahawk Street; this stream system drains to Lake Shenorock to the southeast (Figure 4-1).

Drainage over the western portion of the site is to an unnamed south-to-north flowing stream (western stream) that heads just south of the mall, is diverted under the mall and parking lot by an underground storm drain system (Figure 4-1A), and empties into a relatively steep ravine and valley just north of Route 6 near McDonalds and the Exxon station. This western stream flows through two ponds (an unnamed pond and then Kennard Pond) and Lake Baldwin prior to its confluence with the Muscoot river (Figure 4-1).

The western stream valley north of Route 6 is 30 to 50 feet lower in elevation than the BPM site. It is bounded by hills to the north and west (ridge on Mahopac

Avenue). This valley comprises the most significant topographic feature in the study area. In contrast, the eastern stream topography is relatively featureless.

4.1.2 Groundwater Usage

The residential and commercial establishments within a 1/2-mile radius of the site rely on groundwater for supply purposes. The smaller commercial establishments have individual wells. The BPM and the Mahopac Village Center mall to the northeast of the site (see Figure 1-1) have centralized production well systems. The BPM system is comprised of two wells and the supply from both wells is treated by a granular activated carbon (GAC) filtration system for the removal of chlorinated solvents (PCE and TCE). The Mahopac Village Center mall has three wells and the supply from one well is treated by an air stripper for removal of methyl tert-butyl ether (MTBE). At least seven of the individual commercial wells are also equipped with treatment systems; four primarily for PCE/TCE removal and three for removal of MTBE.

Most of the residences proximate to the site rely on individual wells for drinking water. These include the nineteen homes in the Meadow Park Road community (on Meadow Park Road and Tomahawk Street) directly east of the BPM; approximately 32 homes on Lounsbury Drive and Cornelius Lane east of Tomahawk Street; and at least seven homes on Kennard Lane northwest of the BPM. Nine of the homes in the Meadow Park community have GAC filter systems for PCE/TCE removal, and two of the homes on Kennard Lane have GAC filter systems for the removal of MTBE.

The nearest public supply is the Lake Baldwin system located approximately 1,800 feet northwest of the western BPM site boundary which serves 165 residences in the Lake Baldwin community area. This utility, which is owned and operated by the Town Of Carmel, uses six wells and delivers on average 32,000 gallons per day (gpd). No treatment has been necessary. The Lake Baldwin system wells are all completed in bedrock; range in depth from 220 to 950 feet bgs; and have reported yields from 8 to 30 gpm.

Available well records indicate that the residential and commercial wells are also completed in bedrock. Table 3-9 provides a summary of the available construction details for nearby residential and commercial wells.

In addition, three of the four service stations located near the Baldwin Place intersection along Route 6 (Exxon, Citgo and Texaco), have active groundwater recovery systems. An investigation at the fourth service station (Shell) concluded that this facility has not been a source of gasoline constituents (International Technology Corporation, 1990).

The major pumping stresses in the area are the BPM, Mahopac Village Center mall and Lake Baldwin well systems. Estimated average daily withdrawals for these three supply systems are 5,400 gpd for the BPM, 10,000 gpd for the Mahopac Village Center, and 32,000 gpd for the Lake Baldwin system.

A development has been proposed for an area east of the site and Tomahawk Street (Route 118). This potential development reportedly plans to tie into the Amawalk-Shenorock water system with onsite production wells available for backup purposes.

4.2 GEOLOGY

The Baldwin Place Mall is situated in an area of southeastern New York comprised of two distinct petrologic provinces. The first petrologic province constitutes the Precambrian metamorphic rocks of the Hudson Highlands and the second province comprises the metamorphic rocks of the Manhattan Prong. The Hudson Highland group of metamorphic rocks are considered as a northeast extension of the Reading Prong and of the New Jersey Highlands (Prucha, J.J. et al., 1968). The metamorphic rocks of the Manhattan Prong occur to the southeast of the Hudson Highlands and are separated from the Hudson Highlands by a high-angle reverse fault (The Highlands Border Fault). The BPM site is located in the Hudson Highlands.

The areas underlain by the Hudson Highland rocks are generally characterized by greater relief in contrast to the areas underlain by Manhattan Prong rocks. In general, the highest hills and ridges are underlain by gneiss and granite, intermediate elevations by schist and the valleys by marble. The topography of the entire region has been further modified by Pleistocene glaciation. Generally the glacial cover is thinnest along the higher elevations and thickens in the valleys.

4.2.1 Regional Bedrock Stratigraphy and Structure

The rocks of the Hudson Highlands include various gneiss, marble, granites and granodiorite. The Hudson Highland group of rocks were initially deposited as sandstone, shales, and limestones within a shallow sea and later underwent metamorphism by a least three deformational events dating back to the Precambrian. To the southeast of the Hudson Highlands, the Manhattan Prong is comprised of the New York City Group of metamorphic rocks consisting of the Fordham Gneiss, the Inwood Marble, and the Manhattan Formation. The Fordham Gneiss consists of a coarsely banded hornblende biotite quartz plagioclase gneiss. The Inwood Marble is a white to grey, medium to coarse grained rock ranging in composition from calcite to nearly pure dolomite and the Manhattan Formation is dominantly a garnetiferous quartz biotite plagioclase gneiss (Prucha J. J. et al., 1968).

The age of the New York City Group of rocks of the Manhattan Prong is not definitely established but is thought to range from Precambrian to early Paleozoic. The Fordham Gneiss is generally considered to be the basal formation of the New York City Group.

The rocks of the Hudson Highlands and the Manhattan Prong have complex histories of repeated intense deformation and metamorphism. The rocks of the Hudson Highlands are moderately to strongly foliated consisting of parallel platy and elongate mineral grains. These foliations are produced by interlayering of beds of different mineral composition and the parallelism by regional stresses during deformation. The repeated episodes of deformation have resulted in intensive metamorphism and a complex series of northeast-plunging isoclinal folds.

4.2.2 Unconsolidated Glacial Deposits

The region is covered by a mantle of Pleistocene glacial materials consisting primarily of till. Glacial till comprises a heterogeneous mixture of clay, silt, sand, and boulders. The till within the region is thinnest on hilltops and ridges, thickens on bedrock slopes, and attains its maximum thickness within the valleys. In addition to the till deposits, stratified sand and gravel deposits are present in the region along streams and major river valleys such as the Peekskill Hollow Creek, Canopus Creek, the Croton River, Chappaqua Brook, the Byram and Wampus Rivers, and the Mianus River. Glacial terraces are reportedly present along the banks of the Peekskill Hollow Creek, Canopus Creek and the Annsville Brook (Westchester County 208 Study, 1977).

4.2.3 Onsite Geology

The BPM site is located on a relative topographic high at approximately 600 feet above mean sea level. The land surface on the BPM is relatively flat and there is a rise in elevation to the north of the property. The results of the drilling program indicate that the stratigraphy beneath the site consists of Hudson Highland granitic-gneiss bedrock overlain by glacial till deposits. The bedrock geology, as described from hand specimens, drill cuttings and bedrock cores, consists of granitic gneiss with mineral assemblages of biotite mica, hornblende, quartz, and white to pink feldspars. This petrology is consistent with published geologic reports for the area (Prucha J. J. et al., 1968). The Westchester County 208 Study (1977) noted a geologic contact between the biotite granitic gneiss of the New York City Group with Hudson Highland rocks just south/southeast of the site, trending approximately North 20 degrees East. The position of the New York City Group of rocks against the Hudson Highland rocks in this area could not be confirmed.

The bedrock profile consists of a zone of intense weathering (residuum) underlain by less weathered bedrock materials which are in turn underlain by competent bedrock. The overlying glacial till deposits consist of a heterogeneous mixture of clay, silt, sand, gravel and boulders. These till materials were found to be thinnest over the western area of the site where depths to bedrock are relatively shallow and thicken to the east where the depths to bedrock reach the maximum onsite depth. Figure 4-6 is a contour map showing the configuration of the partially weathered bedrock surface. In order to visualize the onsite geology, three cross sections were prepared as shown on Figures 4-3, 4-4 and 4-5. The lines of section are shown on Figure 4-2.

Geologic Cross Section A - A' (Figure 4-3) is constructed with a northwest to southeast orientation through Monitoring Wells MW-9D, MW-10D, and Production Well PW-2. This profile demonstrates the increasing thickness of the glacial till materials toward the east-southeast. At the MW-9D location, unconsolidated till materials were observed to a depth of approximately 6 feet bgs. Highly weathered gneiss materials were observed below the till to approximately 12 feet bgs underlain by partially weathered bedrock to approximately 35 feet bgs. Competent bedrock was observed below this depth. The depth to the top of highly weathered bedrock (thickness of unconsolidated till materials) at the MW-10D location is approximately 24.5 feet bgs. Again, to the southeast toward PW-2, the thickness of the till materials increases.

Geologic Cross Section B - B' (Figure 4-4) is constructed with a general west to east orientation through Monitoring Wells MW-9D, MW-1D, MW-7D, MW-5D, and MW-3DD. The geologic profile through MW-9D and MW-1D indicates the relatively shallow depths to bedrock in the western site areas. The thickness of the unconsolidated glacial till materials at the MW-9D and the MW-1D locations is similar; approximately 6 feet. The thickness of highly weathered bedrock materials (residuum) increases toward the MW-1D location (northeast). The geologic profile towards the east through Monitoring Wells MW-7D, MW-5D, and MW-3DD, also depicts the increasing thickness of the glacial till materials and the increasing depth to competent bedrock. A maximum till thickness of approximately 80 feet was observed during the drilling of MW-3DD. The highly weathered (decomposed) and partially weathered bedrock is on the order of 15 to 30 feet thick.

Geologic Cross Section C - C' (Figure 4-5) is oriented in a north to south direction through Monitoring Wells MW-4D, MW-5D, and Production Well PW-1 over the eastern portion of the BPM property. The thickness of the glacial till is approximately 47 feet at the MW-4D location and increases to the south-southeast through the MW-5D location (approximately 55 feet) toward PW-1. From north to south, the depth to weathered and competent bedrock likewise increases.

Table 3-6 summarizes depths to fractures and groundwater blow-out yields that were recorded during drilling. Within the western site area where a relatively thin cover of glacial till materials is present (MW-9S/9D, MW-1S/1D, and MW-10S/10D), groundwater blowout yields measured within the partially weathered bedrock ranged from less than 1 to 9 gpm. Blowout yields generally increased with depth due to the cumulative contribution of groundwater through fractures and relatively friable intervals. Once the well casing was installed and grouted at 60 feet bgs in these wells, the blowout yields decreased and ranged from less than 1 to 1.5 gpm. Bedrock blowout yields were measured at less than 1 gpm in the monitoring wells within the eastern area of the site (MW-5D and MW-7D) where the glacial till materials are thicker.

4.3 HYDROGEOLOGY

4.3.1 Nature and Occurrence of Groundwater

The BPM site is underlain by three principal water-bearing units: glacial till, weathered bedrock and bedrock.

Glacial Till: The glacial till is the uppermost water-bearing unit over most of the site area. Although present over the extreme western and northwestern portion of the site (MW-1S/1D and MW-9S/9D), the bottom of the glacial till lies near the top of the water table in this area. The saturated glacial till materials range in thickness from less than 1 foot in the northwest to as much as 76 feet in the southeast site area. The thickness of the glacial till materials increases to the east/southeast of the BPM as indicated from residential well records for Meadow Park Road and for wells further to the southeast (State of New York Department of Conservation Water Power and Control Commission, 1955). The depth to the top of the zone of saturation (groundwater) in the till materials ranges from less than 2 feet bgs in the eastern site area (MW-6S) to as much as 6 to 7 feet bgs in the topographically higher northeastern site area (MW-8S). Recharge to the glacial till materials is principally from the infiltration of precipitation.

Groundwater in the glacial till occurs in intergranular pore spaces. The till serves to recharge the underlying weathered bedrock and fractured bedrock units as evidenced by the higher water-level elevations (heads) in the till materials as compared to those in the underlying weathered bedrock and bedrock units in Monitoring Well Clusters MW-2S/2D, MW-3S/3D, MW-4S/4D, MW-5S/5D and MW-7S/7D.

Weathered Bedrock: Directly underlying the glacial till materials is highly weathered (decomposed) bedrock which is on the order of five feet thick. Groundwater occurs in intergranular pore spaces/openings in the decomposed bedrock. As is common in a weathered bedrock setting, there is a transition from decomposed bedrock to more competent bedrock. As such, the geologic cross-sections indicate the depth to and thickness of a decomposed and also a partially weathered bedrock horizon. Groundwater circulation is significant in the highly and partially weathered bedrock horizons as indicated by water strikes and yields during drilling (Table 3-6 and Figures 4-3, 4-4 and 4-5), and from iron staining on rock cuttings indicative of groundwater circulation.

Bedrock: The depth to competent bedrock ranges from 35 feet bgs on the western portion of the site (MW-9S/9D) to about 100 feet bgs in the east/southeast (MW-3DD). Groundwater occurs in fracture and joint openings in the bedrock and was also observed to occur in friable intervals of biotite and feldspars. The yield of individual wells is dependent on the number and intensity of fracture openings encountered. Table 3-6 provides a summary of fracture intervals encountered during the drilling of the bedrock monitoring wells and relative yields measured during the drilling process.

The weathered bedrock and bedrock systems are unconfined over the extreme western and northwestern portion of the site (MW-9S/9D and MW-1S/1D), and are overlain by the glacial till water-bearing unit over the main body of the site.

4.3.2 Groundwater Flow Conditions

The RI included a characterization of onsite groundwater flow for the following conditions:

(1) June 8, 1993: Normal operation of BPM production wells at approximately 3.8 gpm.

(2) June 28, 1993: Following shutdown of the BPM production wells for approximately 2 weeks.

(3) June 30, 1993: After BPM Production Well PW-1 had been operative for 42 hours at a sustained pumping rate of 39 gpm.

In addition, one water-level measurement event included selected residential and commercial wells in the site vicinity, to develop a picture of deeper (bedrock) regional groundwater flow conditions (August 18, 1993).

4.3.2.1 Onsite Shallow Groundwater Flow Conditions

The shallow water-level contour maps were developed from water-level measurements made in the onsite shallow monitoring well network. These shallow wells are completed in unconsolidated glacial till deposits (MW-2S, MW-3S, MW-4S, MW-5S, MW-6S, MW-7S and MW-8S) over the main body of the site, and in shallow weathered bedrock (MW-1S, MW-9S and MW-10S) over the west/northwest portion of the site.

The June 8 and June 28, 1993 shallow water-level contour maps (Figures 4-7 and 4-8) show very similar shallow flow conditions under normal BPM production well pumping and non-pumping conditions. The northeast portion of the site (MW-4S and MW-8S vicinity) is upgradient of the site and flow from this northeast portion is to the west/southwest. A groundwater divide is evident, oriented in a northeast to southwest direction, just south of the mall building and proximate to the dry cleaners. The contours indicate a shallow groundwater flow component from the identified source area behind the dry cleaners to the west toward MW-9S. Likewise, there is a shallow groundwater flow component from the divide to the southeast.

The location of the groundwater divide is much nearer to the eastern stream than to the western stream, indicating that the western stream has a more pronounced influence on shallow groundwater flow than the eastern stream. This is likely due to the greater topographic relief to the west of the site as compared with that to the east. There is an approximate 30 to 50 foot difference in elevation between the eastern and western streams.

Water-level elevations within the northern portion of the eastern stream where it enters the site indicate losing conditions within the stream to the groundwater system. Water levels at Staff Gauge SG-1 have consistently been several feet higher than water levels in proximate Monitoring Well MW-8S. For much of the year, the eastern stream is in transition from a losing to gaining stream between SG-1 and SG-2; during measurement events in June and July 1993, the eastern stream was dry at SG-2 with flow beginning just downgradient.

Figure 4-9 depicts shallow water levels measured on June 30, 1993 after BPM Production Well PW-1 had been pumping at a continuous rate of 39 GPM for 42 hours. A companion map (Figure 4-10) shows the magnitude of water-level changes on this date from the June 28, 1993 pre-pumping static water-levels. Given the distribution of water levels over the western portion of the site (MW-1S, MW-2S, MW-9S and MW-10S), it was not possible with any degree of certainty to construct shallow water-level contours over this portion of the site. It appears that the sustained pumping of PW-1 influenced (drew down) water levels in shallow wells completed in weathered bedrock (especially in MW-9S and MW-10S) more than water levels in shallow wells completed in glacial till (MW-7S) as shown on Figure 4-10. This suggests that sustained pumping of PW-1 (beyond the 2-day test period) may in fact begin to capture shallow groundwater in the weathered bedrock over the western portion of the site.

4.3.2.2 Onsite Deeper Groundwater Flow Conditions

The deeper water-level contour maps were developed from water-level measurements in the onsite deeper monitoring well network. These deeper monitoring wells are completed in weathered bedrock (MW-2D, MW-3D and MW-5D) and in competent bedrock (MW-1D, MW-3DD, MW-4D, MW-7D, MW-9D and MW-10D). Water-level data from MW-1D were not used in preparation of the deeper water-level contour maps as the water level in this well appeared to take many weeks/months to recover after sampling and the well is completed in an interval of very tight bedrock.

The June 8, 1993 water-level contour map (Figure 4-11) depicts deeper groundwater flow conditions under normal BPM production well operation. The water-level contour configuration and flow lines indicate that the two BPM production wells are capturing deeper groundwater over a portion of the site, with a component of flow to the southeast.

The June 28, 1993 water-level contour maps (Figures 4-12 and 4-13) depict two interpretations of deeper groundwater flow conditions after the two BPM production wells had been shut down for almost two weeks. The first map (Figure 4-12) provides a strict interpretation of the data with a principal deeper groundwater flow direction to the southeast. The second map (Figure 4-13) takes into consideration the higher water-level elevation (head) in MW-2D as compared to those in MW-9D and MW-10D. The water-level elevation data for these three wells point to the presence of a southwest-to-northeast oriented groundwater divide as shown on Figure 4-13. This interpretation indicates that there is a deeper groundwater flow component to the northwest from this divide as well as to the southeast. The deeper water-level contour configuration on Figure 4-13 is similar to the June 8 and June 28, 1993 contour maps for the shallow groundwater. This configuration is reasonable given the presence of the pronounced western stream valley to the northwest and the significant elevation difference between this stream valley and the western portion of the site. The regional water-level contour map (Section 4.3.2.4, Figure 4-16) provides confirmation of the presence of a deeper groundwater divide onsite under non-pumping conditions.

The June 30, 1993 water-level contour map (Figure 4-14) depicts deeper groundwater flow conditions after BPM Production Well PW-1 had been pumping for 42 hours at a continuous rate of 39 gpm. The flow lines from both the east and west sides of the site are toward the pumping well. This water-level map clearly indicates that PW-1 is effectively capturing deeper groundwater on the site. Theoretical capture zones were also determined for PW-1 pumping at a rate of 39 gpm and are shown on Figure 4-15. The actual and theoretical capture zones show a reasonable correlation.

In summary, groundwater flow systems in areas underlain by shallow glacial/crystalline bedrock materials are generally local flow systems wherein local topographic high areas behave as groundwater recharge areas and local topographic low areas behave as groundwater discharge areas. Local groundwater flow systems are generally limited to small drainage basins where the depth of groundwater circulation is quite shallow and short flow paths exist.

As discussed in Section 4.1.1, the BPM is located in a relative topographic high area with surface drainage to a north-to-south flowing stream system (eastern steam) and a south-to-north flowing stream system (western stream). Absent pumping stresses, natural groundwater flow in both the shallow glacial till/weathered bedrock and deeper bedrock should be to the southeast and northwest with a groundwater divide on the site proximate to the topographic high area. The shallow water-level contour maps clearly show the presence of such a divide under normal pumping and non-pumping conditions on June 8 and June 28, 1993.

The deeper water-level contour maps for June 8, 1993 (normal BPM production well pumping operations) and June 30, 1993 (sustained pumping of PW-1) do not show a groundwater divide for deeper flow due to the overriding influence of the BPM production well pumping. Figure 4-13 for June 28, 1993 (BPM wells shutdown for two weeks) shows the presence of a divide with deeper groundwater flow to the southeast and west/northwest towards the two stream drainages (eastern and western streams).

4.3.2.3 Onsite Vertical Groundwater Flow Conditions

The water-level measurement data from the three synoptic measurement events (June 8, June 28 and June 30, 1993) indicate that the water-level elevations (heads) in shallow wells completed in the shallow glacial till materials are higher than water-level elevations (heads) in coupled wells completed in the underlying weathered bedrock and bedrock units. This water-level elevation difference indicates that a vertical (downward) component to groundwater flow is present over the portion of the site wherein saturated glacial till materials overlie the bedrock. As shown on the table below, this downward component to flow is more pronounced in well clusters south and east of the mall building (MW-2S/2D, MW-3S/3D and MW-5S/5D) as compared to well clusters north and west of the mall building (MW-4S/4D and MW-7S/7D).

WATER LEVEL ELEVATIONS IN FEET MSL

Well Cluster	June 8, 1993 (Normal BPM Well Pumping)	June 28, 1993 (BPM Wells Off)	June 30, 1993 (Sustained BPM Well Pumping)
Glacial Till/Weathered Bedrock Clusters South and East of Mall			
MW-2S	599.89	599.56	599.11
MW-2D	584.85	589.88	583.77
difference	-15.04	-9.68	-15.34
MW-3S	598.42	598.19	598.41
MW-3D	585.55	590.43	584.87
difference	-12.87	-7.76	-13.54
MW-5S	599.89	599.22	599.35
MW-5D	586.97	591.11	586.27
difference	-12.92	-8.11	-13.08
Glacial Till/Bedrock Clusters North and West of Mall			
MW-4S	604.22	603.06	602.93
MW-4D	602.00	601.33	601.14
difference	-2.22	-1.73	-1.79
MW-7S	594.37	593.73	593.56
MW-7D	592.16	592.03	591.43
difference	-2.21	-1.70	-2.13

In contrast, as shown on the table below, the downward vertical head differentials are less for the monitoring well clusters completed in weathered bedrock/bedrock (MW-9S/9D and MW-10S/10D).

WATER LEVEL ELEVATIONS IN FEET MSL

Well Cluster	June 8, 1993 (Normal BPM Well Pumping)	June 28, 1993 (BPM Wells Off)	June 30, 1993 (Sustained BPM Well Pumping)
Weathered Bedrock/Bedrock Clusters			
MW-9S	590.13	589.60	589.29
MW-9D	589.70	588.98	588.70
difference	-0.43	-0.62	-0.59
MW-10S	590.12	589.80	589.09
MW-10D	588.51	588.59	587.50
difference	-1.61	-1.21	-1.59

The less significant downward head differentials for coupled wells completed in weathered bedrock/bedrock horizons as compared to coupled wells completed in glacial till/weathered bedrock or bedrock indicates that flow in the bedrock unit on the western part of the site (unencumbered by a saturated lower permeability glacial till) has less of a downward flow component.

Figure 4-17 is a vertical flow net along Cross Section B - B' for June 28, 1993. This figure demonstrates the vertical nature of groundwater flow from the glacial till to weathered bedrock unit on the southeastern portion of the site and the more horizontal nature of groundwater flow, particularly in the weathered bedrock unit, over the western portion of the site where saturated glacial till is thin to absent.

The sustained pumping of BPM production well PW-1 (June 28 to 30, 1993) resulted in a significant increase in water-level elevation (head) differential for the three glacial till/weathered bedrock clusters south and east of the mall (MW-2S/2D, MW-3S/3D and MW-5S/5D); a minor increase in water-level elevation differential for the glacial till/bedrock clusters north and west of the mall (MW-4S/4D and MW-7S/7D); and in no change to little increase in water-level elevation differential for the two weathered bedrock/bedrock clusters to the west (MW-9S/9D and MW-10S/10D). The increase is sharpest in MW-2S/2D, MW-3S/3D and MW-5S/5D because while water levels in the deeper weathered bedrock wells declined about 5 to 6 feet, the water levels in the shallow glacial till wells remained unaffected. In contrast, in the MW-9S/9D and MW-10S/10D clusters, the water level declines in both the shallow and deeper wells were of similar magnitude.

Finally, the water-level data from the MW-3D/3DD cluster demonstrate that the BPM production wells influence water level elevations in the weathered bedrock more than in deeper competent bedrock:

WATER LEVEL ELEVATIONS IN FEET MSL

Well Cluster	June 8, 1993 (Normal BPM Well Pumping)	June 28, 1993 (BPM Wells Off)	June 30, 1993 (Sustained BPM Well Pumping)
Weathered Bedrock/Deep Bedrock Cluster			
MW-3D	585.55	590.43	584.87
MW-3DD	589.64	590.13	588.63
difference	+4.09	-0.30	+3.76

On June 8, 1993, the water-level elevations in this cluster show an upward vertical flow component; on June 28, 1993 after the BPM wells had been off for two weeks, a slight downward vertical flow component; and on June 30, 1993 after two days of sustained pumping, the return of an upward flow component. This is because the water-level response to pumping in MW-3D is more pronounced than in MW-3DD and indicates that the BPM wells are producing water primarily from the weathered bedrock horizon.

4.3.2.4 Regional Groundwater Flow Conditions

The August 18, 1993 water-level measurements made in the deeper onsite monitoring wells and proximate residential (Meadow Park Road) and commercial (Route 6) wells were used to develop a regional water-level contour map for the bedrock system (Figure 4-16). The BPM production wells were not actively pumping during the period of measurement; however this was not during a sustained period of shutdown.

The regional water-level configuration and contours confirm the presence of a deeper groundwater divide onsite. This is because of lower water-level elevations (non-pumping) within wells along Meadow Park Road and also within wells along Route 6 relative to onsite water-level elevations. For example, water-level elevations in deeper western onsite wells MW-9D and MW-10D are respectively 587.61 and 586.20 feet msl, as compared to a 531.44 feet msl water-level elevation in Route 6 well CW-23; this represents a 56-foot difference. Water-level elevations in deeper eastern onsite wells (589.79 feet msl in MW-5D and 589.16 in MW-3D) were also higher than water-level elevations in Meadow Park Road residential wells (e.g., 576.42 feet msl in RW-05; 576.76 in RW-09 and 561.18 in RW-12).

4.3.3 Surface Water

The BPM site drains to two small stream systems discussed in Section 4.1.1; an eastern stream and a western stream. The eastern stream heads just north of Route 118 and flows to the south parallel to the site's eastern boundary. This stream has been split into two channels by the abandoned railroad embankment. Near Staff Gauge SG-2, water from the channel to the east flows under a bridged section of the embankment and joins the channel nearest to the BPM. Both channels flow through a series of man-made ponds in the Meadow Park Road residential area prior to the stream's confluence with the Muscoot River about one mile south of the site.

As discussed in Section 4.3.2.1, the eastern stream is a losing stream between SG-1 and SG-2. This condition has been documented by: (1) a comparison of the water-level elevation in the stream (at SG-1) with the water-level elevation in proximate monitoring well MW-8S, and (2) stream flow measurements. Water-level elevations in SG-1 have been at least 7 feet higher than water-level elevations in MW-8S. Stream flow measurements made on June 8, 1993 indicated flows of 4.5 gpm at SG-1 and 1.5 gpm at SG-2; which is a net loss in flow of 3 gpm.

The western stream heads just south of the site, is diverted under the mall by a drainage system, and empties into a steep ravine just north of Route 6 near McDonalds and the Exxon station. Upon entering the ravine north of Route 6, the stream drains through a valley that is bounded by rising topography to the north/northeast and west (ridge on Mahopac Avenue). Shortly north of Route 6, the western stream is joined by a drainage channel to the east (Figure 4-1) that receives runoff from the area to the northeast of the Baldwin Place intersection. The western stream flows through two small ponds prior to entering Lake Baldwin. Lake Baldwin empties into a drainage that feeds into the Muscoot River which flows north to south approximately 3,500 feet from where the western stream crosses under Route 6.

A small drainage pathway on the south side of Route 6 and west of McDonalds conveys surface runoff from the area west of McDonalds to a culvert that passes under Route 6 just east of the Texaco (former Sunoco) station and ultimately empties into Kennard Pond that feeds into Lake Baldwin (see Figure 3-7). Seepage from the hillside directly west of McDonalds has been noted (less than 0.1 gpm) and serves as a source of flow in this drainageway.

4.3.4 Summary

The BPM site is located in a relative topographic high area, and drains to two stream systems (the eastern and western streams). Both of these streams head near the site, thus have very small drainage areas in the vicinity of the site, and are tributary to the Muscoot river. The western stream valley comprises the most significant topographic feature in the study area.

Water supply in the immediate site area is derived from groundwater. The BPM and Mahopac Village Center mall are supplied by centralized production well systems with appropriate treatment. The nearest public supply system is the Lake Baldwin system located about 1,800 feet from the western site boundary. No treatment has been necessary for this system. The remaining residences and commercial establishments rely on individual wells for supply purposes. At least sixteen of these wells are equipped with treatment systems.

The site and area are underlain by glacial till, weathered bedrock and bedrock. The glacial till comprises the uppermost geologic and water-bearing unit. The till is very thin near the western and northwestern site boundaries and thickens to the south/southeast. The saturated glacial till materials range in thickness from less than 1 foot in the northwest to as much as 76 feet in the southeast site area.

The weathered bedrock materials are approximately 15 to 30 feet thick and there is a gradation from highly weathered (decomposed) bedrock to competent bedrock in this interval. Groundwater circulation appears to be significant in the weathered and partially weathered horizon based on water strikes during drilling and iron staining on rock cuttings indicative of water circulation. The depth to competent bedrock (biotite gneiss) ranges from 35 feet bgs in the western part of the site (MW-9S/9D) to about 100 feet bgs in the east/southeast (MW-3DD).

The weathered bedrock and bedrock systems are unconfined over the extreme western and northwestern portion of the site (MW-1S/1D and MW-9S/9D), and are overlain /confined over the main body of the site by the glacial till water-bearing unit.

Water-level measurements made in the shallow monitoring well network indicate the presence of an onsite groundwater divide oriented in a southwest to northeast direction in the vicinity of the main mall building (and dry cleaners). This divide is evident under normal BPM pumping conditions (3.8 gpm), and also when the mall wells have been shut down for an extended period. Groundwater flow from the divide is to the southeast and west/northwest. The sustained pumping of PW-1 (beyond the two-day test) may begin to capture shallow groundwater in the weathered bedrock over the western portion of the site.

Water-level measurements made in the deeper monitoring well network provide an understanding of the extent to which the BPM production wells serve to capture deeper flow. Under present BPM pumping conditions, the mall wells appear to be capturing groundwater over a portion of the site with a component of groundwater flow to the southeast. Under sustained pumping conditions (two days at 39 gpm), BPM Production Well PW-1 effectively captures deeper groundwater on the site.

The regional water-level contour map for the bedrock system confirms the presence of a deeper groundwater divide onsite under non-pumping conditions with flow components to the southeast and west/northwest. The regional water-level measurements were made during a period when the BPM wells were not actively pumping, but not during a sustained period of shutdown.

Water-level measurement data for glacial till/weathered bedrock clustered wells indicate a significant downward vertical component of groundwater flow in areas where saturated glacial till overlies bedrock. This implies that the saturated glacial till materials serve to recharge the underlying bedrock system. In contrast, the downward vertical head differentials are much lower for monitoring well clusters completed in weathered bedrock/bedrock (MW-9S/9D and MW-10S/10D).

4.4 ANALYSIS OF HYDROGEOLOGIC TESTS

4.4.1 Short-Term Pumping Tests

Short-term pumping tests were conducted on sixteen monitoring wells during the RI field program to develop a preliminary understanding of hydraulic characteristics for the glacial till, weathered bedrock and bedrock systems. The monitoring wells were pumped and water-level drawdown measured while the wells were being evacuated for sampling purposes. The pumping test data were used to calculate individual well specific capacity and where possible to develop estimates of aquifer transmissivity. For many of the monitoring wells, it was not possible to calculate transmissivity due to low well yields, short pumping durations, and the related effects of casing storage.

The initial step in the analysis involved determining the critical time, t_c, after which the water held in storage in the well casing or open borehole has a negligible effect on transmissivity calculation. The following equation (Schafer, 1978) is used to determine t_c:

$$t_c = 0.6\,(d_c^2 - d_p^2)\,/\,Q/s$$

where: t_c = time when casing storage effect becomes negligible (minutes).
d_c = inside diameter of well casing (inches).
d_p = outside diameter of pump column pipe (inches).
Q/s = specific capacity of well at time t_c (gpm/ft).

The calculations for t_c for pumping tests at nine of the monitoring wells (MW-6S, MW-10S, MW-1D, MW-3D, MW-3DD, MW-4D, MW-5D, MW-7D, and MW-9D) indicated that the time at which casing storage effect became negligible exceeded the total time of pumping. The drawdown data for these monitoring wells were therefore influenced by casing storage and transmissivity could not be estimated.

The calculations for t_c for the pumping tests at Monitoring Wells MW-1S, MW-3S, MW-5S, MW-7S, MW-9S, MW-2D and MW-10D) indicated that the total time of pumping was greater than the time at which the storage casing effect became negligible, and as such the drawdown data after the critical time t_c were no longer influenced by casing storage. The water-level drawdown versus time data for the Monitoring Wells MW-9S and MW-7S tests, however, could not be analyzed due to the low pumping rate and little to no change in water-level drawdown after time t_c.

Transmissivity was first calculated for the remaining monitoring wells for which the casing storage effect did not exceed 30 minutes by using the specific capacity data normalized to 30 minutes. An estimate of aquifer transmissivity was derived from the normalized specific capacity data using the empirical equation by Walton (1984):

$$Q/s = T/264 \log (Tt/2693\ r^2S) - 66.1$$

where: Q/s = specific capacity (gpm/ft).
S = storativity (dimensionless)
r = nominal well radius (feet).
t = time of pumping (minutes).
T = transmissivity (gpd/ft).

Transmissivity was also calculated for these wells using the Cooper-Jacob modified non-equilibrium equation (1946):

$$T = \frac{264\ Q}{\text{delta } s}$$

where: T = transmissivity in gallons per day per foot (gpd/ft).
Q = pumping rate (gpm).
Delta s = slope of the time-drawdown plot on semi-log paper over one log cycle of time (feet).

The estimated specific capacity and transmissivity values derived from the short-term pumping tests are presented on Table 4-1. The results for the three systems (glacial till, weathered bedrock and bedrock) indicate that the weathered bedrock wells exhibit the highest 30-minute specific capacities (0.78 gpm/ft average) and transmissivities. The highest specific capacities and transmissivities were for weathered bedrock monitoring wells MW-1S and MW-9S. Specific capacities were lower for wells completed in the overlying glacial till (0.41 gpm/ft average) and even lower for wells completed in the underlying bedrock (0.15 gpm/ft average).

4.4.2 Background Water-Level Data

As described in Section 3.10.3, the background monitoring period began on June 8, 1993 and lasted until June 28, 1993 after which the constant-rate aquifer pumping test began. Initially, background monitoring was conducted in Monitoring Wells MW-10D and MW-7D while the BPM production wells were operating from June 8, 1993 through June 15, 1993. Background monitoring was then conducted in Monitoring Wells MW-10D, MW-3D, MW-3DD, and the two BPM production wells (PW-1 and PW-2) while these wells were not operating from June 16, 1993 until the startup of the constant-rate aquifer pumping test on June 28, 1993. Background monitoring was also continued at MW-5D for a period of 16 days after the conclusion of the constant-rate aquifer pumping test. The depth to water versus time plots for the background monitoring are provided in Appendix L.

The two BPM production wells recorded a total of 16,900 gallons pumped between June 11, 1993 (initial record entry) and June 15, 1993 (last entry prior to the step-drawdown pumping test) as indicated on Table 4-2. A review of the depth to water versus time plots for Monitoring Well MW-10D indicated an approximate 0.40 foot steady decline in the water level in this well from June 8, 1993 to June 10, 1993 followed by an approximate 0.60 foot steady rise of the water level until June 11, 1993. These data may reflect a decline in water-level elevation due to the pumping, and water-level recovery due to the shutdown of pumping, of the BPM production wells.

The background water-level monitoring data at the MW-7D location, collected while the BPM wells were in operation, indicated a cycle of declines and rises in the water level in this well which appear to be in response to the intermittent pumping of PW-1 and PW-2. A decline of approximately 0.13 feet was recorded in the first 24-hours of record followed by a rise of approximately 0.12 feet over the next 24 hours. A similar pattern of water-level decline and rise was recorded in this well through to June 15, 1993 after which a water-level fluctuation of approximately 0.03 feet was recorded until the end of record on June 18, 1993; these last 2 to 3 days (June 16 to 18, 1993) correspond to a period when the BPM production wells were not in use.

The background monitoring plots for the remaining well locations (that were monitored during the time frame when the BPM supply wells were not in operation: June 16, 1993 until the start of the constant-rate aquifer test on June 28, 1993) did not indicate any water-level fluctuations due to other nearby pumping stresses in the vicinity of the BPM site.

Water levels in the two BPM production wells showed an overall rise in water levels during the period of background monitoring (June 16, 1993 to June 28, 1993). The initial water level rise in PW-1 and PW-2 from June 16, 1993 to June 17, 1993 was in response to the shutdown of PW-1 on June 15, 1993. The 2.5 foot and 1.7 foot rise in the water levels in PW-1 and PW-2, respectively from June 18, 1993 to June 19, 1993 was in response to water-level recovery following the end of the step-drawdown pumping test on June 18, 1993. The background monitoring at the PW-2 location was terminated on June 19, 1993 as the transducer wire was cut/vandalized. The transducer in this well was replaced on June 28, 1993 prior to starting the constant-rate aquifer pumping test.

The background monitoring data at the MW-10D, MW-3D, and MW-3DD locations indicated maximum water-level fluctuations of approximately 0.25 feet, 0.50 feet, and 1.40 feet, respectively, during the background monitoring period from June 18, 1993 through June 28, 1993.

Monitoring at the MW-5D location continued after the constant-rate aquifer pumping test had ended on June 30, 1993 and continued through July 16, 1993. The initial rise of the water level in this well (from July 1 through July 4, 1993) was in response to the end of the 48-hour pumping test on PW-1. The remaining record for MW-5D indicated water-level fluctuations of less than 0.50 feet.

4.4.3 Step-Drawdown Pumping Test

The step-drawdown pumping test on BPM Production Well PW-1 was conducted on June 18, 1993. During this test, PW-1 was pumped at three successively decreasing rates: 39, 32 and 22 gpm.

The step-drawdown pumping test data were analyzed by a graphical method developed by Bruin and Hudson (1955). The observed drawdown (s_W) in the pumping well PW-1 was plotted against the corresponding time (t) for each pumping step on semi-logarithmic graph paper (Appendix L). The curve through the plotted data for each step was then extrapolated to the end of the next step in the test. The incremental drawdown (delta s), the difference between the drawdown at the end of a given step and the extrapolated drawdown for the preceeding step, was determined for each step. The ratio s_w/Q_n (where Q_n = individual step pumping rate) was then calculated. The data derived from the PW-1 step test are summarized below:

Step	Q_n (gpm)	Delta s (ft)	s_w (ft)	Q/s_w (gpm/ft)	s_w/Q (ft/gpm)
1	39	62.90	62.90	0.62	1.61
2	32	14.00	48.90	0.65	1.53
3	22	18.00	30.90	0.71	1.40

The calculated values of s_w/Q_n versus the corresponding values of Q_n were plotted on arithmetic graph paper. The straight line plot through the data was used to derive values of the aquifer loss constant (B) and the well loss constant (C). These data were then used to estimate the aquifer loss and well loss components of drawdown for each of the three pumping steps.

Table 4-3 provides a summary of the step-drawdown pumping test analysis and notes the magnitude of drawdown as a result of aquifer loss (BQ) and well loss (CQ^2) for each step. Analysis of the test data indicated that Production Well PW-1 can sustain a yield of 39 gpm (the maximum pump capacity) with 30 to 40 feet of remaining available drawdown.

4.4.4 Constant-Rate Aquifer Pumping Test

The drawdown phase of the aquifer pumping test began at 2:30 pm on June 28, 1993 and lasted for 48 hours until 2:30 pm on June 30, 1993. As described in Section 3.10.4, water-level data from the wells were collected utilizing both pressure transducers and hand held water-level indicators. Pumping was held constant at 39 gpm for the duration of the test.

Once the pump was shut down on June 30, 1993, water-level recovery measurements were initiated for approximately 8 hours with the water-level indicators and for approximately 20 hours with the pressure transducers. During the drawdown and recovery periods, no precipitation was recorded at the site.

The water-level drawdown and recovery data from the 48-hour pumping test were analyzed to determine aquifer hydraulic characteristics (transmissivity and storativity) for the bedrock aquifer underlying the BPM site and vertical permeability of the confining unit (glacial till). Water-level contour maps were prepared for the two synoptic rounds of water-level measurements collected during the test after 1440 minutes (24 hours) and 2520 minutes (42 hours) of pumping. In addition, actual and theoretical capture zones were derived for BPM Production Well PW-1 (Figures 4-14 and 4-15).

Logarithmic and semi-logarithmic plots of water-level drawdown versus time were used to determine aquifer hydraulic characteristics using appropriate analytical models. These data plots are provided in Appendix L.

The water-level drawdown data were analyzed by the following analytical methods: the Theis Non-Equilibrium Method (1935); the Non-Equilibrium Leaky Artesian Analytical Method (Hantush and Jacob, 1955); and the Cooper-Jacob Modified Non-Equilibrium Method (1946). Correction of the water-level drawdown data for external influences were not deemed necessary given the absence of precipitation during the test.

The water-level drawdown response (log-log plots) for Monitoring Wells MW-3D, MW-5D and MW-2D showed a departure from the Theis type curve indicative of leaky artesian conditions. These test data were analyzed by the Hantush-Jacob Leaky Artesian Method.

The water-level drawdown data for MW-3DD (deeper bedrock monitoring well) and PW-2 showed a reasonable fit to the Theis type curve and were analyzed by the Theis method. The MW-10D water-level drawdown data, while showing a reasonable fit to the Theis type curve, had much less of a drawdown response than in wells at a comparable distance from PW-1 (MW-2D, MW-3D and MW-5D). Shallow monitoring well MW-5S showed essentially no response to the pumping of PW-1 over the 48-hour period.

The Cooper-Jacob method was also used to analyze data from the pumping well and observation wells. Before applying the Cooper-Jacob method to the pumping well (PW-1), the critical time (t_c) when casing storage became negligible was determined to be 30 minutes (Shaffer, 1978). In addition, the time at which the Cooper-Jacob method is valid was also determined for each observation well. The results of these analyses are provided on Table 4-6; the Cooper-Jacob method could only be applied to PW-1 and PW-2.

Leaky Artesian Analytical Method Analysis

The geologic logs and cross sections (Figures 4-3, 4-4 and 4-5) indicate that the weathered bedrock and bedrock systems are overlain by a confining bed (glacial till) over most of the site. The presence of higher heads (water-level elevations) in shallow monitoring wells completed in glacial till as compared to lower heads (water-level elevations) in weathered bedrock and bedrock monitoring wells indicates that the glacial till confining bed serves as a source bed for water to the underlying weathered bedrock/bedrock aquifer. In that the water-level drawdown response for monitoring wells MW-2D, MW-3D and MW-5D showed a departure from the Theis type curve indicative of leakage, the data for these wells were analyzed by a leaky artesian method.

Hantush and Jacob (1955) developed a family of type curves to take into account leakage from an overlying confining bed (source bed) to an underlying semi-confined aquifer. Applying the type curve matching method involves superimposing the type curves on the log-log plot of water-level drawdown versus time while keeping the coordinate axes parallel, and adjusting the type curves until a position is found where much of the plotted water-level drawdown data fall on one of the type curves. An arbitrary match point is then selected on the two overlapping curves and the values for W(u,r/B), u (or 1/u), s, and t are noted. These data are then substituted into the equation outlined below to calculate transmissivity:

$$T = \frac{114.6\,Q}{s}\,W(u,r/B)$$

where: s = drawdown at any point in the vicinity of a well discharging at a constant rate (feet).

T = aquifer transmissivity (gpd/ft).

Q = pumping rate (gpm).

W(u,r/B) = "Well function" for leaky artesian aquifer (dimensionless).

Storativity was calculated from the equation:

$$S = \frac{T\,u\,t}{1.87\,r^2}$$

where: r = distance from the pumped well to the observation well where drawdown is measured (feet).

S = storativity (dimensionless).

t = time since pumping started (days).

The hydraulic conductivity (permeability) of the confining unit can then be calculated with the following equation:

$$P'/M' = T(r/B)^2/r^2$$

where: P' = vertical permeability of the overlying confining unit (gpd/ft^2).

M' = saturated confining unit thickness (feet).

Table 4-4 provides a summary of the aquifer hydraulic characteristics determined for observation wells MW-2D, MW-3D, and MW-5D using the Hantush-Jacob (1955) analytical method. Transmissivity is in the range from 1,000 to 1,500 gpd/ft. Storativity is fairly similar for the three wells (1.7×10^{-4} to 6.3×10^{-4}) as is the vertical permeability of the glacial till confining bed (0.043 to 0.050 gpd/ft^2).

Theis Non-Equilibrium Method Analysis

An examination of the water-level drawdown versus time data for observation wells PW-2, MW-3DD and MW-10D indicates a close relationship to the theoretical type curve developed by Theis (1935). Applying the Theis type curve matching method involves superimposing the type curve developed by Theis (1935) on the log-log plot of water-level drawdown versus time while keeping the coordinate axis parallel, and adjusting the type curve until a position is found where much of the plotted water-level drawdown data fall on the type curve. An arbitrary match point is then selected on the two overlapping curves and the values for W(u), u, s, and t are noted. These data are then substituted into the equations below to calculate transmissivity and storativity.

$$T = \frac{114.6\,Q}{s}\,W(u)$$

where: s = drawdown at any point in the vicinity of a well discharging at a constant rate (feet).

T = aquifer transmissivity (gpd/ft).

Q = pumping rate (gpm).

W(u) = "Well function of u".

Storativity was calculated from the equation:

$$S = \frac{T\,u\,t}{1.87\,r^2}$$

where: r = distance from the pumped well to the observation well where drawdown is measured (feet).

S = storativity (dimensionless).

t = time since pumping started (days).

The data for the values of W(u), u, s, and t derived from observation wells PW-2 and MW-3DD, and the calculated values for aquifer transmissivity and storativity are provided in Table 4-5. Aquifer transmissivity was 745 gpd/ft for PW-2 and 2,352 gpd/ft for MW-3DD. Storativity for PW-2 was 6.6×10^{-4} and 2.5×10^{-3} for MW-3DD.

The drawdown response for MW-10D and the two other bedrock monitoring wells to the north of the mall (MW-7D and MW-9D) was less than for wells to the south of the mall (MW-2D, MW-3D and MW-5D) indicating a lesser degree of hydraulic connection to the north. As such, the calculated transmissivity for MW-10D was apparent (not representative) and reflects a somewhat lesser degree of hydraulic connection and concomittant drawdown response over the area proximate to this well. The water-level drawdown response in MW-3DD was much less than in MW-3D indicating that the weathered zone (MW-3D screened interval) has a more pronounced hydraulic connection to PW-1 than the deeper bedrock (MW-3DD open-hole interval).

<u>Cooper-Jacob Modified Non-Equilibrium Method Analysis</u>

Cooper and Jacob (1946) developed a method of analysis based on the Theis non-equilibrium equations. The Cooper-Jacob method is a straight-line method which can be applied when the values of u are small (less than 0.05). Applying the Cooper-Jacob method involves plotting the water-level drawdown data on semi-logarithmic graph paper with time (t) on the logarithmic scale. The difference in drawdown over one log cycle is then determined and substituted into the following equation to determine aquifer transmissivity (T):

$$T = \frac{264\ Q}{\text{delta } s}$$

where: Q = pumping rate (gpm).
T = transmissivity (gpd/ft)
delta s = the difference in drawdown over one log cycle (feet).

Storativity (S) is determined from the data in an observation well by substituting the calculated transmissivity, and the time at which the straight line intercepts the time axis where drawdown equals 0 into the following equation:

$$S = \frac{0.3\,T\,t}{r^2}$$

where: S = storativity (dimensionless).
r = distance from a pumped well to an observation well (feet).
t = time at which drawdown is zero (days).

The aquifer characteristics derived using the Cooper-Jacob modified non-equilibrium method are summarized on Table 4-6. Transmissivity was 940 gpd/ft for PW-1 and 760 gpd/ft for PW-2. Storativity for PW-2 was 5.4 x 10^{-4}. The data derived for PW-2 using the Cooper-Jacob method are comparable with the data derived using the Theis method.

4.4.5 Summary

The short-term pumping test results indicate that wells completed in weathered bedrock showed the highest specific capacities (0.78 gpm/ft average) and transmissivities. Specific capacities and transmissivities were lower for wells completed in the overlying glacial till and underlying bedrock.

The step-drawdown pumping test on PW-1 indicates that PW-1 can sustain a yield of 39 gpm (the maximum pump capacity) with 30 to 40 feet of remaining available drawdown.

The analysis of the 48-hour constant-rate pumping test indicates that the weathered bedrock/bedrock aquifer underlying the site behaves as a leaky artesian aquifer wherein the overlying glacial till materials serve as a leaky confining unit (source bed). Leakage through the glacial till is the principal source of recharge to the weathered bedrock/bedrock aquifer system.

The transmissivity of the weathered bedrock/bedrock aquifer is in the range from 750 to 1,500 gpd/ft which is characteristic of a moderately permeable weathered bedrock/bedrock system. Storativity is in the range from 2.5 x 10^{-3} to 1.7 x 10^{-4}

reflective of leaky artesian conditions. The vertical permeability of the confining unit is in the range from 0.043 to 0.050 gpd/ft^2.

5.0 SOURCE AREA CHARACTERISTICS

The analytical results for the soil samples collected from the test borings, and observations and photoionization detector (PID) screening during drilling, confirmed the presence of a residual PCE source area in the alleyway near the back door of the dry cleaners.

5.1 REMEDIAL INVESTIGATION

The locations of the RI test borings are shown on Figures 3-3 and 3-4, and the analytical results for the soil samples from the test borings are summarized on Tables 5-1 through 5-5. The samples tested were selected based on the field PID screening results (see Section 3.4). The unsaturated soil samples from three of the test borings, TB-1, TB-4 and TB-6 (background) were analyzed for the full TCL/TAL parameters. The remainder of the samples from the unsaturated and saturated zones were analyzed for TCL VOCs.

5.1.1 Unsaturated Zone

The analytical results for TCL VOCs in the unsaturated zone (soil above the water table) are summarized on Table 5-1. Elevated PCE concentrations were detected in the unsaturated soil samples from the three test borings immediately in back of the dry cleaners: TB-1, TB-2 and TB-7 (see Figure 5-1). The soil sample (2 to 4 feet bgs) from Test Boring TB-1, the boring nearest to and approximately 5 feet from the dry cleaners, exhibited 1,200 mg/Kg PCE concentration. In the soil sample (2 to 4 feet bgs) from Test Boring TB-2, located approximately 5 feet east of TB-1, 660 mg/Kg PCE was detected. PCE was detected at 12 mg/Kg in the soil sample (0 to 2 feet bgs) from Test Boring TB-7 located 6 feet south of TB-2. At Test Boring TB-1, 0.260 mg/Kg TCE was also detected.

The elevated PCE concentrations in the unsaturated zone appear to be limited to the interior of the alleyway in the vicinity of these three test borings (TB-1, TB-2 and TB-7), as evidence by the much lower results for soil samples from adjacent test borings just east of this area. The sample (0 to 2 feet bgs) from Test Boring TB-8 exhibited a very low (0.026 mg/Kg) PCE concentration. In the sample (2 to 4 feet bgs) from Test Boring TB-9, only a trace level of PCE (0.008 mg/Kg) was detected. A very low PCE concentration (0.027 mg/Kg) was also detected in the sample (0 to 1.5 feet bgs) from Test Boring TB-3, located approximately 30 feet southeast of the alleyway near Monitoring Well MW-5S (see Figure 3-3).

Test Borings TB-4 and TB-11 were located directly in front of the dry cleaners on the west side of the building (see Figure 3-4). In the unsaturated soil samples from these two borings (4 to 6 feet bgs), only traces of PCE were detected (0.003 to 0.004 mg/Kg). This was also the case for the sample at the same depth from Test Boring TB-5 (0.002 mg/Kg), located approximately 100 feet west of TB-4 near Monitoring Well MW-7S.

Other VOC compounds were not detected at significant concentrations in Test Borings TB-1 through TB-9 and TB-11 (traces less than 0.010 mg/Kg); there was no Test Boring TB-10. Test Borings TB-12 through TB-15 were drilled next to certain soil gas survey points and near the apparent leak in the gas pipeline to investigate these remote locations where total volatile hydrocarbon concentrations, but not PCE, were reported in the soil gas. As shown on Table 5-1, VOC concentrations were negligible in these samples. The data QC reviewer indicated that, although there was no direct reason to question the very low acetone concentrations found in samples from remote borings (up to 0.033 mg/Kg), these results should be viewed with caution because this is a very common laboratory contaminant (Environmental Standards, Inc., 1993d).

The finding of residual PCE concentrations in the unsaturated soil in the area defined by TB-1, TB-2 and TB-7 immediately behind the dry cleaners is consistent with observations made during the RI and the site history. This area was used for PCE drum storage, and the asphalt in this area of the alleyway was observed to be in a very deteriorated condition, possibly as a result of solvent attack during repeated incidents of spillage. Solvent odors were noted in the split-spoon samples from Test Boring TB-1. In addition, the dry cleaner vent was located in this area, and this vent was observed to be approximately 8 feet above ground surface and facing downward when Malcolm Pirnie collected an air sample on May 23, 1991 (Malcom Pirnie, 1992).

The unconsolidated materials within the source area consist of glacial till materials comprised of silty sand with varying amounts of clay and fine to medium gravel. The top of the zone of saturation (water table) in this area is approximately 3 feet below ground surface. The unsaturated materials in the source area which have been impacted by residual PCE encompasses an area of approximately 15 by 15 feet. As such, the volume of these impacted materials is small (approximately 25 cubic yards).

With respect to other constituents, low levels of several polyaromatic hydrocarbon compounds (PAHs) were detected in background Test Boring TB-6 (up to 0.110 mg/Kg), but not in Test Borings TB-1 and TB-4 behind and in front of the dry cleaners. Pesticides but not PCBs were detected in all three of these borings. TCL metals concentrations in Test Borings TB-1 and TB-4 do not appear elevated and were generally comparable to, and in most cases lower than, those detected in background Test Boring TB-6.

5.1.2 Saturated Zone

The five RI test borings behind the dry cleaners (TB-1, TB-2, TB-7, TB-8, and TB-9) were drilled to depths from 6.5 to 18 feet bgs. These borings were all drilled to refusal, except for TB-1 where a decision was made to end this boring before refusal so as not to penetrate a silty clay layer encountered in this highly impacted borehole at 14 to 15 feet bgs. The geologic materials in these borings generally consisted of silty sand with varying amounts of clay.

The analytical results for TCL VOCs in the saturated zone soils are shown on Table 5-2. Elevated PCE concentrations were detected in the saturated soil samples from two of the test borings in back of the dry cleaners: TB-1 and TB-8 (see Figure 5-1). The sample (6 to 8 feet bgs) from Test Boring TB-1, nearest to and approximately 5 feet from the dry cleaners, exhibited PCE at 4,500 mg/Kg. The saturated soil sample (6 to 6.5 feet bgs) from Test Boring TB-8, located 15 feet east of TB-1, exhibited 410 mg/Kg PCE. Very low PCE concentrations were found in the saturated soil samples from the remainder of the test borings in the alleyway behind the dry cleaners: 0.014 mg/Kg in the sample (8 to 10 feet bgs) from TB-2, 0.960 mg/Kg in the sample (14 to 16 feet bgs) from TB-7, and 0.073 mg/Kg in the sample (4 to 6 feet bgs) from TB-9. The saturated soil samples from the test borings outside of this area (from TB-3, TB-4, TB-5 and TB-6) exhibited negligible PCE concentrations (less than 0.010 mg/Kg).

The PID field screening results indicated that elevated PCE concentration below the water table extends to a depth of at least 12 feet at the Test Boring TB-1 location, the most highly impacted borehole (see Table 3-4). The PCE concentration detected in the saturated soil at TB-1 was higher than that detected in soil above the water table. The extent of the elevated PCE concentration in the saturated zone is somewhat wider than above the water table as evidence by the results for Test Boring TB-8 which indicate elevated PCE in the saturated soil but not above the water table. Whereas, the area of high residual PCE above the water table was defined through the RI program, the area and maximum depth in the saturated zone was less certain. The area of elevated residual PCE in the saturated zone behind the dry cleaner was further delineated by the test borings drilled and sampled during the Source Area Additional Data Collection Program.

5.2 ADDITIONAL DATA COLLECTION PROGRAM

The Source Area Additional Data Collection Program conducted in November and December 1993 was designed to:

Assess the extent and depth of PCE concentration in the saturated unconsolidated materials within the source area.

Characterize groundwater quality within the source area by installing two groundwater monitoring wells (MW-11S and MW-11D).

Determine the extent, if present, of elevated concentrations of PCE within the soils to the west/northwest of the source area beneath the mall building.

Characterize the hydraulic characteristics of the saturated unconsolidated materials within the source area.

The geologic logs for the seven Additional Data Collection Test Borings are provided in Appendix O. The locations of these test borings, and the concentrations in the sampled intervals are shown on Figure 5-2. All of the samples collected during the Additional Data Collection Program were analyzed for PCE, TCE, and 1,2-DCE by USEPA Method 8010 (SW-846). These results are summarized on Table 5-6. The Envirotest Laboratories analytical data package is provided in Appendix P.

5.2.1 Source Area Test Borings and Monitoring Wells

Test Boring TB-16 was drilled at the location closest to the back of the dry cleaners, where the highest PCE concentration (4,500 mg/kg) was detected during the RI test boring program (TB-1 location). Hollow stem augers were used to drill a 12-inch diameter borehole and split spoons were used to continuously sample the subsurface materials. The field screening results (see Table 5-8), and field observations confirmed the presence of elevated concentrations of PCE to 14 feet bgs at the TB-16 location. The soil composition observed from ground surface to 14 feet bgs consisted of silty sand with varying amounts of clay with fine rounded gravel. At 14 feet, a thin silty clay layer was encountered to approximately 15 feet bgs. Based on the results of the initial PID screening (upon opening the split spoon), and the soil composition, a 6-inch diameter steel casing was installed through the highly impacted materials to the top of the silty clay layer at 14 feet bgs.

Below 14 feet, drilling and sampling continued using wet rotary drilling and sampling with split spoon samplers. The soil composition below 15 feet bgs consisted of till of moderately dense to very dense silty sand with a trace of clay. The results of the continuous sampling within TB-16 below 15 feet bgs indicated very low to non-detectable initial PID readings (0 to 0.4 ppm) to the bottom of the borehole at 34 feet bgs.

PCE concentrations detected in the TB-16 borehole ranged from 0.160 mg/Kg up to 1,300 mg/Kg within the interval from land surface to 15 feet bgs. Below 15 feet bgs, PCE concentrations were much lower ranging from 0.0012 mg/Kg to 0.250 mg/Kg. TCE was detected from only one interval (8 to 10 feet bgs) within the TB-16 borehole at a trace concentration of 0.0079 mg/Kg and 1,2-DCE was not detected.

Two monitoring wells designated MW-11S and MW-11D were installed within the source area behind the dry cleaners. At the TB-16 location, the 6-inch diameter drilled borehole was terminated based on low to non-detect PID readings and a 2-inch diameter stainless steel monitoring well was installed screened from 22 to 32 feet bgs. Approximately 5 feet east of the TB-16/MW-11D location, shallow Monitoring Well MW-11S was installed with 4-inch diameter stainless steel screen and casing. MW-11S is screened from 4 to 14 feet bgs. The well construction details for the two source area monitoring wells are provided in Appendix O.

The monitoring wells were sampled on December 22, 1993 approximately 2 weeks after installation and development. PCE concentrations of 24,000 ug/L (24 mg/L) were detected in MW-11S and 3,200 ug/L (3.2 mg/L) were detected in MW-11D (Table 5-7).

5.2.2 Perimeter Test Borings

Three test borings (TB-17 through TB-19) were drilled along the perimeter of the source area behind the dry cleaners to delineate the extent of residual PCE in the saturated zone east of the source area. These test borings were also sampled continuously.

Test Boring TB-17 was drilled to a total depth of 30 feet bgs, approximately 5 feet east of RI Test Boring TB-8 where 410 mg/Kg of PCE was detected within the saturated interval from 6 to 6.5 feet bgs. PCE concentrations within the saturated zone ranged from 43 mg/Kg in the 8 to 10 feet bgs interval, to much lower levels (up to 0.040 mg/Kg) in the other intervals. The laboratory results for the unsaturated soil at the TB-17 location were very low and on the order of 0.130 mg/Kg to 0.160 mg/Kg PCE (Table 5-6). TCE was only detected within the 1 to 2 foot bgs interval at a trace concentration of 0.0011 mg/Kg and 1,2-DCE was not detected.

Perimeter test boring TB-18 was drilled approximately 5 feet southeast of Test Boring TB-9 and sampled to a total depth of 22 feet bgs. The laboratory analytical results for PCE from this borehole were very low and on the order of 0.0018 to 0.034 mg/Kg within the saturated interval. PCE was not detected in the unsaturated zone. TCE and 1,2 DCE were not detected in any of the seven samples collected from this borehole.

Perimeter Test Boring TB-19 was drilled approximately 16 feet east of Test Boring TB-17 to a total depth of 25 feet bgs. PCE was the only compound detected at a trace concentration of 0.0021 mg/Kg within the 7 to 9 foot bgs interval in this borehole.

The soil composition at the perimeter test boring locations consisted of till materials of loose to moderately dense silty sand and clay with fine to medium rounded gravel to a depth of approximately 8 feet bgs. Below this depth the till materials are much more dense and compact.

5.2.3 Test Borings Beneath The Mall Building

Three test borings (TB-20 through TB-22) were drilled beneath the mall building west and north of the source area to assess if residual PCE contamination extended in these directions. Test Boring TB-20 was drilled within the dry cleaners approximately 5 feet west of the backdoor. Test Borings TB-21 and TB-22 were drilled northwest and north of the source area, respectively as shown on Figure 5-2. These borings were sampled to total depths of 11 feet (TB-20), 8 feet (TB-21), and 7.5 feet (TB-22). The laboratory results indicated trace concentrations of PCE in the saturated interval at the TB-20 location (0.0044 mg/Kg to 0.0082 mg/Kg) and a trace concentration of 0.0023 mg/Kg in the unsaturated interval. At the TB-22 location, trace PCE concentrations were detected in the saturated (0.0012 mg/Kg to 0.003 mg/Kg) and unsaturated intervals (0.012 mg/Kg). PCE was not detected in Test Boring TB-21. TCE and 1,2-DCE were not detected in these three borings.

5.2.4 Source Area Hydraulic Characteristics

The result of a shelby tube sample from TB-16 indicated a low vertical hydraulic conductivity (permeability) of the saturated till materials at the source area (approximately 1.40 X 10^{-5} cm/sec). The results of a short-term pumping test on MW-11S indicated a transmissivity of 188 gpd/ft for the approximately 11 feet of saturated materials at this well location. This transmissivity translates to a hydraulic conductivity of 8.0 X 10^{-4} cm/sec. The results of a rising head slug test conducted on MW-11D indicated a hydraulic conductivity on the order of 1.5 X 10^{-5} to 2.0 X 10^{-5} cm/sec.

5.3 SUMMARY OF PCE SOURCE AREA DELINEATION

A total of nine test borings were drilled within the alleyway behind the dry cleaners and three test borings were drilled below the mall building (dry cleaner and former bakery) in April, 1993 (RI Test Boring Program) and in November/December, 1993 (Additional Data Collection Program). The locations of these test borings are shown on Figure 5-2. A conceptual profile constructed from west to east (TB-20, TB-16/MW-11D, MW-11S, TB-8, TB-17, and TB-19) through the source area is shown on Figure 5-3.

The analytical results for VOCs in the unsaturated zone (soil above the water table) indicated elevated PCE concentrations at three Test Borings TB-1, TB-2, and TB-7: 1,200 mg/Kg, 660 mg/Kg and 12 mg/Kg, respectively. Given the relatively shallow depths to groundwater in this area, PCE contamination within the unsaturated zone is limited to a depth of approximately 3 feet bgs and spatially within an area of approximately 15 feet by 15 feet. PCE, TCE and 1,2-DCE were either not-detected or detected at very low concentrations within the unsaturated zone from the remaining test borings in this area including the three borings drilled below the mall building.

The analytical results for PCE, TCE and 1,2-DCE within the saturated zone indicated elevated concentrations of PCE at Test Borings TB-1, TB-16, TB-8 and TB-17 to a maximum depth of approximately 15 feet bgs (TB-16). PCE concentrations within the saturated zone at the TB-1/TB-16 location (approximately 5 feet from the backdoor of the dry cleaners) ranged from 130 mg/Kg to as much as 4,500 mg/Kg. At the TB-8 location, a relatively high PCE concentration of 410 mg/Kg was detected within the saturated zone at 6 to 6.5 feet bgs and at the TB-17 location, 43 mg/Kg of PCE was detected within the saturated zone from 8 to 10 feet bgs. There is a marked contrast in the analytical results for PCE below 15 feet in Test Borings TB-1/TB-16 which were either trace or detected at very low concentrations. The area of elevated PCE concentrations in the saturated zone extends approximately 5 to 10 feet further east from the source area above the water table and extends to a maximum depth of 15 feet bgs.

At the remaining test boring locations east of the source area (TB-18, and TB-19) and west and north of the source area beneath the mall building (TB-20, TB-21, and TB-22), PCE was either not detected or detected at trace concentrations. TCE and 1,2-DCE were not detected.

The two monitoring wells within the source area (MW-11S and MW-11D) were installed to assess the quality of groundwater both within the highly impacted interval within the saturated zone (above 15 feet bgs) and just below it. The analytical results for the groundwater samples collected from these monitoring wells indicated PCE concentrations of 24,000 ug/L in MW-11S (24 mg/L) and 3,200 ug/L (3.2 mg/L) in MW-11D (Table 5-7).

The unconsolidated materials within the source area consist of till materials comprised of loose to moderately dense silty sand and clay with fine to medium rounded gravel to a depth of approximately 6 to 8 feet bgs. Below this depth the till materials attain a much greater density and as such are more compact.

6.0 CHEMICAL CHARACTERISTICS OF GROUNDWATER

The groundwater quality on and in the vicinity of the BPM site is discussed in this section. Given that groundwater quality has been impacted by both the BPM dry cleaners and by service stations in the area, this section is divided into two main headings. In the first part, the nature and extent of the BPM site-related constituents are delineated. The second part addresses the distribution of gasoline constituents to the extent that the BPM and areas impacted by the BPM are affected by these constituents. The third part of the section recaps the areas that have been impacted by the site-related and gasoline constituents, and the well locations that are equipped with point-of-use treatment systems for PCE removal (as a BPM site Interim Remedial Measure) or for removal of MTBE.

Tables 6-1 through 6-9 present summaries of the RI analytical data in order of the text discussion. In addition, compilations of the historical data that are available for many of the wells used for water supply in the site proximity are shown on Tables 6-10 through 6-13. The offsite residential (RW), commercial (CW) and public water supply (PW) wells have been assigned designations for data compilation and discussion purposes and Table 6-14 lists the well locations. The RI results are highlighted in bold in the text discussion.

The distribution of the BPM site-related constituents in groundwater is shown on Figure 6-1 and the distribution of gasoline constituents is shown on Figure 6-2. Data for the onsite monitoring wells, BPM production wells, and nearby residential, commercial and public community supply wells are shown on these figures. The RI results are shown for the wells that were sampled during this study; the most recent available data are shown for other wells in the area. In addition, the most recent results (May 1994) are noted on Figure 6-1 for the Meadow Park Road residential wells and Route 6 commercial wells that are included in the quarterly monitoring program conducted by Big V Supermarkets, Inc.

6.1 ANALYTICAL RESULTS FOR BPM SITE-RELATED CONSTITUENTS

6.1.1 Overview of Monitoring

The RI samples were collected from the onsite monitoring wells in August/September 1992 and May 1993, from the BPM production wells and Meadow Park Road residential wells in February 1993, and from the Route 6 commercial wells in March and April 1993. For the BPM production wells, Meadow Park Road residential wells, and several Route 6 commercial wells, the historical data base encompasses samples collected both prior to and more recently than the RI samples. The routine monitoring results for these locations through the 2nd Quarter (May) 1994 are included in this report. The historical data base also includes samples for many other residential and commercial wells in the BPM vicinity and for the Lake Baldwin community supply system.

As discussed in Section 2.2, the BPM production wells were initially sampled by WCHD in 1979 as part of a county-wide investigation of water supplies vulnerable to dry cleaning chemical contamination. WCHD infrequently resampled these wells through the mid 1980s, and WCHD and NYSDEC collected several samples from November 1988 through March 1989 as part of area-wide investigations. Routine sampling was instituted during and after mid 1989 when the GAC filter system was installed on the BPM supply system. J. Robert Folchetti & Associates collected samples through mid 1990, Landau & Heyman collected monthly samples through January 1992, and the system was sampled quarterly thereafter (beginning in February 1992) by VUA or Big V Supermarkets, Inc.

From November 1988 through March 1989, residential and commercial wells in Weschester County in the Baldwin Place area were sampled either by WCHD or by NYSDEC which was investigating a petroleum spill (Spill #88-07084) in this area. In addition, as part of the petroleum spill investigation, samples from wells used for water supply in Putnam County in the Baldwin Place area were collected by PCHD and NYSDEC

The WCHD continued to periodically collect samples from residences on Meadow Park Road after the area-wide investigations. During the period from

November 1988 through August 1991, WCHD collected and analyzed over 100 samples. Beginning in October/November 1991, Big V Supermarkets, Inc. (or VUA) has conducted a quarterly monitoring program that includes all 18 of the Meadow Park Road residential wells with and without filter systems.

After the November 1988 through March 1989 investigations, WCHD and NYSDEC also resampled many of the other wells in the area of interest in Westchester and Putnam Counties (commercial wells on Route 6, residential wells on Kennard Road, et. al.). Several of these wells were fitted with GAC filter systems for MTBE removal; data for chlorinated VOCs are available for some but not all of the routine samples that are collected from these wells. Only those samples that were tested for PCE and TCE are shown on the historical data compilation tables.

The Lake Baldwin water supply system was sampled by PCHD and NYSDEC from November 1988 through March 1989 as part of the area-wide investigations. An annual monitoring program has been conducted by the Town Of Carmel, the system owner/operator, since June 1991.

6.1.2 Onsite Monitoring Wells

6.1.2.1 Volatile Organic Compounds

The analytical results for TCL VOC constituents in the monitoring wells are summarized on Tables 6-1 and 6-2. The results confirm that the dry-cleaner related compounds (PCE and its breakdown products TCE and 1,2-DCE) are the contaminants of concern at the site, and their concentration distribution is consistent with a sole contaminant source at the dry cleaners. As a result of the groundwater divide discussed in Section 4.3.2, Groundwater Flow Conditions, these compounds are emanating in both the southeasterly and westerly directions from the dry cleaners proximity. The PCE concentrations that are in the onsite and nearby offsite groundwater, and which have been observed in the BPM production wells since 1979, have emanated from the residual source area in the dry cleaners proximity.

In the east/southeastern area, shallow Monitoring Well MW-5S, the well closest to and approximately 40 feet from the dry cleaners exhibited **64 to 300 ug/L PCE, 25 to 190 ug/L TCE** and **23 to 61 ug/L 1,2-DCE** concentrations in the two rounds of sampling. MW-5D, the deeper well in the cluster (approximately 50 feet south of MW-5S) exhibited **840 to 910 ug/L PCE, 57 ug/L TCE**, and **1,2-DCE** was not detected **(ND)**. Monitoring Well MW-6S is located approximately 110 feet due east of MW-5S; in this well these compounds were not detected **(ND)**. The wells in the MW-3 cluster are located south of MW-6S and east/southeast of MW-5D. The shallow well MW-3S exhibited **7 to 12 ug/L PCE, 1 to 4 ug/L TCE** and **2 to 4 ug/L 1,2-DCE**; these compounds were not detected **(ND)** in the intermediate well MW-3D; and only a trace of **TCE at 1 ug/L** was detected in the first but not in the second round sample from the deepest well MW-3DD.

As discussed in Section 4.3.2.3, there is a significant vertical component to groundwater flow in the east/southeastern site area. This is reflected in the results for Monitoring Well MW-5D, which indicate downward migration of contaminants from the shallow groundwater in the glacial till into the weathered bedrock/bedrock within a very short distance from the source area. The deeper groundwater flow in this area is influenced by the BPM production wells pumping, and is more southerly in direction than flow in the shallower unit. Monitoring Wells MW-3D and MW-3DD appear to be located just east of the area in the bedrock aquifer that is the primary southeastern constituent migration pathway.

In the westerly area, Monitoring Well MW-7S located just in front of the dry cleaners exhibited **12 to 30 ug/L PCE** concentration, and **2 to 3 ug/L PCE** was detected in MW-7D, the deeper well in this cluster. The Monitoring Well MW-9 cluster, located near the western property boundary exhibited the highest concentrations. In the shallow well, MW-9S, **850 ug/L PCE, 14 ug/L TCE** and **20 ug/L 1,2-DCE** were detected. The deeper well, MW-9D, exhibited **300 ug/L PCE, 10 ug/L TCE** and **10 ug/L 1,2-DCE** concentrations. Wells located in areas both north and south of the MW-9 cluster exhibited much lower concentrations. At the more northern MW-1 cluster, these compounds were not detected **(ND)** in shallow well MW-1S, and **1 to 2 ug/L PCE** was detected in deeper well MW-1D. At the more southern MW-10 cluster, these compounds were not detected **(ND)** in shallow well MW-10S, and deeper well MW-10D exhibited **37 ug/L PCE, 1 ug/L TCE** and **1 ug/L 1,2-DCE**. In addition, these compounds were not detected **(ND)** in the MW-2S/2D cluster near the southwest corner of the property.

The finding of the highest concentrations at the MW-9 cluster is consistent with the shallow groundwater flow contours which indicate that this well cluster is located directly downgradient of the dry cleaners (see Figure 4-7). The vertical component of groundwater flow is more gentle here than on the east/southeastern part of the property, (see Section 4.3.2.3) and this is reflected in the MW-9S concentration which is higher than in deeper well MW-9D. The MW-7 and MW-1 cluster locations appear to be just north, and the MW-10 well cluster location appears to be just south of the primary western constituent migration pathway.

Monitoring Wells MW-4S/4D and MW-8S are located in the upgradient area at the northern site boundary. These wells did not exhibit detectable concentrations of the dry cleaner-related constituents **(ND)**.

With respect to other TCL VOCs, low levels of gasoline constituents were detected in monitoring wells on the BPM property. These results are discussed in detail in Section 6.2.4.

Aside from the dry cleaner-related and gasoline constituents, no other VOCs of concern were found in the BPM monitoring wells. Methylene chloride was detected in samples from several wells in the August/September 1992 sampling event; the second sampling event in May 1993 confirmed the absence of this very common laboratory contaminant. Similarly, the detection of acetone in samples was not consistent and is also believed to be a sampling/laboratory artifact. Trace concentrations of 1,1,2,2-tetrachloroethane (2 ug/L) were detected in the first round samples from MW-3S and MW-3DD; however, this compound was also detected in a trip blank sample, and its absence in the wells was confirmed by the second round samples.

6.1.2.2 Semi-Volatile Organic Compounds

The analytical results for TCL semi-VOC compounds are summarized on Table 6-3. Bis(2-ethylhexyl)phthalate was the only targeted compound detected. Low concentrations of this compound (7 to 11 ug/L), which is a laboratory/sampling contaminant and is ubiquitous in most data sets, were detected in samples from two distant deeper monitoring wells, MW-1D and MW-2D. These results are not considered representative of groundwater conditions.

6.1.2.3 Pesticides/PCBs

The analytical results for pesticides and polychlorinated biphenyls (PCBs) are summarized on Table 6-4. No TCL PCBs were detected in any of the monitoring wells tested. Trace levels of TCL pesticides were found in six monitoring wells situated in various site areas; these include the MW-2S/2D cluster near the southwest corner of the property, MW-3D in the central area in back of the mall, and MW-4S and MW-8S near the upgradient property boundary. Thirteen individual pesticides were detected and total estimated pesticide concentrations in these wells ranged from 0.08 to 1.1 ug/L. Although most of the trace level pesticide results could not be qualified as they met the identification criteria stipulated in the method, the data QA reviewer indicated that these results should be used with extreme caution. It is the opinion of the QA reviewer that sufficient reasons exist not to consider these pesticide detections as totally reliable (Environmental Standards, Inc., 1993a). These reasons include the following:

- Examination of the chromatograms revealed significant chromatographic interferences reminiscent of a large hydrocarbon pattern. (Although this multi-peak pattern has the shape and intensity of an Aroclor pattern, these patterns did not provide even a marginal retention time match to Aroclor standards). The interferences evident on the chromatograms could easily result in false positive results for the pesticides.

- All but several of the results are below (some significantly below) the quantitation limit.

- Trace levels of most of the pesticides reported were also observed in laboratory instrument blanks at concentrations of approximately 0.01 ug/L. These could not be used to qualify sample results since they were not (nor required to be) confirmed on a second column.

- The percent differences in the concentrations calculated between the two GC columns is significant with very few exceptions.

It is possible that residual trace pesticides are present from former agricultural land use before development of the BPM and adjacent properties. Review of historical aerial photographs indicates that orchards were present on the BPM as well as on other properties in the immediate area. However, as the data QA reviewer also points out, the variety of unrelated pesticides detected do not represent a pattern of contamination that is typically observed for environmental samples contaminated with pesticides (e.g., the presence of a notable level of gamma-chlordane and the absence of alpha-chlordane).

6.1.2.4 Metals and Inorganics

The analytical results for total and dissolved TAL metals are shown on Tables 6-5 and 6-6, and the groundwater chemistry parameters results are shown on Table 6-7. Aside from iron and manganese, the only result which exceeded New York State groundwater quality standards was the total lead concentration of 47.2 ug/L in Monitoring Well MW-2S; this well was not tested for dissolved concentration.

High total iron and manganese concentrations were detected in the samples from certain monitoring wells. The total concentrations show a high degree of variation and appear to reflect the amount of particulate matter in the samples. Dissolved concentrations were much lower, however, in some cases exceed the New York groundwater quality standards. The iron and manganese are natural components of the subsurface materials and do not indicate contamination. The standards for iron and manganese are based on aesthetic rather than health-based considerations, and it is not unusual for these criteria to be exceeded in natural groundwater systems.

6.1.2.5 Summary

In summary, the RI sampling results confirm that the dry cleaner-related compounds (PCE and its breakdown products TCE and 1,2-DCE) are the contaminants of concern at the BPM site, and their concentration distribution is consistent with a sole contaminant source at the dry cleaners. As a result of the groundwater divide discussed in Section 4.3.2, these compounds are emanating in both the southeasterly and westerly directions from the dry cleaners proximity.

Comparable PCE concentrations were found in monitoring wells located to both the southeast and west of the groundwater divide near the dry cleaners. The highest PCE concentrations detected were 910 ug/L in southeastern well MW-5D and 850 ug/L in western well MW-9S. TCE (up to 190 ug/L) and 1,2-DCE (up to 61 ug/L) concentrations were also detected in southeastern and western monitoring wells.

In the east/southeastern part of the site, the results for Monitoring Well MW-5D indicate downward migration of contaminants from the shallow groundwater in the glacial till into the weathered bedrock/bedrock within a very short distance from the source area. The deeper groundwater flow in this area is influenced by the BPM production wells pumping, and is more southerly in direction than flow in the shallower unit. Monitoring Wells MW-3D and MW-3DD appear to be located just east of the area in the bedrock aquifer that is the primary southeastern constituent migration pathway.

In the western part of the site, the finding of the highest concentrations at the MW-9 cluster is consistent with the shallow groundwater flow contours which indicate that this well cluster is located directly downgradient of the dry cleaners (see Figure 4-7). The vertical component of groundwater flow is more gentle here than on the east/southeastern part of the property, and this is reflected in the MW-9S PCE concentration which is higher than in deeper well MW-9D. The MW-7 and MW-1 cluster locations appear to be just north, and the MW-10 well cluster location appears to be just south of the primary western constituent migration pathway.

6.1.3 BPM Production Wells

The compiled historical monitoring results for the BPM production wells are summarized on Table 6-10. The RI results for these wells are included on this table in addition to being summarized on Table 6-8.

In the February 1993 RI samples, Production Well PW-1 exhibited **93 ug/L PCE, 6.5 ug/L TCE** and a trace of **1,2-DCE at 0.8 ug/L**; and **39 ug/L PCE** and **2.5 ug/L TCE**. were detected in Production Well PW-2. The historical data indicate that PCE concentrations typically range from 50 to 100 ug/L, TCE from 2 to 10 ug/l, and 1,2-DCE appears at below 1 ug/L in the BPM production well samples, with occasional outliers. In most cases, these samples are non-specific with respect to the individual wells. In general, the results over the 15-year period of record do not indicate an overall increasing or decreasing trend in concentration for the production wells.

6.1.4 Meadow Park Road Residential Wells and Northeast Area

The compiled historical monitoring results for the eighteen residential wells along Meadow Park Road (and Tomahawk Street) (RW-01 through RW-18) are summarized on Table 6-11. The RI results for this area are included on this table in addition to being summarized on Table 6-8. Graphs of PCE concentration versus time for the eleven wells which exhibit detectable concentrations are presented in Appendix Q.

The five most northerly situated wells both to the west and east of Meadow Park Road are RW-01, RW-02, RW-03, RW-04 and RW-18. Wells RW-01 through RW-04 were each tested from five to seven times, and RW-18 was tested twice by WCHD in the period from November 1988 through August 1991. With the exception of a single positive result for RW-03 in October 1990 of 1.2 ug/L PCE, none of these samples contained detectable concentrations of PCE or TCE. These five wells continued to exhibit non-detectable PCE and TCE concentrations in the eleven quarterly samples collected from October 1991 through May 1994. These included the February 1993 RI samples from each well (**ND**), which replaced the routine sampling for the first quarter 1993.

Moving southward on the west side of Meadow Park Road, RW-05 was tested by WCHD seven times from November 1988 through June 1991; these samples indicated PCE concentration from 6.0 to 28 ug/L, and trace TCE levels up to 1.8 ug/L. Well RW-05 was equipped with a GAC filter system by the owner in 1989. The eleven quarterly samples collected from October 1991 through May 1994 reflect an increasing trend in concentration. The February 1993 RI sample and replicate indicated **13 to 16 ug/L PCE** and **0.8 to 0.9 ug/L TCE** concentrations. In the May 1994 sample collected from RW-05, 300 ug/L PCE, 10 ug/L TCE, and 0.5 ug/L 1,2-DCE were detected. RW-05 currently exhibits the highest offsite PCE and TCE concentrations.

RW-06 was tested by WCHD four times from November 1988 through November 1989 and PCE and TCE were not detected. This house was unoccupied at the beginning of the quarterly monitoring program in October 1991 and was therefore not readily accessible for sampling. Special arrangements were made to collect a sample in August 1992 which confirmed non-detectable concentrations. Due to access constraints, an RI sample was not collected; however, it was not considered critical given the historical data. In August 1993, this house was purchased by a new owner and incorporated into the quarterly monitoring program. PCE and TCE remained non-detected in the August 1993 through May 1994 samples.

RW-07 was tested by WCHD six times from November 1988 through August 1991. During this period, PCE concentration in this well gradually increased from a trace less than 0.5 ug/L to 4.6 ug/L. RW-07 was equipped with a GAC filter system in December 1991 by Big V Supermarkets, Inc. based on the 6.0 ug/L PCE result for a split sample collected by NYSDOH in October 1991. The eleven quarterly samples collected from October 1991 through May 1994 continue to reflect a steadily increasing trend in concentration. The February 1993 RI sample indicated **4.6 ug/L PCE**, and the May 1994 sample exhibited 14 ug/L PCE.

RW-08 was tested by WCHD six times from December 1988 through August 1991. During this period, PCE concentration in this well increased from 4.9 to 33 ug/L and trace TCE was present up to 1.6 ug/L. Well RW-08 was equipped with a GAC filter system in October 1991 by Big V Supermarkets, Inc. The eleven quarterly samples collected from October 1991 through May 1994 continue to reflect an increasing trend in concentration. The February 1993 RI sample indicated **33 ug/L PCE** and **1.8 ug/L TCE**, and the May 1994 sample exhibited 43 ug/L PCE and 1.9 ug/L TCE.

RW-09 was tested by WCHD eight times from November 1988 through August 1991. In the latter part of this period, PCE concentration increased to 48 to 52 ug/L from earlier 10 to 16 ug/L concentrations. TCE levels up to 2.7 ug/L were also detected. Well RW-09 was equipped with a GAC filter system in October 1991 by Big V Supermarkets, Inc. In the eleven quarterly samples collected from October 1991 through May 1994, PCE concentrations ranged from 21 to 43 ug/L. The February 1993 RI sample indicated **32 ug/L PCE** and **1.9 ug/L TCE**, and 38 ug/L PCE and 1.8 ug/L TCE were found in the May 1994 sample.

RW-10 was tested by WCHD seven times from November 1988 through August 1991. In August 1991, PCE concentration increased to 15 ug/L from earlier concentrations less than 4 ug/L, and a trace of TCE at 0.64 ug/L was also detected in this well. Well RW-10 was equipped with a GAC filter system in October 1991 by Big V Supermarkets, Inc. In the eleven quarterly samples collected from October 1991 through May 1994, PCE concentrations ranged from 9.3 to 18 ug/L. The February 1993 RI sample indicated **13 ug/L PCE** and **0.6 ug/L TCE**, and 18 ug/L PCE was found in the May 1994 sample.

RW-11 was tested by WCHD six times from November 1988 through August 1991. A trace of PCE was first apparent in this well in October 1989, and PCE was detected at 3.7 ug/L by August 1991. In the nine quarterly samples collected from October 1991 through November 1993, PCE concentrations remained below 5 ug/L. RW-11 was equipped with a GAC filter system in March 1994 by Big V Supermarkets, Inc. based on the February 1994 result of 5.9 ug/L PCE. The February 1993 RI sample indicated **3.5 ug/L PCE**, and the May 1994 sample exhibited 6.6 ug/L.

RW-12 was tested by WCHD seven times from November 1988 through August 1991. A trace of PCE at 0.72 ug/L first appeared in the August 1991 sample. In the eleven quarterly samples collected from October 1991 through May 1994, traces of PCE were intermittently and then consistently detected. In the three most recent quarterly sampling events, PCE concentrations reached above 1 ug/L. The February 1993 RI sample indicated **0.8 ug/L PCE**, and the May 1994 sample exhibited 1.3 ug/L PCE.

The southernmost well along Meadow Park Road, RW-13, was tested by WCHD seven times from November 1988 through August 1991. PCE was not detected in any of these samples. Well RW-13 is equipped with a GAC filter system by the homeowner. In the eleven quarterly samples collected from October 1991 through May 1994, including the February 1993 RI sample, PCE has remained undetected **(ND)** in this well.

Moving back north on the east side of Meadow Park Road, RW-14 serves two residences. RW-14 was tested by WCHD five times from November 1988 through August 1991. In August 1991, PCE was first detected at 1.2 ug/L. In the eleven quarterly samples collected from October 1991 through May 1994, very gradually increasing PCE concentrations from 0.99 to 3.0 ug/L were consistently detected. The February 1993 RI sample indicated **1.8 ug/L**, and the May 1994 sample exhibited 3.0 ug/L .

RW-15 was tested by WCHD eight times from November 1988 through August 1991. PCE concentrations increased from trace levels less than 0.5 ug/L to 1 ug/L by May 1990, and showed a further increase to 6.1 ug/L in August 1991. Well RW-15 was equipped with a GAC filter in October 1991 by Big V Supermarkets, Inc. In the eleven quarterly samples collected from October 1991 through May 1994, PCE concentrations showed a gentle increase. The February 1993 RI sample indicated **8.7 ug/L PCE** and **0.6 ug/L TCE**, and the May 1994 sample exhibited 13 ug/L PCE and 0.6 ug/L TCE.

RW-16 was tested eight times between December 1988 and June 1991. During this period, a gradual increase in PCE concentration was apparent from 0.84 to 2.5 ug/L. Well RW-16 was equipped with a GAC filter system in March 1993 based on the February 1993 RI sample result of **5.2 ug/L PCE**. The nine quarterly samples collected from October 1991 through November 1993 showed a very gentle increase. In the two most recent samples, this increase has been steeper. The May 1994 sample exhibited 20 ug/L PCE and 0.6 ug/L TCE.

RW-17 was tested by WCHD five times from December 1988 through August 1991. PCE concentrations detected over this period ranged from non-detectable to 2.1 ug/L. In the nine quarterly samples collected from October 1991 through November 1993, PCE concentrations ranged from 0.74 to 4.6 ug/L. RW-17 was equipped with a GAC filter system in March 1994 by Big V Supermarkets, Inc. based on the February 1994 result of 17 ug/L PCE. The February 1993 RI sample indicated **1.1 ug/L PCE** and the May 1994 sample exhibited a further increase to 27 ug/L PCE and 1.2 ug/L TCE.

Summary

In summary, the area along Meadow Park Road has been impacted by the BPM site-related constituents. The impacted area extends approximately 1,200 feet southward from the vicinity of Residential Wells RW-05 and RW-17 to the vicinity of RW-12. As demonstrated by the test results for residential wells directly north (RW-01, RW-02, RW-03, RW-04 and RW-18) and south (RW-13), the impacted area begins southeast of the dry cleaners and does not reach south beyond Meadow Park Road where it rejoins Tomahawk Street. The delineation of the impacted area is consistent with the identified

PCE source location at the BPM dry cleaners, and the onsite and regional groundwater flow directions (see Section 4.3.2).

In addition, the absence of PCE and TCE to the north and northeast of this area is supported by historic results obtained by WCHD. Between November 1988 and August 1991, WCHD tested a residential well directly north on Tomahawk Street (RW-28) and six residential wells on Lounsbury Drive and Cornelius Lane (RW-29 through RW-34). PCE and TCE were not detected (see Figure 6-1 and Table 6-13).

Also, information on the area to the east of the Meadow Park Road community is available for a test production well installed in connection with a potential new development. This well (Well 1-W) is located across from the central-southern part of the Meadow Park Road community, approximately 200 feet east of Tomahawk Street. This well was sampled on May 6, 1988 in connection with a pumping test, on January 1, 1992 in response to Town concerns about the BPM site-related constituents, and again on February 24, 1994. In all of these samples, PCE and TCE were not detected (Leggette, Brashears & Graham, 1993 & 1994).

Eleven residential wells in the Meadow Park Road community have been impacted; a twelfth well (RW-06) geographically within the impacted area has apparently not been affected. Three wells on the west side of Meadow Park Road have exhibited the highest PCE concentrations: RW-05 up to 300 ug/L; RW-08 up to 46 ug/L; and RW-09 up to 52 ug/L. Six other wells (RW-07, RW-10, RW-11, RW-15, RW-16, and RW-17) have exhibited PCE concentrations on the order of 5 to 27 ug/L. These nine wells are equipped with GAC filter systems. Two additional wells (RW-12 and RW-14 near the south end of the road) exhibit lesser PCE concentrations below 5 ug/L. The concentration distribution indicates that PCE concentrations decline within a short distance in the southeast (downgradient) direction within the Meadow Park Road community area. For example, RW-08 shows 43 ug/L PCE, while RW-15 shows 13 ug/L PCE, and PCE is not detected in Test Well 1-W. The general trend of the five year database from late 1988 through 1993 was one of very gradually increasing concentrations in the Meadow Park Road area. In the first two quarters of 1994, a more marked increase has been observed in the four most northerly impacted wells (RW-05, RW-07, RW-16 and RW-17) within this area.

6.1.5 Route 118 and Upgradient Northern Area

Available data from the PCHD files for the Mahopac Village Center mall wells, located approximately 1,500 feet north on Route 6 from the BPM, included seven samples collected from March 1989 through June 1990. Some of these samples were from taps (non-specific with respect to the wells), and others were specific to the three production wells at the center. The two earliest tap samples (March 16, 1989 and April 11, 1989) had trace PCE concentrations (0.6 ug/L) and the April 26, 1989 sample from Well 3 exhibited PCE at 3 ug/L. PCE and TCE were not detected in April 26, 1989, May 16, 1989 and June 22, 1989 samples from Wells 1 and 2; nor in June 22, 1989 and June 5, 1990 ("influent to stripper") samples from Well 3. Well 3 is connected to an air stripper system to remove gasoline constituents as discussed in Section 6.2.3.

The compiled historical results for four commercial wells (CW-48, CW-49, CW-49A and CW-50) located along and near Route 118 directly north of the BPM site (between the Mahopac Village Center and the BPM) are shown on Table 6-13. PCE and TCE were not detected in these wells which were tested as part of the WCHD/PCHD/NYSDEC area-wide investigations from November 1988 to April 1989. These results, and the results for the upgradient onsite monitoring wells (MW-4S/4D and MW-8S) indicate that PCE is not emanating onto the BPM property from an upgradient source.

6.1.6 Route 6 Commercial Wells and Western Area

The compiled results for the McDonalds well (CW-52) at the northwest end of the BPM property are shown on Table 6-13. The McDonalds well is the only well identified along the south side of Route 6 between the site and Mahopac Avenue. This well was sampled at least five times between June 1988 and January 1989 by Leggette, Brashears & Graham, Mid Hudson Pollution Control, WCHD and NYSDEC. The samples collected in June and July 1988 exhibited 21 and 17 ug/L PCE; in three subsequent samples PCE concentration ranged from non-detectable to 7.2 ug/L. The restaurant used bulk water before being equipped with a GAC filter system in 1993 by Mobil Oil Corporation to remove higher MTBE concentrations. The filter system is monitored monthly by Land Tech Remedial, Inc. The most recent available results for this well were 1.3 ug/L, 3.2 ug/L and 9.9 ug/L PCE in January, February and March 1994.

The compiled historical monitoring results for the nine commercial wells situated along the north side of Route 6 between the Baldwin Place intersection and Mahopac Avenue (CW-19 through CW-27) are summarized on Table 6-12. The RI results for this area are included on this table in addition to being summarized on Table 6-9. Graphs of PCE concentration versus time for the two wells monitored quarterly by Big Supermarkets, Inc. (CW-20 and CW-21) are presented in Appendix Q.

The most easterly well (CW-19) along Route 6 near the Baldwin Place intersection (east of where the western stream crosses under Route 6) was equipped with a GAC filter system by NYSDEC in January 1989 as a result of MTBE concentration. The more recent routine testing of this filter system by NYSDEC has been limited to gasoline-related constituents. In terms of PCE analysis, this well was tested for chlorinated VOCs seven times between November 1988 and October 1989 by NYSDEC and WCHD. PCE and TCE were not detected in any of these samples. The RI sample collected in March 1993 confirmed the continued absence (**ND**) of these compounds.

The second commercial well moving westward (CW-20) is located west of where the western stream crosses under Route 6. This well was tested for chlorinated VOCs three times in December 1988 and March 1989 by NYSDEC and WCHD. PCE was detected in this well at concentrations from 7.5 to 9 ug/L. The RI results in March 1993 indicated **47 ug/L PCE** and **1 ug/L TCE.** Based on the RI results, this well was equipped with a GAC filter system in April 1993 by Big V Supermarkets, Inc. Big V Supermarkets presently maintains this system and conducts quarterly monitoring. In the five quarterly samples collected from April 1993 through May 1994, PCE concentrations ranged from 45 to 80 ug/L and lesser concentrations of TCE and 1,2-DCE were detected. The May 1994 sample exhibited 63 ug/L PCE, 1.7 ug/L TCE and 1.4 ug/L DCE.

The third commercial well moving westward (CW-21) was tested for chlorinated VOCs in December 1988 by NYSDEC. At this time, 3 ug/L PCE was detected. In February 1993, this well was resampled by NYSDOH during a pre-RI sampling visit with VUA in this area and exhibited PCE at 43 ug/L and TCE at 4.7 ug/L. The RI results in March 1993 indicated **47 ug/L PCE** and **4 ug/L TCE.** Based on the RI results, this well was equipped with a GAC filter system in April 1993 by Big V Supermarkets, Inc. Big V Supermarkets presently maintains this system and conducts quarterly monitoring. The five quarterly samples collected from April 1993 through May 1994 indicated variable

PCE concentrations from 1.4 to 37 ug/L. In the sample collected in May 1994, 9.9 ug/L PCE was detected.

The fourth commercial well (CW-22) was tested for chlorinated VOCs twice in December 1988 and January 1989 by NYSDEC and WCHD. PCE was detected at 18 to 19 ug/L. In October 1990, this well was resampled by WCHD and exhibited PCE at 55 ug/L and a 0.53 ug/L trace of TCE. This well was equipped with a GAC filter system by the owner of the property. Permission to sample this well was denied and no monitoring data were made available to the RI investigator.

The fifth commercial well (CW-23) was tested for chlorinated VOCs five times from December 1988 through January 1991 by NYSDEC, WCHD and EPA. PCE concentrations detected in this well ranged from 17 to 28 ug/L. A sample tested privately by a commercial laboratory within this period exhibited an anomalous result of not detected. This well was equipped with a GAC filter system by the owner; this system is reportedly maintained but not monitored routinely. The RI results in March 1993 indicated **46 ug/L PCE** and **0.9 ug/L TCE.**

For the sixth commercial well (CW-24), no historic data were found in the reviewed NYSDEC or WCHD files. The RI investigator was not able to obtain permission to sample this well.

For the seventh and eighth commercial wells (CW-25 and CW-26), also, historic data were unavailable. The RI results in March 1993 for CW-25 indicated non-detectable (**ND**) PCE and TCE. An RI sample could not be collected from CW-26 due to the reluctance of the owner; however, NYSDOH sampled this well in late February 1993 during a pre-RI sampling visit with VUA in this area and the sample exhibited non-detectable (ND) PCE and TCE concentration.

The ninth well (CW-27) located on Route 6 just east of Mahopac Avenue was tested for chlorinated VOCs by WCHD in August 1990. PCE and TCE were not detected. The RI results in March 1993 confirmed the absence of PCE/TCE concentrations (**ND**).

Summary

In summary, a limited area along Route 6 has been impacted by the BPM site-related constituents (as well as by gasoline constituents; see Section 6.2.2). The impacted area extends along Route 6 approximately 1,200 feet, in the vicinity of commercial wells CW-20 to CW-23. It is unclear if a fifth well (CW-24) directly west of these wells has been impacted, as the well and any existing data were not accessible. As demonstrated by the test results for commercial wells to the east (CW-19) and west of this area (CW-25, CW-26 and CW-27), the impacted area begins west of where the western stream crosses under Route 6 and does not extend to CW-25 where the ground surface begins to rise markedly toward Mahopac Avenue to the west. The delineation of the impacted area is consistent with the identified PCE source location at the BPM dry cleaners, and the onsite and regional groundwater flow directions (see Section 4.3.2.4).

In addition, the absence of PCE and TCE to the west of this area is supported by other historic results obtained by WCHD. Between January and October 1989, WCHD tested several commercial and residential wells just west of the Route 6 and Mahopac Avenue intersection (CW-35) and north on Mahopac Avenue (RW-36, CW-37, RW-38 and RW-39). PCE and TCE were not detected in these wells (see Figure 6-1 and Table 6-13). Similarly, the results for the Shell service station supply well (CW-54), and for RW-40 along Kennard Road (discussed below) support the absence of PCE and TCE in wells to the east of where the western stream crosses under Route 6.

In the four wells within the impacted area, PCE concentrations up to 80 ug/L, TCE up to 4.0 ug/L, and 1,2-DCE up to 1.4 ug/L (as of May 1994) have been detected. The general trend of the five year database from late 1988 through the present is one of gradually increasing concentrations in this area.

6.1.7 Kennard Road Residential Wells

The compiled monitoring results for the six residential wells tested along Kennard Road (RW-40, RW-41, RW-42, RW-43, RW-45 and RW-46) and for the Lake Baldwin public water supply (PW-44) are summarized on Table 6-13.

The two most easterly situated residential wells along this road nearest the intersection with Route 6 (RW-40 and RW-41) are equipped with GAC filter systems for MTBE treatment and are sampled routinely. In terms of PCE analysis, the samples collected from these wells between October 1988 and April 1989 included chlorinated VOCs; more recent testing has mainly been limited to gasoline-related constituents (BTEX, dichlorobenzenes, and MTBE). However, in mid-1992, samples were tested for chlorinated VOCs.

The most easterly residential well (RW-40) was tested for chlorinated VOCs five times between October 1988 and March 1989, and twice more in June and August 1992. PCE and TCE were not detected.

The second residential well (RW-41) was tested for chlorinated VOCs seven times between October 1988 and April 1989, and once more in August 1992. PCE and TCE were not detected in the 1988 and 1989 samples. A trace of PCE at 1 ug/L was reported in the August 1992 sample.

The third and fourth residential wells sampled (RW-42 and RW-43), moving west down Kennard Road, were tested for chlorinated VOCs respectively two and three times between October 1988 and March 1989 by PCHD and NYSDEC. PCE and TCE were not detected.

Moving further west, near the intersection of Shore Drive with Kennard Road, the fifth and sixth residential wells sampled (RW-45 and RW-46) were both tested twice for chlorinated VOCs in November 1988 and March 1989 by PCHD and NYSDEC. Except for a trace of TCE less than 1 ug/L in the initial RW-46 sample, PCE and TCE were not detected.

6.1.8 Lake Baldwin Community System

The Lake Baldwin water supply (PW-44) was tested for chlorinated VOCs at least six times between October 1988 and March 1989 by PCHD and NYSDEC. The Lake Baldwin water supply is presently subject to annual monitoring by the owner/operator (Town Of Carmel), and later results are available for this system for June 1991, June 1992 and April 1993. PCE and TCE have never been detected in the water supply samples.

6.2 ANALYTICAL RESULTS FOR GASOLINE CONSTITUENTS

6.2.1 Overview of Monitoring

Analysis of wells along Kennard Road was initiated by Putnam County in October and November 1988, in response to the oil spill at the Lightning Lube at the Baldwin Place intersection (Petroleum Product Spill #88-05397). These initial samples collected by Putnam County indicated gasoline constituents in sediment in the first, unnamed, pond in the western stream and in certain wells in this area, and the case was referred to NYSDEC. NYSDEC collected samples in late November and December 1988 from wells along Kennard Road and from additional wells located in both Putnam and Westchester counties. These early samples by the two agencies in the RI area of interest included residential wells and the Lake Baldwin public community water supply along Kennard Road, and commercial wells along Route 6 and Route 118.

As a consequence of the late 1988 PCHD/NYSDEC testing, a gasoline contamination problem (primarily MTBE) that was subsequently associated with several local service stations was identified within the area. The four service stations at and near the Baldwin Place intersection were investigated, and three of these stations (Mobil (now Exxon), Texaco and Citgo) were determined to have leakage with impact to groundwater. These three stations have installed groundwater recovery systems. The fourth service station (Shell) was not found to be a contributor to the groundwater contamination (International Technology Corporation, 1990).

In December 1988, the two residential wells on the eastern part of Kennard Road nearest to the Baldwin Place intersection (RW-40 and RW-41), and a commercial well on Route 6 (CW-19) were equipped by NYSDEC with GAC filter systems due to MTBE concentration. In January 1989, NYSDEC installed a fourth filter system on the water supply well at the Shell service station (CW-54). NYSDEC monitored these filter systems monthly through May 1989, and thereafter quarterly through April 1991. In August 1991, Spain Oil assumed responsibility for the quarterly monitoring of the RW-40 and RW-41 systems; NYSDEC continues to quarterly monitor the systems at CW-19 and CW-54.

In 1993, Mobil Oil Corporation equipped the McDonalds well (CW-52) on the northwest end of the BPM property with a GAC filter system due to MTBE concentration. Earlier data were available for samples collected by consultants to Big V in mid-1988 and as part the area-wide investigations by WCHD and NYSDEC in late 1988 through January 1989.

MTBE was analyzed in some but not all of the samples that WCHD collected from the Meadow Park Road residential wells from November 1988 through August 1991. MTBE was again analyzed during the first quarterly monitoring event by VUA in October/November 1991, and in the RI samples collected in February 1993. In addition, the four most northerly located wells in this area were tested for MTBE in October 1993.

6.2.2 Route 6 and Kennard Road

A limited area on both the south and north sides of the western stream has been impacted by the service station spills at and near the Baldwin Place intersection (Exxon (formerly Mobil), Texaco and Citgo). Several commercial wells along Route 6 and residential wells on Kennard Road are affected.

The Shell station is located just west of the Baldwin Place intersection. In January 1989, the station supply well (CW-54) was equipped with a GAC filter system to remove MTBE by NYSDEC. The results for NYSDEC samples collected from January 1990 through June 1993 indicate that MTBE concentration has declined in this well from 340 to less than 70 ug/L.

In December 1988, the commercial well on Route 6 just west of the Shell station and east of where the western stream crosses under Route 6 (CW-19) was also equipped with a GAC filter system by NYSDEC. The results for NYSDEC samples collected from November 1988 through March 1993 indicate that MTBE concentrations in this well have steadily declined from over 200 to below 20 ug/L. The RI result in March 1993 indicated **15 ug/L MTBE.**

The next commercial well moving westward on Route 6 (CW-20) exhibited 10 to 14 ug/L MTBE in three samples collected between December 1988 and March 1989 by NYSDEC and WCHD. The RI result in March 1993 indicated **44 ug/L MTBE.**

The next three commercial wells (CW-21, CW-22 and CW-23) continuing westward have exhibited detectable but lower MTBE concentrations. The March 1993 RI results indicated **4 ug/L MTBE in CW-21**, and **1 to 2 ug/L MTBE in CW-23**. The most recent available result for CW-22 was an October 1990 WCHD sample which exhibited MTBE at 2.6 ug/L.

For CW-24, there was no available information. Further west toward Mahopac Avenue, MTBE was not detected **(ND)** in the March 1993 RI sample from CW-25, the NYSDOH February 1993 sample from CW-26, and the April 1993 RI sample from CW-27.

On Kennard Road, the two nearest residential wells to the Baldwin Place intersection are equipped with GAC filter systems to remove MTBE concentration. The first well (RW-40) has exhibited 27 to 72 ug/L MTBE in the series of samples collected from October 1988 to August 1992. The second well (RW-41) exhibited 200 ug/L MTBE in October 1988 and has shown a gradual decrease; the most recent available result in August 1992 indicated 59 ug/L MTBE.

Four other wells further west on Kennard Road (RW-42, RW-43, RW-45 and RW-46) were tested for MTBE by PCHD and/or NYSDEC during the late 1988 investigation. MTBE was detected at 7 ug/L in one of two samples from RW-43; in the other three wells MTBE was not detected. These four wells were also resampled by NYSDEC in March 1989 and MTBE was not detected. (Note that the detection limits for the NYSDEC analyses were 20 ug/L during these timeframes).

The Lake Baldwin water supply (PW-44) was sampled by PCHD three times in October/November 1988 and a trace of MTBE was reported in two of these early samples. MTBE was not detected in three samples collected by NYSDEC in November 1988 through March 1989. In the more recent June 1991, June 1992 and April 1993 annual monitoring by the Town Of Carmel, MTBE has not been detected at a reported detection limit of 1 ug/L.

6.2.3 Route 118 and Northern Upgradient Area

The area north and upgradient of the BPM has also been impacted by service station spill(s) that have resulted in groundwater contamination. A spill from the Sunoco station about 0.7 mile northeast of the Baldwin Place intersection on Route 6 at Union Valley Road is under investigation by NYSDEC. Although the source has not been determined, MTBE and lower levels of benzene are present in a production well (Well 3) at the Mahopac Village Center mall; this well is reportedly 930 feet deep and is located on the northeast part of the mall property, approximately 1,500 feet from the northern boundary of the BPM. Two other shallower production wells at the Mahopac Village Center (less than 300 feet deep), also located on the northeast part of the property, have reportedly not been impacted (VUA, 1993h).

In 1988, MTBE concentration in the Mahopac Village Center Well 3 was at or less than 200 ug/L. An air stripper system was installed in early 1990 and operated until June 1992. In this timeframe, MTBE concentration in the well peaked at approximately 1,300 ug/L and the well was shut down as the treatment system was not capable of treating the water to the NYSDOH standard of 50 ug/L. The treatment system was subsequently upgraded and the well resumed operation in October 1993. Recent data indicate MTBE in the well water before treatment on the order of 500 ug/L (VUA, 1993h).

Wells along Route 118, between the Mahopac Village Center and the BPM were sampled in November 1988 and March 1989 by NYSDEC and Putnam County. One well (CW-50) showed a trace of MTBE at 1.3 ug/L; in the other sampled wells (CW-48, CW-49, CW-49A, and RW-51) MTBE was not detected. MTBE also has not been detected in the Meadow Park Road residential wells.

6.2.4 Onsite Monitoring Wells and Production Wells

The RI results indicate that low MTBE levels are present in the monitoring wells on both the eastern and western portions of the BPM site. MTBE concentrations from **1 to 4 ug/L** were detected in Monitoring Wells MW-1S/1D, MW-3S/3DD, MW-4S, MW-6S, MW-9D, and MW-10D, and **15 ug/L** MTBE was detected in MW-10S (See Tables 6-1 and 6-2). The leakage from the service stations near and at the Baldwin Place intersection has apparently resulted in a dispersion of this highly mobile compound and low MTBE concentrations over wide areas of the BPM property.

Traces of toluene from **2 to 9 ug/L** were also detected in eight monitoring wells located throughout the property. A trace of benzene at **3 ug/L** was detected in one of two samples from MW-5S. A trace of xylene at **2 ug/L** was detected in MW-5D, however, this result is qualitatively suspect ("B"), and xylene was not detected in the replicate MW-5D sample.

Trace levels of MTBE have occasionally been detected in the BPM production wells. MTBE was not detected **(ND)** in the February 1993 RI production wells samples. However, traces of MTBE (1.2 to 1.5 ug/L) were detected in a March 1989 samples collected by NYSDEC and in a recent November 1993 sample (2 ug/L). The reported detection limit for MTBE in routinely collected samples have typically been higher than these trace levels.

6.3 RECAP OF GROUNDWATER IMPACT AND INTERIM REMEDIAL MEASURES

The constituents of concern at the BPM site, PCE, TCE and 1,2-DCE, are classified by New York State as Principal Organic Contaminants (POCs), and the maximum contaminant level (MCL) established for each POC in Class GA groundwater (source of potable water supply) is 5 ug/L (New York State Title 6, Chapter X, Part 703). Figure 6-3 shows the locations of the nearby offsite residential and commercial wells equipped with GAC filter systems due to PCE concentrations exceeding this MCL, and also of wells equipped with GAC filter systems due to MTBE.

In the BPM production well samples, PCE consistently and TCE intermittently exceed the MCL. The BPM production wells are equipped with a GAC filter system that is designed to handle up to 60 gpm. The current average water usage for this system is about 3.8 gpm. The system is monitored quarterly by Big V Supermarkets, Inc. to confirm that the filters are providing effective treatment. The treated water contains non-detectable levels of VOCs.

The McDonalds Restaurant well on the BPM property contains PCE concentration that intermittently exceeds the MCL (9.9 ug/L in March 1994). This well also contains higher MTBE concentrations (100s ug/L) as a result of leakage from the adjacent Exxon (formerly Mobil) service station. This well is equipped with a GAC filter system maintained by Mobil Oil Corporation.

Two offsite areas have been impacted by the BPM site-related constituents: part of the commercial area along Route 6 to the west and part of the Meadow Park Road community to the southeast. PCE concentrations in certain commercial and residential wells in both the Route 6 and Meadow Park Road areas exceed the MCL; TCE, with one exception, is detected in the offsite wells at low concentrations below the MCL, and traces of 1,2-DCE concentration have been detected in two offsite wells.

The Meadow Park Road community area impacted by the BPM site-related constituents extends approximately 1,200 feet, begins southeast of the dry cleaners and does not reach south beyond Meadow Park Road where it rejoins Tomahawk Street. Eleven residential wells (RW-05, RW-07, RW-08, RW-09, RW-10, RW-11, RW-12, RW-14, RW-15, RW-16, and RW-17) in the Meadow Park community have been impacted. PCE concentrations in these wells range from 1.3 to 300 ug/L, TCE from non-detectable to 10 ug/L, and 1,2-DCE from non-dectable to 0.5 ug/L (as of May 1994). In nine of these wells (RW-05, RW-07, RW-08, RW-09, RW-10, RW-11, RW-15, RW-16, and RW-17), PCE concentration consistently or intermittently exceeds the 5 ug/L MCL and Big V Supermarkets, Inc. maintains GAC filter systems on each of these wells. These filter systems are monitored quarterly by Big V Supermarkets, Inc. to confirm that the filters are providing effective treatment. The treated water contains non-detectable levels of VOCs. The quarterly monitoring results for the nine Meadow Park Road point-of-use filter systems are provided on Table 6-15.

The general trend of the five year database from late 1988 through 1993 was one of very gradually increasing concentrations in the Meadow Park Road area. In the first two quarters of 1994, a more marked increase has been observed in the four most northerly impacted wells (which are equipped with filter systems) within this area. All eighteen wells in the Meadow Park Road community are included in the quarterly monitoring program and should concentrations exceeding the MCL be detected in any of the wells without treatment during the RI/FS period, these wells will also be equipped with a filter system by Big V Supermarkets, Inc.

The Route 6 area impacted by the BPM site-related constituents extends approximately 1,200 feet, begins west of where the western stream crosses under Route 6 and does not extend to CW-25 where the ground surface begins to rise markedly toward Mahopac Avenue to the west. In the four wells within the impacted area (CW-20 through CW-23), PCE concentrations up to 80 ug/L have been detected; TCE up to 4.0 ug/L; and 1,2-DCE up to 1.4 ug/L (as of May 1994). It is unclear if a fifth well directly west of these wells (CW-24) has been impacted as the well and any existing data were not accessible.

Two of these impacted Route 6 wells (CW-22 and CW-23) are equipped with GAC filter systems maintained by the owners. Big V Supermarkets, Inc. equipped the two remaining wells (CW-20 and CW-21) with GAC filter systems. The CW-20 and CW-21 filter systems are monitored quarterly by Big V Supermarkets, Inc. to confirm that the filters are providing effective treatment. The treated water contains non-detectable levels of VOCs (see Table 6-15). These Route 6 wells lie within the area that has also been impacted by the leakage from service stations near the Baldwin Place intersection. Well CW-20 exhibits 36 to 53 ug/L MTBE and the three wells to the west, CW-21, CW-22 and CW-23, show lower concentrations (less than 5 ug/L). The GAC filter systems also provide removal of the MTBE.

The area that has been impacted by the service stations in the vicinity of the Baldwin Place intersection (Exxon (formerly Mobil), Texaco, Citgo) extends into the areas both immediately south and north of the western stream. As mentioned above, the four Route 6 wells south of the western stream equipped with filter systems due to PCE concentrations also contain MTBE. The McDonalds well, and four wells north of the western stream are equipped with GAC filter systems due to MTBE concentrations; CW-19 and CW-54 (the Shell service station well) on Route 6, and RW-40 and RW-41 on Kennard Road. One of these wells, RW-41, is located very close to the western stream and is the only well north of the stream that has also exhibited a trace of PCE (1 ug/L in one sample in August 1992). The CW-19 and CW-54 filter systems are monitored quarterly by NYSDEC and the CW-40 and CW-41 filter systems are monitored quarterly by Spain Oil. The Lake Baldwin water supply on Kennard Road is monitored annually by the owner/operator (Town of Carmel); this water supply system is not impacted by either the BPM site-related or gasoline constituents.

The northern area upgradient of the BPM has also been impacted by gasoline constituents. The source of this leakage is likely a service station located further north on Route 6, and the impact has extended to a production well in the Mahopac Village Center. This well is equipped with an air stripper for MTBE removal. MTBE has not been detected in the Meadow Park Road residential wells.

In summary, the BPM production wells, the McDonalds well, nine Meadow Park Road residential wells to the southeast of the BPM and four commercial wells along Route 6 to the west of the BPM contain PCE concentrations that exceed the New York State MCL for Class GA groundwater of 5 ug/L. All of these wells are equipped with point-of-use GAC filter systems which remove the PCE (and lower TCE/1,2-DCE concentrations, where present) and, in the McDonalds and Route 6 wells, MTBE that is also present. The nine additional Meadow Park Road wells are monitored on a quarterly basis and will be equipped with GAC filter systems for PCE removal as an Interim Remedial Measure before the conclusion of the RI/FS should concentration exceed the MCL.

7.0 CHEMICAL CHARACTERISTICS OF SURFACE WATER AND SEDIMENT

Surface water and sediment quality conditions were characterized in the two stream systems that receive drainage from the BPM site: the eastern and the western streams (see Section 4.3.3). Figure 3-7 shows the surface-water/sediment sample locations and the analytical results for the surface-water/sediment samples are summarized on Tables 7-1 through 7-5.

7.1 EASTERN STREAM

The analytical results indicate that the eastern stream has not been impacted by the site-related constituents (PCE, TCE and 1,2-DCE). These compounds were not detected in any of the three surface-water/sediment sample pairs collected from the eastern stream at the upstream location (SW/SD-01), at the wastewater treatment plant outfall (SW/SD-02) and at the downstream location near the southern property boundary (SW/SD-03).

The surface-water samples collected at and downstream of the treatment plant outfall exhibited trihalomethane (THM) concentrations. At the outfall (SW-02), 200 ug/L chloroform and 46 ug/L bromodichloromethane were detected; 120 ug/L chloroform and 31 ug/L bromodichloromethane were found at the downstream location (SW-03). A trace of chloroform (6 ug/Kg) was also detected in the sediment at the outfall (SD-02). The wastewater is chlorinated as part of the treatment process resulting in the presence of these chlorination associated compounds.

No targeted semi-VOC compounds were detected in the eastern stream surface water; however, low levels of polyaromatic hydrocarbons (PAHs) were detected in the upstream sediments (SD-01). Pesticides were detected in the surface water at the SW-02 and SW-03 locations, and in the sediment at all three sampling locations. However, in the opinion of the data QC reviewer, sufficient reasons exist not to consider these pesticide detections as totally reliable (Environmental Standards, Inc., 1993f); these reasons are the same as for the groundwater samples as described in Section 6.1.2.3. PCBs were not detected in either surface water or sediment. With respect to metals, the surface-water and sediment samples at the treatment plant outfall and the downstream location exhibited generally comparable or lower concentrations than at the upstream location.

The sediment materials in the eastern stream were primarily comprised of fine to medium sand and gravel with some silt and clay.

7.2 WESTERN STREAM

The western stream heads south of the BPM property, crosses under Route 6 north of the site and then flows in a westerly direction. The stream flows through two small ponds (an unnamed pond and then Kennard Pond) and Lake Baldwin, prior to its confluence with the Muscoot River approximately 3,500 feet from the site. Four points along this stream channel were sampled extending over a 1,500-foot distance. From east to west (upstream to downstream), these points are located just north of where the stream crosses under Route 6 (SW/SD-04); upstream of the first, unnamed, pond (SW/SD-06); downstream of the first pond (SW/SD-07); and midway between Kennard Pond and Lake Baldwin (SW/SD-08). The surface-water/sediment sampling in the western stream covered an area within which impacted groundwater (containing the BPM site-related constituents) flowing from the site in a northwest direction would be expected to discharge to this stream (sample locations SW/SD-04, SW/SD-06, and SW/SD-07). Sample location SW/SD-08 is further downstream of this area.

The analytical results indicate that the western stream has been impacted to a very limited degree and extent by the site-related constituents. Traces of PCE at 1 and 2 ug/L were detected in the surface water just north of where the stream crosses under Route 6 (SW-04) and at the next downstream location (SW-06). PCE was also detected at 4 ug/Kg in the sediment at SD-04, but not at SD-06. PCE was not detected in either surface water or sediment at the two further downstream locations (SW/SD-07 and SW/SD-08).

A fifth surface-water/sediment sample pair (SW/SD-09) was collected from the tributary drainage channel to the east (see Figure 3-7) that receives runoff from the area to the northeast of the Baldwin Place intersection. This drainage pathway joins the western stream approximately 200 feet north of where the western stream crosses under

Route 6 (between SW/SD-04 and SW/SD-06). A sixth and seventh surface-water/sediment sample pair (SW/SD-10 and SW/SD-11) were collected from a small drainage ditch on the south side of Route 6 and west of McDonalds that conveys surface runoff from the area west of McDonalds to a culvert that passes under Route 6 just east of the Texaco (former Sunoco) station and ultimately empties into Kennard Pond. This drainage ditch receives seepage from the hillside directly west of McDonalds. SW/SD-10 was collected approximately 50 feet downstream (west) from the beginning of this seepage and SW/SD-11 was collected approximately 750 feet further west.

The analytical results indicate that the drainage ditch south of Route 6 has also been impacted to a very limited degree and extent by the site-related constituents. A trace of PCE at 1 ug/L was detected in surface water at SW-10, and 4 ug/Kg PCE was detected in the sediment at this location (SD-10). PCE was not detected in either surface water or sediment 750 feet further west in this drainage ditch at SW/SD-11; nor was PCE detected at the SW/SD-09 (other tributary drainageway) location.

With respect to other constituents, the analytical results and observations during sampling indicate that the western stream has been impacted by the oil and gasoline spills in the area. The sediment material at the location just north of Route 6 (SD-04) was observed to be strongly odorous during sampling; many PAHs were detected in the sediment but not in the surface-water sample. Since the RI program was focused on the BPM site-related constituents, the samples further downstream in the western stream which were collected during the supplemental event were not tested for PAHs. At the SW/SD-09 location in the tributary drainage pathway to the east, the surface water contained a trace of MTBE (2 ug/L). This location was also not tested for PAHs.

With respect to historical data, at least one oil spill is documented in the area to the northeast of the BPM intersection that would flow to the tributary drainage pathway that joins the western stream. This spill occurred at the Lightning Lube at the Citgo station in 1988. Testing at the time was limited to a sediment sample collected by PCHD from the first pond in the western stream in October 1988 which contained benzene, dichlorobenzenes and other VOCs. PAHs were not analyzed.

The sediment materials in the western stream were varied and comprised of medium to coarse grained sand and pebbles at SD-04 and SD-06, and organic soil with some sand at SD-07 and SD-08. As would be expected with the range of sediment materials, total organic carbon (TOC) contents were variable and ranged from 3,900 mg/kg (0.3 percent) in the coarse-grained material at SD-06 to 120,000 mg/kg (12 percent) in the fine-grained material at SD-07. The SD-08 sample contained a TOC of 34,000 mg/kg (3.4 percent).

The sediment materials at the SD-09 location in the tributary drainage channel to the east were comprised of silt with some fine to medium sand. In the small drainage ditch on the south side of Route 6, the sediment materials consisted of medium to coarse grained sand and pebbles with sandy clay at SD-10; and medium to coarse grained sand and pebbles at SD-11. TOC contents of these samples were 64,000 mg/Kg (6.4 percent) in SD-09; 12,000 mg/Kg (1.2 percent) in SD-10; and 1,200 mg/Kg (0.12 percent) in SD-11.

Finally, a sediment sample was obtained from a catch basin in the stormwater system on the BPM property that drains to the western stream (SD-05). This catch basin contained a minor amount of sediment material that was consumed during sampling, and was sufficient only for TCL VOC and TAL metals analyses. PCE was not detected.

8.0 CONTAMINANT TRANSPORT MECHANISMS

This section brings together the information presented regarding the source area, onsite and regional groundwater flow conditions, and distribution of BPM site-related constituents to provide a description of contaminant transport mechanisms.

A single onsite PCE source area is present in the alleyway immediately behind the dry cleaners. PCE used in dry cleaning has entered the subsurface environment in this area. High residual PCE soil concentrations are present in a limited area (approximately 15 by 15 feet) in the unsaturated zone (above the water table). The water table in this area is approximately 3 feet below ground surface. PCE breakdown products (TCE and 1,2-DCE) are also in evidence at lower concentrations.

The PCE has migrated vertically (under the influence of gravity) through the unsaturated zone into the saturated soil beneath the water table. In the saturated zone, the area with high residual soil PCE concentrations is also limited, but of somewhat wider extent than the area showing high PCE concentrations above the water table. The density of PCE (heavier than water), the local stratigraphy, adsorption, and the groundwater flow system are all factors governing the rate and direction of PCE migration in the saturated zone. As a result of the groundwater divide, PCE is moving with the groundwater in both the south/southeasterly and westerly directions.

Over the southeast portion of the site, the glacial till materials are from 45 to 80 feet thick. In this area, water-level elevations in shallow monitoring wells completed in the glacial till are approximately 10 to 12 feet higher than water-level elevations in deeper wells completed in weathered and competent bedrock. As a result, there is a significant downward vertical component to groundwater flow and the lateral extent of contaminant migration in the shallow glacial till materials appears to be somewhat limited. The contaminants are migrating into the weathered bedrock horizon within a very short distance from the source area. As such the principal migration pathway to the south/southeast is in the weathered bedrock/bedrock system.

The operation of the BPM production wells influences the deeper (weathered bedrock/bedrock) groundwater flow conditions. At current rates of pumpage (average 3.8 gpm), the BPM wells capture a portion of the contaminated groundwater emanating from the source area. However, there is a deeper component of groundwater flow in a southeast direction from the source area that passes the site boundary and reaches the Meadow Park Road community area.

With distance from the source, the contaminant concentrations (PCE, TCE and 1,2-DCE) markedly diminish (dilute) due to hydrodynamic dispersion. As a result, the offsite PCE concentrations in the Meadow Park Road wells are trace (1 ug/L) to 300 ug/L, as compared with 24,000 ug/L in Monitoring Well MW-11S in the source area; 3,200 ug/L in MW-11D just beneath the source area; and nearly 1,000 ug/L in Monitoring Well MW-5D just downgradient of the source area. Due to dispersion, the plume tends to widen with distance from the source area. In the Meadow Park Road community, highest concentrations have appeared in RW-05, RW-08 and RW-09, with wells to the east and south showing lower concentrations. The impacted area begins southeast of the dry cleaners and does not reach south beyond Meadow Park Road where it rejoins Tomahawk Street.

On the western portion of the site, the glacial till materials become thinner and over the far western/northwestern parts of the site, the glacial till materials lie at or near the top of the zone of saturation (water table). Therefore, the shallow groundwater system proximate to the source area is in glacial till and farther west as the saturated glacial materials thin (to less than 1 foot), the shallow groundwater system is comprised of weathered bedrock. In contrast to the eastern portion of the site, water-level elevations in shallow monitoring wells (glacial till and weathered bedrock) are only slightly higher than water-level elevations in coupled deeper bedrock monitoring wells. As such, there is less of a downward component to groundwater flow and contaminant migration occurs in the shallow as well as the deeper system.

The shallow groundwater flow component from the source area is toward the Monitoring Well MW-9 cluster. The regional flow conditions point to the presence of a deeper groundwater divide onsite and a deeper component of groundwater flow in a westerly direction when the BPM production wells are not pumping. The highest PCE concentrations are found in both the shallow and deeper monitoring wells in the MW-9 cluster which is directly downgradient of the dry cleaners. This is consistent with groundwater flow conditions on the western portion of the site, and indicates that contaminant transport from the source occurs within both the shallow and deeper groundwater. PCE concentrations were detected in shallow and deeper wells MW-9S and MW-9D at 850 and 300 ug/L, respectively. As a result of hydrodynamic dispersion, lower concentrations are detected in the MW-1 cluster to the north and in MW-10D to the south. The lower to non-detectable concentrations in the monitoring wells on the western side of the site (MW-7S/7D, MW-10S/10D, and MW-1S/1D) and in commercial wells along Route 6 (McDonalds well, CW-19, and CW-25) serve to bound the plume and provide an additional confirmation of the source area behind the dry cleaners by eliminating the possibility of contribution from any other areas on the site. Although there is no specific explanation for the apparent absence of PCE in MW-10S (during this one sampling event), the data from this sampling point does not affect the conclusions which have been drawn regarding the source area, groundwater flow and contaminant transport in the western site area.

Groundwater flow from the western site boundary is in a northwesterly direction toward Route 6 and the western stream. Along Route 6, there is a sharply delineated area of impact. This area extends from CW-20 to CW-23, and within this area PCE concentrations have been detected up to 80 ug/L. Wells both east and west of this area exhibit non-detectable concentrations (CW-19 to the east and CW-25 to the west). The impacted area begins west of where the western stream crosses under Route 6 and does not extend to CW-25 where the ground surface begins to rise markedly toward Mahopac Avenue to the west.

Residential wells (RW-40, RW-41, RW-42 and RW-43) and public community supply wells (PW-44) north of the western stream have not shown the presence of site-related constituents, with the exception of a single occurrence of 1 ug/L PCE in RW-41 in August 1992. This well is located within a few feet of the western stream.

The area to the north of Route 118 is hydraulically upgradient of the site in both the shallow and deeper groundwater flow systems. PCE is not entering the site from the upgradient direction as evidenced by its absence in the three upgradient monitoring wells (MW-4S/4D and MW-8S) located at the northern site boundary.

The groundwater quality in the site vicinity has also been impacted by spills/leakage at three of the four service stations located at and near the Baldwin Place intersection (the Exxon (formerly Mobil), Texaco, and Citgo stations). The western stream is the discharge point for the shallow and deeper groundwater emanating from these stations. Concentrations of MTBE, a gasoline constituent, are present in a limited area just north and south of the western stream. South of the western stream, MTBE is present in the McDonalds well, and in several of the wells with PCE concentrations along the north side of Route 6. The leakage from the service stations near and at the Baldwin Place intersection has also resulted in a dispersion of this highly mobile compound and low MTBE concentrations (1 to 15 ug/L) over wide areas of the BPM site.

Surface water and sediments in the eastern stream did not contain site-related constituents. The western stream serves as a discharge point for groundwater emanating from the western portion of the site and has been impacted to a very limited degree and extent by the site-related constituents. Traces of PCE at 1 ug/L and 4 ug/kg were detected in the surface water and sediment just north of where the stream crosses under Route 6, and at 2 ug/L in surface water only at the next downstream location. PCE was not detected in either surface water or sediment at two further downstream locations: downstream of the first, unnamed, pond in the western stream channel and midway between Kennard Pond and Lake Baldwin. These results demonstrate that the site-related constituents have not migrated to the Muscoot River via either the eastern or western streams.

9.0 FISH AND WILDLIFE IMPACT ANALYSIS

The Fish and Wildlife Impact Analysis for the Baldwin Place Mall was prepared by Jay Fain & Associates of Westport, Connecticut. The complete report "Fish and Wildlife Impact Analysis for the Baldwin Place Mall, Town of Somers, Westchester County, New York" is included as Appendix M, and the study results are summarized in this section.

Step I of the study identified the fish and wildlife resources present in the vicinity of the site and provided a qualitative assessment of the value of these resources. A topographic map was prepared documenting NYSDEC Significant Habitats, other habitats that may support rare, threatened or endangered species, species of special concern, regulated wetlands, wild and scenic rivers, lakes and other waterbodies, if present, within a two-mile radius of the site perimeter. A covertype map was prepared for the area within one-half mile of the site perimeter illustrating major vegetative communities including forested and emergent wetlands, terrestrial and aquatic habitats based on vegetative covertypes, NYSDEC Significant Habitats (none present) and other land use features. Fish and wildlife species known or expected to be associated with the identified covertypes and aquatic habitats are identified within the study area.

The Step I study concluded that all surface flow from the BPM is confined to the Muscoot River sub-basin, and that the most significant fish and wildlife resource, both within the one-half mile radius and within two miles downstream of the site, is the Muscoot River including the Amawalk Reservoir, and its associated wetlands, open water, and riparian areas. Correspondence with the New York Natural Heritage Program did not identify any resident endangered, threatened, or species of special concern within the boundaries of the study area. Two wetland communities were found on the BPM; field investigation of these areas did not disclose the presence of any Federal or State listed rare or endangered plant species on the site.

Step II of the study determined if there has been, or may be, potential impacts of site-related constituents on fish and wildlife resources via a Pathway Analysis. This analysis was based on the RI surface-water/sediment sampling data which indicate that limited areas within the western stream and in a tributary drainageway to the western stream (which runs west of the site along the south side of Route 6) are the only surface water areas adjacent to the BPM where site-related constituents (PCE) occur. The ecological risk posed by the identified levels of constituents was examined in the Baseline Risk Assessment (See Section 10.0) which concluded that the "results show that no chemical analyzed in surface water poses a risk to the freshwater aquatic life or its uses at the Baldwin Place Mall site. Results of the ecological analysis of sediment demonstrated no environmental risk". Furthermore, constituent migration ends well before the western stream's confluence with the Muscoot River. Based on the finding of no impact to fish and wildlife resources in the Pathway Analysis, the Fish and Wildlife Impact Analysis concluded that further studies are not warranted.

10.0 BASELINE RISK ASSESSMENT

The Baseline Risk Assessment for the Baldwin Place Mall was prepared by Environmental Standards, Inc. of Valley Forge, Pennsylvania. The complete report, "Baseline Risk Assessment for the Baldwin Place Mall Site in Somers, New York" is included as Appendix N, and the methodology and results of the evaluation are summarized in this section.

The risk assessment provides an analysis of potential risks to human health and the environment associated with exposures to site-related chemical constituents, under current and potential future site conditions based on the Remedial Investigation sampling data. The results of the assessment document the magnitude of risk associated with the site, and identify the major contributors to that risk, in order to support a "no-action" alternative where appropriate, or to determine whether additional remediation is necessary to be protective of human health and the environment. The baseline risk assessment follows accepted USEPA procedures and guidelines (e.g., Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, 1989a). Risk is estimated by utilizing conservative point estimates of exposure parameters. Parameters are selected in order that the maximum exposure estimate represents the reasonable maximum exposure (defined as the maximum exposure reasonably expected to occur under a given set of conditions). The comprehensive approach considers potential risks posed by the soil, surface water, groundwater and air pathways.

The exposure assessment (Section 4.0 of the risk assessment) estimates the type, magnitude, frequency, and duration of exposures to the chemicals of potential concern that are present at or migrating from the BPM. The exposure scenarios chosen are identified given both current and potential future activities at the site. The current-use scenario considers potential risks posed to nearby residents. Potential future-use scenarios consider the risks posed to site construction workers, office workers, children and nearby residents. The following pathways are considered to be a comprehensive assessment of potential risks under current and future conditions and are quantitatively addressed in the assessment:

- Dermal contact and ingestion of soil by construction workers;
- Volatile emissions via excavation and grading activities with subsequent inhalation by construction workers;
- Inhalation of volatile organics emissions from site unsaturated soils by current residents;
- Inhalation of vapors from soil infiltrating into a future building foundation by office workers;

- o Dermal contact and ingestion of soil by children;
- o Inhalation of volatile organic emissions from the soil by site children;
- o Dermal contact and ingestion of sediments in the western stream and tributary drainage ditch by children;
- o Dermal contact and ingestion of surface water in the western stream and tributary drainage ditch by children swimming;
- o Inhalation of volatile organic emissions from surface water by children swimming;
- o Ingestion and dermal contact of contaminants in groundwater by current residents who utilize a domestic well adjacent to the property boundary (concentrations in groundwater assumed to equal MCLs);
- o Inhalation of contaminants volatilized from groundwater by current residents during household use of contaminated domestic well water;
- o Ingestion and dermal contact of contaminants in groundwater by future residents who utilize a domestic well adjacent to the property boundary (no GAC filtration assumed);
- o Inhalation of contaminants volatilized from groundwater by future residents during household use of contaminated domestic well water.

Summaries of the combined hazard indices and upper-bound lifetime cancer risks resulting from exposure to site-related chemicals in the exposure scenarios defined above are presented in Table 10-1. Risk calculations for the various chemicals and individual pathways are presented in the Baseline Risk Assessment Tables 9 through 23 (Appendix N).

Cancer risks posed to future construction workers in the area of soil contamination (source area) via exposure through all pathways and all chemicals is estimated to be 1 x 10-5 (i.e., one case of excess cancer in one hundred thousand exposed individuals). This risk is within USEPA's acceptable target risk range of 1 x 10-4 to 1 x 10-6, but exceeds the de minimis benchmark level of 1 x 10-6. The combined hazard index for the construction worker is estimated to be 6.0 which exceeds the threshold benchmark of 1.0. All of the cancer risk and hazard quantity is attributable to the inhalation pathway for PCE.

Future office workers via exposure through infiltration of vapors through the foundation of a future building constructed over the area of soil contamination (source area) are estimated to incur a combined cancer risk of 9 x 10-6, and a hazard index of 2.0. Again, all of the cancer risk and hazard quantity is attributable to PCE.

Children are estimated to incur a combined cancer risk of 5 x 10-7, which is below the de minimis benchmark level of 1 x 10-6. The total combined hazard index for this population is estimated to be 0.2, indicating that no adverse health effects are anticipated, even under reasonable maximum conditions of exposure. The population incorporated soil, sediment and surface water media and the results indicate that no remediation of any media is necessary under the scenarios developed to assess potential exposure by children.

The National Contingency Plan (NCP) states that the Applicable or Relevant and Appropriate Requirement (ARAR) for groundwater that is currently a source of drinking water are federal non-zero MCLGs, MCLs, or the state drinking water standards. At this time, all residential and commercial water supplies analyzed during the RI are currently meeting MCLs and are, therefore, adequately protected. This assumes that regular maintenance on the existing GAC filter systems will continue; that the GAC systems will not be dismantled until groundwater has been remediated or an alternate water supply provided; and that if any further residential wells exhibit PCE attributable to the site above the MCL of 0.005 mg/L, a GAC filter will be installed or an alternate water supply provided. The combined total hazard index for this group of exposed individuals (current residents) is estimated to be 0.08, which is well below unity and indicates no possible health hazards other than the very minimal added risk of cancer (which may be zero). The nearby residents (residence time of 30 years) are estimated to incur a combined excess risk of cancer of about 4 x 10-6, which slightly exceeds the de minimis benchmark level of 1 x 10-6. The risk is attributable only to groundwater pathways which utilized the federal and NYSDEC/NYDOH maximum contaminant levels (MCL) for PCE and TCE as the groundwater concentrations. Assuming the concentrations of both PCE and TCE are 0.005 mg/L for current residents is a conservative assumption because for the wells with existing GAC filter systems PCE and TCE are not detected in the treated water, and none of the wells without filter systems exceed the MCL. The upper 95th confidence limit (UCL) is, therefore, more likely to be much lower than 0.005 mg/L.

Under the assumption that the concentrations of constituents detected in the residential wells, commercial wells and deep monitoring wells would be of future domestic use without any treatment, a carcinogenic risk of 5 x 10-5 is estimated. This risk, while within USEPA's acceptable target risk range of 1 x 10-4 to 1 x 10-6, exceeds the de minimis benchmark level of 1 x 10-6. The combined hazard index for the future residents is estimated to be 1.0.

The results of the ecological assessment of the surface water in the vicinity of the site indicate that no chemical analyzed in surface water poses a risk to the freshwater aquatic life or its uses at the BPM site. Results of the ecological analysis of sediment additionally demonstrated no environmental risk.

11.0 SUMMARY AND CONCLUSIONS

General

The BPM site is located in a relative topographic high area and surface drainage from the site is to two stream systems: the eastern and the western streams. Both of these streams head near the site, thus have very small drainage areas in the vicinity of the site, and are tributary to the Muscoot River. The western stream valley comprises the most significant topographic feature in the study area.

Water supply in the area proximate to the site is derived from groundwater. The BPM and Mahopac Village Center mall are supplied by centralized production well systems with appropriate treatment. The nearest public supply system is the Lake Baldwin system located about 1,800 feet northwest of the western site boundary. No treatment has been necessary for this system. The remaining residences and commercial establishments rely on individual wells for supply purposes. At least sixteen of these wells are equipped with treatment systems.

Hydrogeologic Framework

The site and vicinity are underlain by glacial till, weathered bedrock and bedrock. The glacial till comprises the uppermost geologic and water-bearing unit. The till is very thin near the western and northwestern site boundaries and thickens to the south/southeast. The saturated glacial till materials range in thickness from less than 1 foot in the northwest to as much as 80 feet in the southeast site area.

The glacial till is directly underlain by weathered bedrock. The weathered bedrock is approximately 20 feet thick and there is a gradation from highly weathered (decomposed) bedrock to competent bedrock. Groundwater circulation appears to be significant in the weathered and partially weathered bedrock horizon. The depth to competent bedrock (biotite gneiss) ranges from 22 feet bgs in the western part of the site to about 100 feet bgs in the east/southeast.

The weathered bedrock/bedrock system is unconfined over the extreme western and northwestern portion of the site. Over the main body of the site, the weathered bedrock/bedrock system is overlain/confined by the glacial till water-bearing unit.

Water-level measurements made in the shallow monitoring well network indicate the presence of an onsite groundwater divide oriented in a southwest to northeast direction in the vicinity of the main mall building (and dry cleaners). This divide is evident under normal BPM pumping conditions (average 3.8 gpm), and also when the mall wells have been shutdown for an extended period. Groundwater flow from the divide is to the southeast and west/northwest. The water-level drawdown response in shallow weathered bedrock monitoring wells during the 2-day pumping test indicate that sustained pumping of PW-1 (beyond the 2-day pumping test) may begin to capture shallow groundwater in the weathered bedrock over the western portion of the site.

Water-level measurements made in the deeper monitoring well network provide an understanding of the extent to which the BPM production wells serve to capture deeper flow. Under present BPM pumping conditions, the mall wells are capturing groundwater over a portion of the site with a component of groundwater flow offsite to the southeast. Under sustained pumping conditions (2 days at 39 gpm), BPM Production Well PW-1 effectively captures deeper groundwater over the site.

The regional water-level contour map for the bedrock system confirms the presence of a deeper groundwater divide onsite under non-pumping conditions with flow components to the southeast and west/northwest. The regional water-level measurements were made during a period when the BPM production wells were not actively pumping, but not during a sustained period of shutdown.

Water-level measurement data for glacial till/weathered bedrock clustered wells indicate that water-level elevations (heads) in shallow wells completed in the shallow glacial till are higher than water-level elevations in coupled wells completed in the underlying weathered bedrock/bedrock unit. This water-level elevation difference indicates that a vertical (downward) component to groundwater flow is present over the portion of the site wherein saturated glacial till materials overlie the bedrock. This downward component to flow is more pronounced in well clusters south and east of the mall building as compared to well clusters north and west of the mall building.

In contrast, the water-level elevation (head) differences are less for monitoring well clusters completed in weathered bedrock/bedrock over the western portion of the site. This indicates that flow in the weathered bedrock/bedrock unit on the western part of the site (unencumbered by a saturated lower permeability glacial till) has less of a downward flow component.

Aquifer Hydraulic Characteristics

The analysis of data from the short-term pumping tests indicates that monitoring wells completed in weathered bedrock show the highest specific capacities (0.78 gpm/ft average) and transmissivities. Individual well specific capacities and transmissivities are lower for monitoring wells completed in the overlying glacial till and underlying competent bedrock.

The analysis of the 48-hour constant-rate pumping test indicates that the weathered bedrock/bedrock aquifer underlying the site behaves as a leaky artesian system wherein the overlying glacial till materials serve as a leaky confining unit (source bed). Leakage through the glacial till is the principal source of recharge to the weathered bedrock/bedrock system.

The transmissivity of the weathered bedrock/bedrock aquifer is in the range from 750 to 1,500 gpd/ft which is characteristic of a moderately permeable bedrock system. Storativity is in the range from 1.7×10^{-4} to 2.5×10^{-3} reflective of leaky artesian conditions. The vertical permeability of the glacial till confining unit is in the range from 0.043 to 0.050 gpd/ft^2.

The step-drawdown pumping test on BPM Production Well PW-1 indicates that this well can sustain a yield of 39 gpm (maximum pump capacity) with 30 to 40 feet of remaining available drawdown.

The theoretical capture zone calculated for PW-1 pumping at 39 gpm with a transmissivity of 1,500 gpd/ft shows a reasonable correlation with the field-determined capture zone based on water-level measurements made after 42 hours of pumping. Both the theoretical and field-based capture zones demonstrate that the sustained PW-1 pumping effectively captures deeper groundwater on the site.

Source Area Characteristics

The analytical results for the soil samples collected from the test borings confirm the presence of a residual PCE source area in the alleyway near the back door of the dry cleaners. Residual PCE concentrations are present in both the unsaturated and saturated soil in this area.

Elevated PCE concentration in the unsaturated zone (soil above the water table) appears to be limited to an approximate 15 by 15 foot area directly behind the dry cleaners. The top of the zone of saturation in this area is about 3 feet below ground surface. As such, the volume of unsaturated material in the source area is small (approximately 25 cubic yards).

Elevated PCE concentration extends below the water table to a maximum depth of 15 feet at the most highly impacted location (approximately 5 feet from the backdoor of the dry cleaners). The area of elevated PCE concentration in the saturated zone extends approximately 5 to 10 feet further east than the source area above the water table. The groundwater within the source area exhibits 24,000 ug/L PCE concentration, and, immediately below the source area, 3,200 ug/L.

Onsite Groundwater Quality

The dry cleaner-related compounds (PCE and its breakdown products TCE and 1,2-DCE) are the constituents of concern in groundwater at the BPM site, and their concentration distribution is consistent with a sole contaminant source at the dry cleaners. As a result of the groundwater divide, these compounds are emanating in both the southeasterly and westerly directions from the dry cleaners proximity. The PCE concentrations that are in the onsite and nearby offsite groundwater, and which have been observed in the BPM production wells since 1979, have emanated from this residual source area in the dry cleaners proximity.

Comparable PCE concentrations are present in monitoring wells located to both the southeast and west of the shallow groundwater divide near the dry cleaners. The highest PCE concentrations detected were 910 ug/L in southeastern well MW-5D and 850 ug/L in western well MW-9S. TCE (up to 190 ug/L) and 1,2-DCE (up to 61 ug/L) concentrations were also detected in southeastern and western monitoring wells.

In the east/southeastern part of the site, downward migration of contaminants from the shallow groundwater in the glacial till into the weathered bedrock/bedrock occurs within a very short distance from the source area as demonstrated by the concentrations in Monitoring Well MW-5D. Monitoring Wells MW-3D and MW-3DD appear to be just east (outside) of the area in the bedrock aquifer that is the primary southeastern constituent migration pathway.

In the western part of the site, the finding of the highest concentrations at the MW-9 cluster is consistent with the shallow water-level contours which indicate that this well cluster is located directly downgradient of the dry cleaners. The vertical component of groundwater flow is more gentle here than on the east/southeast part of the site, and this is reflected in the Monitoring Well MW-9S PCE concentration which is higher than in deeper well MW-9D. The MW-7 and MW-1 cluster locations appear to be just north, and the MW-10 well cluster location just south of the primary western constituent migration pathway.

Offsite Groundwater Quality

Two offsite areas have been impacted by the BPM site-related constituents: part of the commercial area along Route 6 to the west and part of the Meadow Park Road community to the southeast. PCE concentrations in certain commercial and residential wells in both the Route 6 and Meadow Park Road area exceed the New York State MCL for Class GA groundwater of 5 ug/L; TCE, with one exception, is detected in the offsite wells at low concentrations below the MCL, and traces of 1,2-DCE have been detected in two offsite wells.

The Meadow Park Road area impacted by the BPM site-related constituents extends approximately 1,200 feet, begins southeast of the dry cleaners and does not reach south beyond Meadow Park Road where it rejoins Tomahawk Street. Eleven residential wells in the Meadow Park Road community have been impacted. PCE concentrations in these wells range from 1.3 to 300 ug/L, TCE from non-detectable to 10 ug/L, and 1,2-DCE from non-detectable to 0.5 ug/L (as of May 1994). In nine of these wells, PCE concentration consistently or intermittently exceeds the 5 ug/L MCL and Big V Supermarkets, Inc. maintains GAC filter systems on each of these wells. The concentration distribution indicates that PCE levels decline within a short distance in the southeast (downgradient) direction within the Meadow Park Road area. The general trend of the five year database from late 1988 through 1993 was one of very gradually increasing concentrations in the Meadow Park Road area. In the first two quarters of 1994, a more marked increase has been observed in the four northernmost impacted wells within this area.

The Route 6 area impacted by the site-related constituents also extends approximately 1,200 feet, begins west of where the western stream crosses under Route 6, and does not extend to where the ground surface begins to rise markedly towards Mahopac Avenue to the west. In the four commercial wells within the impacted area, PCE concentrations up to 80 ug/L have been detected; TCE up to 4.0 ug/L; and 1,2-DCE up to 1.4 ug/L (as of May 1994). Two of these wells are equipped with GAC filter systems maintained by the owners. Big V Supermarkets, Inc. maintains GAC filter systems on the other two wells.

The impact by the service stations in the vicinity of the Baldwin Place intersection (Exxon (formerly Mobil), Texaco and Citgo) extends into the areas both immediately south and north of the western stream. The four Route 6 commercial wells south of the western stream equipped with filter systems due to PCE concentration also contain MTBE. The McDonalds well, and four wells north of the western stream are equipped with GAC filter systems due to MTBE concentrations; two commercial wells on Route 6 (east of where the stream crosses under Route 6) and two residential wells on Kennard Road. One of the Kennard Road wells is located very close to the western stream and is the only well north of the stream that has also exhibited a trace of PCE. Neither PCE or MTBE are present in the Lake Baldwin public water supply system. The McDonalds well is also fitted with a GAC filter system due to MTBE.

The leakage from the service stations near and at the Baldwin Place intersection has resulted in a dispersion of MTBE (a highly mobile compound) over wide areas of the BPM property. Low levels of MTBE (from 1 to 15 ug/L) are present in monitoring wells on both the eastern and western parts of the property, and traces of MTBE (on the order of 2 ug/L) are intermittently present in the BPM production wells.

The northern area upgradient of the BPM has also been impacted by gasoline constituents. The source of this leakage is likely a service station located further north on Route 6, and the impact has extended to a production well in the Mahopac Village Center mall. This well is equipped with an air stripper for MTBE removal. Historical results for wells along Route 118, between the Mahopac Village Center mall and the BPM, do not indicate the presence of MTBE. MTBE is also not present in the Meadow Park Road residential wells.

In all, the BPM production wells, the McDonalds well, nine Meadow Park Road residential wells to the southeast of the BPM and four commercial wells along Route 6 to the west of the BPM contain PCE concentrations that exceed the New York State MCL for Class GA groundwater of 5 ug/L. All of these wells are equipped with GAC filter systems which remove the PCE (and lower TCE/1,2-DCE concentrations, where present), and, in the McDonalds and Route 6 wells, MTBE that is also present. The nine remaining Meadow Park Road wells are monitored on a quarterly basis and will be equipped with GAC filter systems for PCE removal as an Interim Remedial Measure before the conclusion of the RI/FS should concentrations exceed the MCL.

Surface-Water/Sediment Quality

The eastern stream heads just north of Route 118 and flows parallel to the site's eastern boundary. The stream flows through a series of man-made ponds in the Meadow Park Road residential area prior to the stream's confluence with the Muscoot River about one mile south of the site. The analytical results indicate that the eastern stream has not been impacted by the site-related constituents (PCE, TCE and 1,2-DCE).

The western stream heads south of the BPM property, crosses under Route 6 north of the site and then flows in a westerly direction. The stream flows through two small ponds (an unnamed pond and then Kennard Pond) and Lake Baldwin, prior to its confluence with the Muscoot River approximately 3,500 feet from the site.

The analytical results indicate that the western stream and a tributary drainageway to the western stream (which runs along the south side of Route 6 to the west of the site) have been impacted to a limited degree and extent by the site-related constituents. Traces of PCE were detected in surface water and/or sediment only in the sampled locations most proximate to the site and not at downstream locations.

Future Modelling Effort

As part of the Feasibility Study, an analytical mass transport groundwater model will be formulated that simulates the total VOC (PCE and its breakdown products) distribution over the southeastern and western site areas emanating from the source area near the dry cleaners. This model will also be used to predict total VOC concentrations in the impacted southeastern and western onsite and offsite areas, given source remediation and groundwater recovery alternatives consistent with the goal of remediating groundwater at the onsite production wells to below standards in a reasonable timeframe. The modelling effort will also yield an estimate of the quantity of total VOCs in the subsurface.

12.0 REFERENCES

Bruin J. and Hudson H.E. 1955. Selected Methods for Pumping Test Analysis. Illinois State Water Survey, Report of Investigation 25.

Cooper, H.H. and Jacob, C.E. 1946. A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History. Transactions American Geophysical Union, Volume 27, No. 4.

Environmental Standards, Inc. (ESI) 1993a. Quality Assurance Review of the Samples Collected August 31 - September 2, 1992 for the Baldwin Place Mall Project. March 3, 1993.

ESI. 1993b. Quality Assurance Review of the Samples Collected February 24, 1993 for the Baldwin Place Mall Project. April 14, 1993.

ESI. 1993c. Quality Assurance Review of the Samples Collected March 11, 1993 for the Baldwin Place Mall Project. May 5, 1993.

ESI. 1993d. Quality Assurance Review of the Samples Collected April 12-14, 1993 and April 22, 1993 for the Baldwin Place Mall Project. June 30, 1993.

ESI. 1993e. Quality Assurance Review of the Samples Collected May 18-21, 1993 for the Baldwin Place Mall Project. July 29, 1993.

ESI. 1993f. Quality Assurance Review of the Samples Collected June 2, 1993 for the Baldwin Place Mall Project. August 20, 1993.

ESI.1993g. Quality Assurance Review of the Samples Collected October 15, 1993 for the Baldwin Place Mall Project. December 7, 1993.

ESI.1993h. Quality Assurance Review of the Samples Collected December 9, 1993 for the Baldwin Place Mall Project. January 14, 1994.

Hantush and Jacob. 1955. Steady Three-Dimensional Flow to a Well in a Two Layered Aquifer. Transactions American Geophysical Union, Volume 36. No. 2.

International Technology Corporation. 1990. Environmental Site Assessment, Mahopac Shell Service Station, Route 6 & Baldwin Place Road. Prepared for NYSDEC. January 24, 1990.

J. Fain & Associates. 1991. Environmental Assessment for the Somers Square Site. June 17, 1991.

J. Robert Folchetti & Associates (JRFA). 1989. Baldwin Place Ground Water Investigation Report. May 1989.

Leggette, Brashears & Graham, Inc. 1988. Environmental Assessment of the Baldwin Place Shopping Center, Somers, New York. August 1988.

Leggette, Brashears & Graham, Inc. 1993 and 1994. Letters to Vincent Uhl regarding Well 1-W Data on the Morelite Development "Meadows in Somers" Subdivision. May 6, 1993 and March 24, 1994.

Malcolm Pirnie, Inc. 1990. Big V Supermarkets Baldwin Place Hazardous Waste Site Classification. March 1990.

Malcolm Pirnie. 1992. Baldwin Place Mall Site Investigation, Big V Supermarkets, Baldwin Place, New York. January 1992.

New York State Department of Environmental Conservation (NYSDEC). 1989. Letter to Big V Supermarkets, Inc. from Robert L. Marino, Chief Site Control Section, Bureau of Hazardous Waste Control, Division of Hazardous Waste Remediation re. notification of the inclusion of the BPM in the Registry of Inactive Hazardous Waste Disposal Sites in New York State. October 31, 1989.

NYSDEC. 1991a. Order On Consent in the Matter of the Development and Implementation of a Limited Field Investigation for an Inactive Hazardous Waste Disposal Site, Under Article 27, title 13 of the Environmental Conservation Law of the State of New York. Site #3-60-023. Index #W3-0390-89-12. Entered into by NYSDEC and Big V Supermarkets, Inc. June 3, 1991.

NYSDEC. 1991b. Order On Consent in the Matter of the Development and Implementation of Interim Remedial Measures for an Inactive Hazardous Waste Disposal Site, Under Article 27, title 13 of the Environmental Conservation Law of the State of New York. Site #3-60-023. Index #W3-0390-89-12. Entered into by NYSDEC and Big V Supermarkets, Inc. September 12, 1991.

NYSDEC. 1992a. Order On Consent in the Matter of the Development and Implementation of a Remedial Investigation/Feasibility Study for an Inactive Hazardous Waste Disposal Site, Under Article 27, Title 13, of the Environmental Conservation Law of the State of New York. Site #3-60-023. Index #3-0390-89-12. Entered into by NYSDEC and Big V Supermarkets, Inc. August 4, 1992.

NYSDEC. 1992b. Letter to Jaclyn Baron re. Baldwin Place Shopping Center, Somers, New York. Site Code 360023. November 17, 1992.

NYSDEC. 1992c. Letter to Jaclyn Baron, VUA re. Baldwin Place Shopping Center, Somers, New York, Site Code 360023. December 24, 1992.

NYSDEC. 1993. Letter to Vincent W. Uhl re. Baldwin Place Shopping Center, Somers, N.Y. Site Code 360023. October 25, 1993.

NYSDEC. 1994a. Letter to Vincent W. Uhl, CPG, PH re. Baldwin Place Shopping Center, Site Code 360023. April 28, 1994.

NYSDEC. 1994b. Letter to Vincent W. Uhl, CPG, PH re. Baldwin Place Shopping Center, Site Code 360023. August 15, 1994.

Prucha, J.J., Scotford, D.M., and Sneider, R.M. 1968. Bedrock Geology of Parts of Putnam and Westchester Counties, New York and Fairfield County, Connecticut. New York State Museum and Science Service. Map and Chart Series Number 11. The University of the State of New York, The Education Department. Albany, N.Y.

Schafer, D.C. 1978. Casing Storage Can Affect Pumping Test Data. Johnson Drillers' Journal, Johnson Division, St. Paul, Minnesota. January/February 1978.

State of New York Department of Conservation, Water Power and Control Commission. 1955. The Groundwater Resources of Westchester County, New York. Part I, Records of Wells and Test Holes. By E. S. Asseltine and I. G. Grossman, Geologists, U.S. Geological Survey. Bulletin GW-35, Albany, New York.

Technical Environmental Specialists Corporation (TES). 1991. Status Report, Mobil Service Station #06-GDK, Route 6, Baldwin Place, New York. Prepared for Mobil Corporation. February 15, 1991.

Theis C.V. 1935. The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Ground Water Storage. American Geophysical Union, pages 518-524.

Vincent Uhl Associates (VUA). 1991. Visit with Natasha Court, Westchester County Health Department, White Plains, New York. November 18, 1993.

VUA. 1992a. Work Plan for Remedial Investigation/Feasibility Study at the Baldwin Place Mall, Somers, New York. May 1992.

VUA. 1992b. Sampling and Analysis Plan for Remedial Investigation/Feasibility study at the Baldwin Place Mall, Somers, New York. August 1992. Revised October 1992.

VUA. 1992c. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Monitoring Well Details and Hydrogeologic Data; Baldwin Place Mall, Somers, New York. October 16, 1992.

VUA. 1992d. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Drill Cuttings; Baldwin Place Mall, Somers, New York. October 16, 1992.

VUA. 1992e. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Analytical Results for Groundwater Samples; Baldwin Place Mall, Somers, New York. November 19, 1992.

VUA. 1992f. Interim Site Characterization Report, Baldwin Place Mall, Somers, New York. December 1992.

VUA. 1993a. Personal Communication with Hari O. Agrawal, NYSDEC Region 3. January 8, 1993.

VUA. 1993b. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Soil Gas Survey Data; Baldwin place Mall. February 18, 1993.

VUA. 1993c. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. 1) Proposed Soil Sampling/Test Boring Locations, 2) Rationale for Proposed Additional Monitoring Wells (Supplemental Field Elements, and 3) Clarification of Surface-Water/Sediment Sampling Locations. February 25, 1993.

VUA. 1993d. Letter Report to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Technical Specification for Aquifer Pumping Test (Field Sampling Plan Appendix N). March 19, 1993.

VUA. 1993e. Letter Report to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Remedial Investigation Test Boring/Soil Sampling Program Results; Baldwin Place Mall, Somers, New York. July 26, 1993.

VUA. 1993f. Work Plan for Additional Data Collection [in the] PCE Source Area Near the Dry Cleaners, Baldwin Place Mall, Somers, New York. August 1993.

VUA. 1993g. Visit with Larry Werper, Putnam County Health Department, Division of Environmental Health Services, Carmel, New York. September 30, 1993.

VUA. 1993h. Personal communication with Peter DeCicco, NYSDEC Region 3 Spills Management Section. November 1, 1993.

VUA. 1993i. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Drill Cuttings from Supplemental Program, Baldwin Place Mall. November 3, 1993.

VUA. 1993j. Personal communication with Bill DeRose, Town of Carmel. November 11, 1993.

VUA. 1993k. Letters to John Rankin, Chief, Investigation Support Section, NYSDEC re. transmittals of ESI Quality Assurance Review Reports and Envirotest Laboratories responses. March 4, 1993, April 20, 1993, May 13, 1993, July 23, 1993, August 2, 1993, September 9, 1993, October 21, 1993, December 10, 1993, and January 20, 1994.

VUA. 1994. Letter to Hari O. Agrawal, P.E., NYSDEC Region 3 re. Baldwin Place Mall; Somers, New York. Response to NYSDEC and NYSDOH Comments on Draft Remedial Investigation Report and Baseline Risk Assessment. July 11, 1994.

Walton, William C. 1984. Practical Aspects of Groundwater Modeling. National Water Well Association.

Westchester County. 1977. 208 Areawide Waste Treatment Management Planning for Westchester County, N.Y., North County Technical Study Groundwater Section.

Westchester County Department of Health. 1989. Interim Report, Groundwater Volatile Organic Chemical Contamination., Baldwin Place, Somers (T). Bureaus of Environmental Quality and Environmental Risk Control. April 14, 1989.

TABLE 3-1. HORIZONTAL AND VERTICAL SURVEY DATA; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL/STAFF GAUGE	COORDINATES NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE)		ELEVATION OF GROUND SURFACE (feet, msl)	ELEVATION OF WELL/STAFF GAUGE MEASURING POINT (feet, msl)
MW-1S	N: 490017.05	E: 657865.91	597.41	596.94
MW-1D	N: 489996.75	E: 657866.21	597.41	596.98
MW-2S	N: 489208.54	E: 657911.87	601.53	604.05
MW-2D	N: 489201.58	E: 657913.29	601.66	603.41
MW-3S	N: 489840.09	E: 658547.14	602.65	604.60
MW-3D	N: 489928.54	E: 658517.37	602.25	604.23
MW-3DD	N: 489916.99	E: 658522.03	602.22	604.21
MW-4S	N: 490472.33	E: 658342.09	609.68	611.64
MW-4D	N: 490472.33	E: 658348.70	609.72	611.84
MW-5S	N: 489975.41	E: 658440.21	603.36	602.84
MW-5D	N: 489926.38	E: 658434.72	602.80	602.26
MW-6S	N: 489984.66	E: 658555.87	602.09	603.95
MW-7S	N: 489977.81	E: 658216.91	602.07	601.67
MW-7D	N: 489925.39	E: 658230.61	602.18	601.85
MW-8S	N: 490494.34	E: 658582.67	618.28	618.02
MW-9S	N: 489830.91	E: 657691.12	596.21	595.99
MW-9D	N: 489839.13	E: 657686.69	595.99	595.68
MW-10S	N: 489657.78	E: 657883.94	600.64	600.18
MW-10D	N: 489705.74	E: 657883.78	600.52	600.22
MW-11S	N: 490004.09	E: 658418.01	-	603.33
MW-11D	N: 490003.42	E: 658413.05	-	603.23
PW-1	N: 489420.61	E: 658466.45	607.29	609.32
PW-2	N: 489306.83	E: 658345.46	610.32	613.51
LBG-1	N: 489797.52	E: 658637.44	600.48	602.26
LBG-2	N: 489732.80	E: 658577.38	-	602.57
SG-1	N: 490524.34	E: 658726.43	-	620.70
SG-2	N: 489677.57	E: 658758.07	-	596.77
SG-3	N: 489058.38	E: 658836.19	-	593.61
SG-4	N: 489165.00	E: 657894.10	-	602.30
SG-5	N: 490277.19	E: 657439.91	-	571.35

msl - Mean sea level.

Staff gauge (SG) measuring points are at the 3-foot mark.

Vincent Uhl Associates

TABLE 3-2. REMEDIAL INVESTIGATION SAMPLING AND ANALYTICAL TESTING SUMMARY; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Location	Description	Sample Matrix	Sample Designation	Sample Date	TCL-VOCs	TCL-BNAs	TCL-Pest/PCBs	TAL Metals & Inorganics (Total)	TAL Metals & Inorganics (Dissolved)	Groundwater Chemistry
MONITORING WELLS										
Monitoring Well MW-1S	Shallow	Groundwater	BPM-MW-1S-01	9/1/92	X	X	X	X		
		Groundwater	BPM-MW-1S-02	5/20/93	X					
Monitoring Well MW-1D	Bedrock	Groundwater	BPM-MW-1D-01	9/1/92	X	X	X	X	X	X (1)
		Groundwater	BPM-MW-1D-02	5/20/93	X					
Monitoring Well MW-2S	Shallow	Groundwater	BPM-MW-2S-01	9/1/92	X	X	X	X		
		Groundwater	BPM-MW-2S-02	5/19/93	X					
Monitoring Well MW-2D	Deep	Groundwater	BPM-MW-2D-01	9/1/92	X	X	X	X		
		Groundwater	BPM-MW-2D-02	5/19/93	X					
Monitoring Well MW-3S	Shallow	Groundwater	BPM-MW-3S-01	8/31/92	X	X	X	X	X	X (1)
		Groundwater	BPM-MW-3S-02	5/18/93	X					
		Field Blank	BPM-MW-3S-02B	5/18/93	X					
Monitoring Well MW-3D	Deep	Groundwater	BPM-MW-3D-01	8/31/92	X	X	X	X	X	X (1)
		Groundwater	BPM-MW-3D-01R	8/31/92	X	X	X	X	X	
		Field Blank	BPM-MW-3D-01B	8/31/92	X	X	X	X		
		Groundwater	BPM-MW-3D-02	5/19/93	X					
Monitoring Well MW-3DD	Bedrock	Groundwater	BPM-MW-3DD-01	8/31/92	X	X	X	X	X	X (1)
		Groundwater	BPM-MW-3DD-02	5/19/93	X					
Monitoring Well MW-4S	Shallow	Groundwater	BPM-MW-4S-01	8/31/92	X	X	X	X		X (1)
		Groundwater	BPM-MW-4S-02	5/19/93	X					
Monitoring Well MW-4D	Bedrock	Groundwater	BPM-MW-4D-01	9/1/92	X	X	X	X	X	X (1)
		Groundwater	BPM-MW-4D-02	5/19/93	X					
Monitoring Well MW-5S	Shallow	Groundwater	BPM-MW-5S-01	9/1/92	X					
		Groundwater	BPM-MW-5S-02	5/18/93	X					
Monitoring Well MW-5D	Deep	Groundwater	BPM-MW-5D-01	5/21/93	X					
		Groundwater	BPM-MW-5D-01R	5/21/93	X					
		Field Blank	BPM-MW-5D-01B	5/21/93	X					
Monitoring Well MW-6S	Shallow	Groundwater	BPM-MW-6S-01	9/2/92	X					
		Field Blank	BPM-MW-6S-01B	9/2/92	X					
		Groundwater	BPM-MW-6S-02	5/18/93	X					
Monitoring Well MW-7S	Shallow	Groundwater	BPM-MW-7S-01	9/2/92	X					
		Groundwater	BPM-MW-7S-02	5/20/93	X					
Monitoring Well MW-7D	Bedrock	Groundwater	BPM-MW-7D-01	5/21/93	X					
		Groundwater	BPM-MW-7D-01R	5/21/93	X					
Monitoring Well MW-8S	Shallow	Groundwater	BPM-MW-8S-01	9/1/92	X	X	X	X	X	
		Groundwater	BPM-MW-8S-02	5/19/93	X					
Monitoring Well MW-9S	Shallow	Groundwater	BPM-MW-9S-01	5/19/93	X					
Monitoring Well MW-9D	Bedrock	Groundwater	BPM-MW-9D-01	5/20/93	X					
Monitoring Well MW-10S	Shallow	Groundwater	BPM-MW-10S-01	5/20/93	X					
Monitoring Well MW-10D	Bedrock	Groundwater	BPM-MW-10D-01	5/20/93	X					
		Trip Blank	BPM-TB-08/31	8/31/92	X					
		Trip Blank	BPM-TB-09/01	9/1/92	X					
		Trip Blank	BPM-TB-09/02	9/2/92	X					
		Trip Blank	BPM-TB-05/18	5/18/93	X					
		Trip Blank	BPM-TB-05/19	5/19/93	X					
		Trip Blank	BPM-TB-05/21	5/21/93	X					
Water Used in Drilling	BPM Water Supply	Treated Water		7/7/92	X	X	X	X		
Generated Water	Monitoring Wells	Water	BPM Tanker Water	9/9/92	X (1)					
Drill Cuttings Soil Piles	Monitoring Wells	Soil	BPM Soil Pile #1	9/9/92	X (1)					
			BPM Soil Pile #1	9/9/92	X (1)					
			BPM Soil Pile Comp.	9/9/92		X (1)	X (1)	X (1)		
	Supplemental Monitoring Wells	Soil	BPM Soil Pile #2	5/21/93	X (1)	X (1)	X (1)	X (1)		

NOTE: (1) - Standard (non-CLP) analyses and reporting.

Vincent Uhl Associates

TABLE 3-2. REMEDIAL INVESTIGATION SAMPLING AND ANALYTICAL TESTING SUMMARY; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Location	Description	Sample Matrix	Sample Designation	Sample Date	TCL-VOCs	TCL-BNAs	TCL-Pest/PCBs	TAL Metals & Inorganics (Total)	TAL Metals & Inorganics (Dissolved)	Groundwater Chemistry
BPM PRODUCTION WELLS										
Production Well PW-1	Northeast Well	Groundwater	BPM-WELL1-01	2/24/93	X					
Production Well PW-2	Southwest Well	Groundwater	BPM-WELL2-01	2/24/93	X					
		Trip Blank	BPM-TB-02/24	2/24/93	X					
RESIDENTIAL & COMMERCIAL WELLS										
Residential Well RW-01	Meadow Park Road	Groundwater	BPM-RW-01-01	2/24/93	X					
Residential Well RW-02	Meadow Park Road	Groundwater	BPM-RW-02-01	2/24/93	X					
Residential Well RW-03	Meadow Park Road	Groundwater	BPM-RW-03-01	2/24/93	X					
Residential Well RW-04	Meadow Park Road	Groundwater	BPM-RW-04-01	2/24/93	X					
Residential Well RW-05	Meadow Park Road	Groundwater	BPM-RW-05A-01	2/24/93	X					
		Groundwater	BPM-RW-05A-01R	2/24/93	X					
Residential Well RW-07	Meadow Park Road	Groundwater	BPM-RW-07A-01	2/24/93	X					
Residential Well RW-08	Meadow Park Road	Groundwater	BPM-RW-08A-01	2/24/93	X					
Residential Well RW-09	Meadow Park Road	Groundwater	BPM-RW-09A-01	2/24/93	X					
Residential Well RW-10	Meadow Park Road	Groundwater	BPM-RW-10A-01	2/24/93	X					
Residential Well RW-11	Meadow Park Road	Groundwater	BPM-RW-11-01	2/24/93	X					
Residential Well RW-12	Meadow Park Road	Groundwater	BPM-RW-12-01	2/24/93	X					
Residential Well RW-13	Meadow Park Road	Groundwater	BPM-RW-13-01	2/24/93	X					
Residential Well RW-14	Meadow Park Road	Groundwater	BPM-RW-14-01	2/24/93	X					
Residential Well RW-15	Tomahawk Street	Groundwater	BPM-RW-15-01	2/24/93	X					
Residential Well RW-16	Meadow Park Road	Groundwater	BPM-RW-16-01	2/24/93	X					
		Groundwater	BPM-RW-16-01R	2/24/93	X					
Residential Well RW-17	Tomahawk Street	Groundwater	BPM-RW-17-01	2/24/93	X					
Residential Well RW-18	Meadow Park Road	Groundwater	BPM-RW-18-01	2/24/93	X					
		Trip Blank	BPM-TB-02/24	2/24/93	X					
Commercial Well CW-19	Route 6;	Groundwater	BPM-CW-19-01	3/11/93	X					
Commercial Well CW-20	Route 6;	Groundwater	BPM-CW-20-01	3/11/93	X					
Commercial Well CW-21	Route 6;	Groundwater	BPM-CW-21-01	3/11/93	X					
Commercial Well CW-23	Route 6;	Groundwater	BPM-CW-23-01	3/11/93	X					
		Groundwater	BPM-CW-23-01R	3/11/93	X					
Commercial Well CW-25	Route 6;	Groundwater	BPM-CW-25-01	3/11/93	X					
Commercial Well CW-27	Route 6;	Groundwater	BPM-CW-27-01	4/22/93	X					
		Trip Blank	BPM-TB-03/11	3/11/93	X					
		Trip Blank	BPM-TB-04/22	4/22/93	X					

TABLE 3-2. REMEDIAL INVESTIGATION SAMPLING AND ANALYTICAL TESTING SUMMARY; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Location	Description	Sample Matrix	Sample Designation	Sample Date	TCL-VOCs	TCL-BNAs	TCL-Pest/PCBs	TAL Metals & Inorganics (Total)	TAL Metals & Inorganics (Dissolved)	Groundwater Chemistry
TEST BORINGS										
Test Boring TB-1 2 to 4 ft bgs	Behind dry cleaners.	Unsaturated Soil	BPM-TB-1/2-4 ft.	4/12/93	X	X	X	X		
Test Boring TB-2 2 to 4 ft bgs	Behind dry cleaners.	Unsaturated Soil	BPM-TB-2/2-4 ft.	4/12/93	X					
Test Boring TB-3 0 to 1.5 ft bgs	Near MW-5S.	Unsaturated Soil	BPM-TB-3/0-1.5 ft.	4/12/93	X					
Test Boring TB-4 4 to 6 ft bgs	In front of dry cleaners.	Unsaturated Soil	BPM-TB-4/4-6 ft.	4/14/93	X	X	X	X		
Test Boring TB-5 4 to 6 ft bgs	Near MW-7S.	Unsaturated Soil	BPM-TB-5/4-6 ft.	4/14/93	X					
Test Boring TB-6 2 to 3 ft bgs	Near MW-8S; Background.	Unsaturated Soil	BPM-TB-6/2-3 ft.	4/14/93	X	X	X	X		
		Field Blank (aqueous)	BPM-TB-6-FB	4/14/93	X	X	X	X		
Test Boring TB-7 0 to 2 ft bgs	Behind dry cleaners.	Unsaturated Soil	BPM-TB-7/0-2 ft.	4/13/93	X					
Test Boring TB-8 0 to 2 ft bgs	Behind dry cleaners.	Unsaturated Soil	BPM-TB-8/0-2 ft.	4/13/93	X					
Test Boring TB-9 2 to 4 ft bgs	Behind dry cleaners.	Unsaturated Soil	BPM-TB-9/2-4 ft.	4/13/93	X					
Test Boring TB-11 4 to 6 ft bgs	In front of dry cleaners.	Unsaturated Soil	BPM-TB-11/4-6 ft.	4/14/93	X					
Test Boring TB-12 0 to 2 ft bgs	Near SG38.	Unsaturated Soil	BPM-TB-12/0-2 ft.	4/14/93	X					
Test Boring TB-13 0 to 2 ft bgs	Near SG33/34/39	Unsaturated Soil	BPM-TB-13/0-2 ft.	4/14/93	X					
Test Boring TB-14 0 to 2 ft bgs	Near SG9.	Unsaturated Soil	BPM-TB-14/0-2 ft.	4/14/93	X					
Test Boring TB-15 0 to 2 ft bgs	Near SG36.	Unsaturated Soil	BPM-TB-15/0-2 ft.	4/14/93	X					
Test Boring TB-1 6 to 8 ft bgs	Behind dry cleaners.	Saturated Soil	BPM-TB-1/6-8 ft.	4/12/93	X (1)					
Test Boring TB-2 8 to 10 ft bgs	Behind dry cleaners.	Saturated Soil	BPM-TB-2/8-10 ft.	4/12/93	X (1)					
Test Boring TB-3 5.5 to 7.5 ft bgs	Near MW-5S.	Saturated Soil	BPM-TB-3/5.5-7.5 ft.	4/12/93	X (1)					
Test Boring TB-4 6 to 8 ft bgs	In front of dry cleaners.	Saturated Soil	BPM-TB-4/6-8 ft.	4/14/93	X (1)					
Test Boring TB-5 6 to 8 ft bgs	Near MW-7S.	Saturated Soil	BPM-TB-5/6-8 ft.	4/14/93	X (1)					
Test Boring TB-6 3 to 6 ft bgs	Near MW-8S; Background.	Saturated Soil	BPM-TB-6/3-6 ft.	4/14/93	X (1)					
		Field Blank (aqueous)	BPM-TB-6-FB-2	4/14/93	X (1)					
Test Boring TB-7 14 to 16 ft bgs	Behind dry cleaners.	Saturated Soil	BPM-TB-7/14-16 ft.	4/13/93	X (1)					
Test Boring TB-8 6 to 6.5 ft bgs	Behind dry cleaners.	Saturated Soil	BPM-TB-8/6-6.5 ft.	4/13/93	X (1)					
Test Boring TB-9 4 to 6 ft bgs	Behind dry cleaners.	Saturated Soil	BPM-TB-9/4-6 ft.	4/13/93	X (1)					
SURFACE WATER/SEDIMENT										
Eastern Stream	Adjacent to SG-1 (North).	Surface Water	BPM-SW-01	6/2/93	X	X	X	X		
		Sediment	BPM-SD-01	6/2/93	X	X	X	X		
Eastern Stream	WW treatment plant outfall.	Surface Water	BPM-SW-02	6/2/93	X	X	X	X		
		Sediment	BPM-SD-02	6/2/93	X	X	X	X		
Eastern Stream	South of Bridge.	Surface Water	BPM-SW-03	6/2/93	X	X	X	X		
		Sediment	BPM-SD-03	6/2/93	X	X	X	X		
Western Stream	Just North of Route 6.	Surface Water	BPM-SW-04	6/2/93	X	X	X	X		
		Surface Water	BPM-SW-04R	6/2/93	X	X	X	X		
		Field Blank	BPM-SW-04B	6/2/93	X	X	X	X		
		Sediment	BPM-SD-04	6/2/93	X	X	X	X		
		Field Blank (aqueous)	BPM-SD-04B	6/2/93	X	X	X	X		
Catch Basin	Northwest part of property.	Sediment	BPM-SD-05	6/2/93	X	(2)	(2)	X		
Western Stream	Upstream of First Pond.	Surface Water	BPM-SW-06	10/15/93	X					
		Sediment	BPM-SD-06	10/15/93	X (3)					
Western Stream	Downstream of First Pond.	Surface Water	BPM-SW-07	10/15/93	X					
		Sediment	BPM-SD-07	10/15/93	X (3)					
Western Stream	Upstream of Lake Baldwin.	Surface Water	BPM-SW-08	10/15/93	X					
		Field Blank	BPM-SW-08B	10/15/93	X					
		Sediment	BPM-SD-08	10/15/93	X (3)					
		Field Blank (aqueous)	BPM-SD-08B	10/15/93	X					
Drainage to Western Stream	BPM Intersection.	Surface Water	BPM-SW-09	10/15/93	X					
		Sediment	BPM-SD-09	10/15/93	X (3)					
Drainage to Western Stream	Near Seepage at Route 6.	Surface Water	BPM-SW-10	12/9/93	X					
		Sediment	BPM-SD-10	12/9/93	X (3)					
Drainage to Western Stream	West on Route 6.	Surface Water	BPM-SW-11	12/9/93	X					
		Sediment	BPM-SD-11	12/9/93	X (3)					
		Trip Blank	(with surface water)	6/2/93	X					
		Trip Blank	(with sediment)	6/2/93	X					
		Trip Blank	(with both)	10/15/93	X					
		Trip Blank	(with both)	12/9/93	X					

NOTES: (1) - Standard (non-CLP) analyses and reporting.
(2) - Insufficient material for analysis.
(3) - Samples were also tested for total organic carbon (TOC).

Vincent Uhl Associates

TABLE 3-3. ANALYTICAL RESULTS FOR SOIL GAS SAMPLES IN PPMV; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Samples Collected On 1/20/93.

SAMPLE	BENZENE (ppmv)	TOLUENE (ppmv)	ETHYL BENZENE (ppmv)	XYLENES (ppmv)	TVHC (ppmv)	METHYLENE CHLORIDE (ppmv)	TCE (ppmv)	PCE (ppmv)
SG-01-2'	0.0192	0.27	<0.096	<0.12	14.3	<0.116	0.095	55.5
SG-02-2'	NA	NA	NA	NA	NA	<0.58	<0.0171	2.55
SG-03-2'	NA	NA	NA	NA	NA	<1.16	<0.038	51.0
SG-04-2'	INT	<0.027	<0.096	<0.12	1.82	<5.8	0.19	8.4
SG-05-2'	0.032	<0.027	<0.096	<0.12	0.13	<0.0116	<0.00038	0.0045
SG-06-2'	<0.0192	<0.027	<0.096	<0.12	1.04	<0.029	0.0171	3.3
SG-07-2'	NA	NA	NA	NA	NA	<0.0145	0.00057	0.006
SG-08-2'	<0.0128	<0.027	<0.048	<0.096	0.78	<0.0116	0.057	0.075
SG-09-2'	<0.0192	<0.027	<0.096	<0.12	119.6	<0.029	0.95	1.05
SG-10-2'	<0.032	<0.081	<0.192	<0.24	<0.26	<0.0116	<0.00038	<0.0003
SG-11-2'	<0.0192	<0.027	<0.096	<0.12	0.182	<0.0145	0.0076	0.03
SG-12-2'	<0.0192	<0.027	<0.096	<0.12	3.38	<0.0145	0.019	0.045
SG-13-2'	<2.56	2.43	<0.096	<0.12	78	<0.0145	0.095	0.105
SG-14-2'	<0.0192	0.216	<0.096	<0.12	1.82	<0.058	0.038	0.15
SG-15-2'	<0.0192	0.135	<0.096	<0.12	0.26	<0.0145	0.0038	0.0045
AIR	NA	NA	NA	NA	NA	<0.0058	<0.000171	<0.00012

SG-01-2' - Sample point designation and depth below ground surface, (feet).

ppmv - Parts per million in air by volume, converted from Tracer Research Corporation results in micrograms per liter (Appendix D).

Total volatile hydrocarbons (TVHC) are estimated concentrations.

NA - Not Analyzed.

INT - Interference with Adjacent Peaks.

Refer to Figure 3-2 for soil gas sample locations and PCE concentrations.

Vincent Uhl Associates

TABLE 3-3. ANALYTICAL RESULTS FOR SOIL GAS SAMPLES IN PPMV; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Samples Collected On 1/21/93.

SAMPLE	BENZENE (ppmv)	TOLUENE (ppmv)	ETHYL BENZENE (ppmv)	XYLENES (ppmv)	TVHC (ppmv)	METHYLENE CHLORIDE (ppmv)	TCE (ppmv)	PCE (ppmv)
AIR	<0.0128	<0.027	<0.048	<0.096	<0.104	<0.0087	0.000152	<0.000105
SG-16-2'	<0.64	<0.027	<0.096	<0.12	101.4	<0.058	0.0076	0.015
SG-17-2'	<0.016	<0.027	<0.096	<0.12	31.2	<0.0203	0.0019	0.00135
SG-18-2'	<0.016	<0.027	<0.096	<0.12	<0.13	<0.0174	0.00019	0.00075
SG-19-2'	<0.016	<0.027	<0.096	<0.12	<0.13	<0.0203	<0.000152	0.0015
SG-20-2'	0.064	<0.027	<0.096	<0.12	0.156	<0.0087	<0.000152	0.00045
AIR	<0.0128	<0.027	<0.048	<0.096	<0.104	<0.0087	<0.000152	<0.000105
SG-21-2'	<0.0128	<0.027	<0.048	<0.096	1.04	<0.0087	0.00038	0.003
SG-22-2'	INT	<0.027	<0.048	<0.096	75.4	<0.0087	<0.000152	0.0003
SG-23-2'	<0.0128	<0.027	<0.048	<0.096	6.24	<0.0087	<0.000152	0.0003
SG-24-2'	<0.64	<0.027	<0.048	<0.096	46.8	<0.0087	0.000152	0.00012
SG-25-2'	INT	<0.027	<0.048	<0.096	33.8	<0.0087	0.00076	0.00135
SG-26-2'	0.16	0.081	<0.048	<0.096	1.56	<0.0087	0.0019	0.06
SG-27-2'	<0.0128	0.027	<0.048	<0.096	2.08	<0.0087	0.00095	0.0015
SG-28-2'	0.032	0.054	<0.048	<0.096	0.26	<0.0087	<0.000152	0.00015
AIR	<0.0128	<0.027	<0.048	<0.096	<0.104	<0.0087	<0.000152	0.000135

SG-16-2' - Sample point designation and depth below ground surface, (feet).

ppmv - Parts per million in air by volume, converted from Tracer Research Corporation results in micrograms per liter (Appendix D).

Total volatile hydrocarbons (TVHC) are estimated concentrations.

NA - Not Analyzed.

INT - Interference with Adjacent Peaks.

Refer to Figure 3-2 for soil gas sample locations and PCE concentrations.

Vincent Uhl Associates

TABLE 3-3. ANALYTICAL RESULTS FOR SOIL GAS SAMPLES IN PPMV; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Samples Collected On 1/22/93.

SAMPLE	BENZENE (ppmv)	TOLUENE (ppmv)	ETHYL BENZENE (ppmv)	XYLENES (ppmv)	TVHC (ppmv)	METHYLENE CHLORIDE (ppmv)	TCE (ppmv)	PCE (ppmv)
AIR	<0.0128	<0.027	<0.048	<0.072	<0.078	<0.0087	<0.000152	<0.000075
SG-29-2'	<0.0128	<0.027	<0.048	<0.072	0.52	<0.087	<0.00152	0.00012
SG-30-2'	<0.0128	<0.027	<0.048	<0.072	4.68	<0.0087	<0.000152	0.0003
SG-31-1'	0.0288	<0.027	<0.048	<0.072	0.78	<0.0087	<0.000152	0.00015
SG-32-1'	0.0288	0.054	<0.048	<0.072	0.26	<0.0087	<0.000152	0.0009
SG-33-10"	INT	<0.54	<0.72	<1.2	364	<0.0087	0.00095	0.0015
AIR	<0.0128	<0.027	<0.048	<0.072	<0.078	<0.0087	<0.000152	0.00045
SG-34-1.5'	<0.32	<0.81	<1.68	<2.4	338	<0.0087	0.00095	0.0045
SG-35-1.5'	<0.0128	<0.027	<0.048	<0.072	3.38	<0.0087	<0.000152	0.0015
SG-36-15"	INT	<0.027	<0.048	<0.072	127.4	<0.0087	<0.000152	0.00015
SG-37-1.5'	<0.0128	<0.027	<0.048	<0.072	<0.078	<0.0087	<0.000152	0.0003
AIR	0.016	<0.027	<0.048	<0.072	0.208	<0.0087	<0.00152	<0.00075
SG-38-1.5'	<0.96	<2.16	<4.08	<5.76	754	<0.0087	0.00057	0.00045
SG-39-2'	INT	<0.54	<0.72	<1.2	312	<0.0087	0.00152	0.015

SG-29-2' - Sample point designation and depth below ground surface, (feet).
ppmv - Parts per million in air by volume, converted from Tracer Research Corporation results in micrograms per liter (Appendix D).
Total volatile hydrocarbons (TVHC) are estimated concentrations.
NA - Not Analyzed.
INT - Interference with Adjacent Peaks.
Refer to Figure 3-2 for soil gas sample locations and PCE concentrations.

Vincent Uhl Associates

Table 3-4. RI Test Boring Soil Sample PID Screening Results; Baldwin Place Mall, Somers, New York.
Test Borings Located Immediately Outside Backdoor of the Dry Cleaners.

	TB-1			TB-2			TB-7	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 2	NR	NR	0 to 2	1	NR	0 to 2	0 to 1	100
2 to 4	200	320 to 400	2 to 4	25	550	2 to 4	0 to 1	40
4 to 6	50 to 150	500	4 to 6	0 to 3	490	4 to 6	10	280
6 to 8	50 to 100	540	6 to 8	20 to 30	400	6 to 8	0	220
8 to 10	50 to 100	220	8 to 10	0 to 20	500	8 to 10	0	80
10 to 12	300	480	10 to 11.5	0 to 3	290	10 to 12	5	320
11.5 to 13.5	5	320				12 to 14	5 to 10	400
14 to 16	0 to 3	220				14 to 16	300	400
						16 to 17.5	20	400

	TB-8			TB-9	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 2	0	60	0 to 2	NR	NR
2 to 4	5	40	2 to 4	0	30
4 to 6	50	320	4 to 6	0	100
6 to 6.5	100	440	6 to 8	0 to 1	48
			8 to 10	0	20
			10 to 11	5	30

Samples were screened with an HNu photoionization detector (PID).
bgs - Below ground surface.
ppm - Parts per million.
NR - No or insufficient recovery.

Vincent Uhl Associates

Table 3-4. RI Test Boring Soil Sample PID Screening Results; Baldwin Place Mall, Somers, New York.
Test Borings Located Further East and in Front (West) of the Dry Cleaners.

	TB-3			TB-4			TB-5	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 1.5	0	50	0 to 2	0	5	0 to 2	0	0
1.5 to 3.5	0	50	2 to 4	0	6	2 to 4	0	0.2
3.5 to 5.5	0	30	4 to 6	2	8	4 to 6	0	100
5.5 to 7.5	0	40	6 to 8	5.5	20	6 to 8	0	80
7.5 to 8.5	0	40	8 to 10	2	10	8 to 10	0	30
						10 to 12	0	10
						12 to 14	0	5
						14 to 16	0	8
						16 to 18	0	8
						18 to 19.5	0	11

	TB-6			TB-11	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 2	0	0	0 to 2	0	0.6
2 to 4	0	0	2 to 4	5	0.8
4 to 6	0	0	4 to 6	3	3

Samples were screened with an HNu photoionization detector (PID).
bgs - Below ground surface.
ppm - Parts per million.

Vincent Uhl Associates

Table 3-4. RI Test Boring Soil Sample PID Screening Results; Baldwin Place Mall, Somers, New York.
Test Borings Located at Soil Gas Survey Points where Total Volatile Hydrocarbon Concentration (TVHC) was Detected.

	TB-12			TB-13			TB-14	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 2	0	0.8	0 to 2	0	1	0 to 2	0	1.5
2 to 4	0	NS	2 to 4	0	NS	2 to 4	0	NS

	TB-15	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 2	0	2.2
2 to 4	0	NS

Samples were screened with an HNu photoionization detector (PID).
bgs - Below ground surface.
ppm - Parts per million.
NS - Not sampled.

Vincent Uhl Associates

TABLE 3-5. CONSTRUCTION DETAILS OF RI MONITORING WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL DESIGNATION	INSTALLATION DATE	LAND SURFACE ELEVATION (feet MSL)	SCREENED/OPEN HOLE INTERVAL (feet bgs)	SCREENED/OPEN HOLE INTERVAL ELEVATION (feet MSL)	SCREEN or OPEN HOLE
MW-1S	7/30/92	597.41	3.6 to 23.6	593.81 to 573.81	Screened
MW-1D	7/31/92	597.41	59.2 to 90.8	538.21 to 506.61	Open Hole
MW-2S	7/29/92	601.53	1 to 14	600.53 to 587.53	Screened
MW-2D	7/29/92	601.66	60 to 90	541.66 to 511.66	Screened
MW-3S	8/6/92	602.65	3 to 23	599.65 to 579.65	Screened
MW-3D	8/11/92	602.35	60 to 90	542.35 to 512.35	Screened
MW-3DD	8/13/92	602.22	170 to 200	432.22 to 402.22	Open Hole
MW-4S	8/5/92	609.68	3.6 to 23.6	606.08 to 586.08	Screened
MW-4D	8/4/92	609.72	58.4 to 90.5	551.32 to 519.22	Open Hole
MW-5S	8/5/92	603.36	3 to 23	600.36 to 580.36	Screened
MW-5D	4/15/93	602.80	57 to 87	545.80 to 515.80	Screened
MW-6S	8/14/92	602.09	3 to 23	599.09 to 579.09	Screened
MW-7S	8/5/92	602.07	5 to 25	597.07 to 577.07	Screened
MW-7D	4/13/93	602.18	60 to 90	542.18 to 512.18	Open Hole
MW-8S	8/4/92	618.28	4 to 24	614.28 to 594.28	Screened
MW-9S	4/21/93	596.21	10.55 to 30.55	585.66 to 565.66	Screened
MW-9D	4/20/93	595.99	60 to 90	535.99 to 505.99	Open Hole
MW-10S	4/22/93	600.64	31 to 51	569.64 to 549.64	Screened
MW-10D	4/22/93	600.52	59.5 to 90	541.02 to 510.52	Open Hole

Screened wells are completed with 4-inch diameter 0.01 or 0.02-inch slot PVC well screen and 4-inch PVC casing.

Open Hole wells are completed with 6-inch diameter steel casing to the top of the open-hole interval.

bgs - Below ground surface.

MSL - Mean sea level.

Vincent Uhl Associates

TABLE 3-6. DEPTH AND YIELD FROM FRACTURED INTERVALS ENCOUNTERED DURING DRILLING; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL	GROUND SURFACE ELEVATION (ft msl)	DEPTH OF BEDROCK INTERVAL DRILLED (ft bgs)	ELEVATION OF BEDROCK INTERVAL DRILLED (ft msl)	DEPTH TO FRACTURE (ft bgs)	ELEVATION OF FRACTURE (ft msl)	CUMULATIVE BLOWOUT YIELD MEASURED DURING DRILLING (gpm)	COMMENTS
MW-1D	597.41	11-35	586-562	29, 34	568, 563	< 1 gpm	6-inch diameter casing set at 59 feet bgs.
		35-45	562-552	Friable interval	562, 552	6 gpm	
		45-60	552-537	49, 57	548, 540	NR	
		60-90	537-507	-	-	Dry	
MW-3DD	602.22	80-200	522-402	107, 109-116, 128, 129-131, 138, 166-167, 175-178, 184-185, 189-190, 195	495, 493-486, 474, 473-471, 464, 436-435, 427-424, 418-417, 413-412, 407	NR	6-inch diameter casing set at 170.5 bgs. Bedrock cored from 101 ft bgs to 200 ft bgs
MW-4D	609.72	48-60	562-550	-	-	NR	6-inch diameter casing set at 58.4 bgs.
		60-65	550-545	62	548	0.8	
		70-80	540-530	NR	NR	2.3	
		80-85	530-525	-	-	4.0	
		85-90	525-520	85	525	4.5	
MW-5D	602.80	56-90	547-513	65	538	< 1 gpm	Top of screen at 57.0 bgs.
MW-7D	602.18	37-60	565-542	57-58	545-544	NR	6-inch diameter casing set at 60.0 bgs.
		60-65	542-537	-	-	0.5	

NR - Not Recorded.
bgs - Below Ground Surface.
msl - Mean Sea Level.
gpm - Gallons Per Minute.

Vincent Uhl Associates

TABLE 3-6. DEPTH AND YIELD FROM FRACTURED INTERVALS ENCOUNTERED DURING DRILLING;
BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL	GROUND SURFACE ELEVATION (ft msl)	DEPTH OF BEDROCK INTERVAL DRILLED (ft bgs)	ELEVATION OF BEDROCK INTERVAL DRILLED (ft msl)	DEPTH TO FRACTURE (ft bgs)	ELEVATION OF FRACTURE (ft msl)	BLOWOUT YIELD MEASURED DURING DRILLING (gpm)	COMMENTS
MW-9D	595.99	6-12	590-584	-	-	Wet Cuttings	6-inch diameter casing set at 60 feet bgs.
		12-20	584-576	-	-	2.0	
		20-25	576-571	-	-	3.0	
		25-45	571-551	27, 33-35,	569, 563-561,	4.5	
				36-38	560-558		
		45-60	551-536	48-50	548-546	6.0	
		60-61.5	536-534.5	61.5	534.5	1.5	
		61.5-90	534.5-506	-	-	No Flow	
MW-10D	600.52	28-30	572.5-570.5	-	-	-	6-inch diameter casing set at 59.5 feet bgs.
		30-35	570.5-565.5	-	-	3.0	
		35-45	565.5-555.5	-	-	4.5	
		45-60	555.5-540.5	45-54	555.5-546.5	9.0	
		60-80	540.5-520.5	67-70	533.5-530.5	No Flow	
		80-85	520.5-515.5	80	520	Wet Cuttings	
		85-90	515.5-510.5	-	-	No Flow	

bgs - Below Ground Surface.
msl - Mean Sea Level.
gpm - Gallons Per Minute.

Vincent Uhl Associates

TABLE 3-7. GROUNDWATER-LEVEL MEASUREMENTS AND STREAM STAFF GAUGE READINGS (JUNE 8, 1993, JUNE 28, 1993, AND JUNE 30, 1993); BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL/GAUGE NUMBER	ELEVATION OF GROUND SURFACE (feet, msl)	MEASURING POINT ELEVATION (ft msl)	JUNE 8, 1993 DEPTH TO WATER (ft bmp)	WATER-LEVEL ELEVATION (ft msl)	JUNE 28, 1993 DEPTH TO WATER (ft bmp)	WATER-LEVEL ELEVATION (ft msl)	JUNE 30, 1993 DEPTH TO WATER (ft bmp)	WATER-LEVEL ELEVATION (ft msl)
MW-1S	597.41	596.94	7.08	589.86	7.77	589.17	7.88	589.06
MW-1D	597.41	596.98	11.48	585.50	4.36	592.62	4.41	592.57
MW-2S	601.53	604.05	4.16	599.89	4.49	599.56	4.94	599.11
MW-2D	601.66	603.41	18.56	584.85	13.53	589.88	19.64	583.77
MW-3S	602.65	604.60	6.18	598.42	6.41	598.19	6.19	598.41
MW-3D	602.25	604.23	18.68	585.55	13.80	590.43	19.36	584.87
MW-3DD	602.22	604.21	14.57	589.64	14.08	590.13	15.58	588.63
MW-4S	609.68	611.64	7.42	604.22	8.58	603.06	8.71	602.93
MW-4D	609.72	611.84	9.84	602.00	10.51	601.33	10.70	601.14
MW-5S	603.36	602.84	2.95	599.89	3.62	599.22	3.49	599.35
MW-5D	602.80	602.26	15.29	586.97	11.15	591.11	15.99	586.27
MW-6S	602.09	603.95	4.12	599.83	4.79	599.16	3.88	600.07
MW-7S	602.07	601.67	7.30	594.37	7.94	593.73	8.11	593.56
MW-7D	602.18	601.85	9.69	592.16	9.82	592.03	10.42	591.43
MW-8S	618.28	618.02	6.38	611.64	6.64	611.38	6.61	611.41
MW-9S	596.21	595.99	5.86	590.13	6.39	589.60	6.70	589.29
MW-9D	595.99	595.68	5.98	589.70	6.70	588.98	6.98	588.70
MW-10S	600.64	600.18	10.06	590.12	10.38	589.80	11.09	589.09
MW-10D	600.52	600.22	11.71	588.51	11.63	588.59	12.72	587.50
PW-1	607.29	609.32	107.53	520.14*	25.42	583.90	104.88	527.38*
PW-2	610.32	613.51	50.18	563.33	30.22	583.29	52.36	561.15
LBG-1	600.48	602.26	5.90	596.36	6.22	596.04	6.22	596.04
LBG-2	-	602.57	NM	-	7.00	595.57	7.11	595.46
SG-1	-	620.70	2.04	618.66	2.10	618.60	Dry	-
SG-2	-	596.77	1.04	595.73	Dry	-	1.86	594.91
SG-3	-	593.61	1.50	592.11	1.60	592.01	1.55	592.06
SG-4	-	602.30	Dry	-	Dry	-	Dry	-
SG-5	-	571.35	1.92	569.43	2.00	569.35	2.00	569.35

msl - Above Mean Sea Level.
bmp - Below Measuring Point
* - Drawdown Corrected For Well Loss.

Vincent Uhl Associates

TABLE 3-8. REGIONAL GROUNDWATER-LEVEL MEASUREMENTS AND STREAM STAFF GAUGE READINGS (AUGUST 18, 1993).

WELL/GAUGE NUMBER	MEASURING POINT ELEVATION (ft msl)	DEPTH TO WATER (ft bmp)	WATER LEVEL ELEVATION (ft msl)
ONSITE			
MW-1S	596.94	9.22	587.72
MW-1D	596.98	5.18	591.80
MW-2S	604.05	3.95	600.10
MW-2D	603.41	16.58	586.83
MW-3S	604.60	5.98	598.62
MW-3D	604.23	15.07	589.16
MW-3DD	604.21	14.85	589.36
MW-4S	611.64	10.13	601.51
MW-4D	611.84	11.57	600.27
MW-5S	602.84	3.68	599.16
MW-5D	602.26	12.47	589.79
MW-6S	603.95	2.62	601.33
MW-7S	601.67	9.85	591.82
MW-7D	601.85	11.81	590.04
MW-8S	618.02	7.18	610.84
MW-9S	595.99	8.11	587.88
MW-9D	595.68	8.31	587.37
MW-10S	600.18	12.33	587.85
MW-10D	600.22	13.57	586.65
PW-1	609.32	28.18	581.14
PW-2	613.51	32.20	581.31
LBG-1	602.26	6.51	595.75
LBG-2	602.57	7.49	595.08
SG-1	620.70	2.00	618.70
SG-2	596.77	Dry	
SG-3	593.61	-	
SG-4	602.30	Dry	
SG-5	571.35	1.93	569.42

bgs - Below ground surface.
msl - Mean Sea Level.
bmp - Below measuring point.

Vincent Uhl Associates

TABLE 3-8. REGIONAL GROUNDWATER-LEVEL MEASUREMENTS AND STREAM STAFF GAUGE READINGS (AUGUST 18, 1993).

WELL/GAUGE NUMBER	MEASURING POINT ELEVATION (ft msl)	DEPTH TO WATER (ft bmp)	WATER LEVEL ELEVATION (ft msl)
OFFSITE			
RW-01	617.30	29.29	588.01
RW-02	611.78	23.77	588.01
RW-04	613.16	32.61	580.55
RW-05	614.70	38.28	576.42
RW-06	613.15	34.00	579.15
RW-07	610.90	32.29	578.61
RW-09	605.78	29.02	576.76
RW-12	596.46	35.28	561.18
RW-13	590.89	30.20	560.69
CW-19	588.45	14.68	573.77
CW-23	547.37	15.93	531.44
CW-25	541.17	6.08	535.09
CW-27	578.77	54.28	524.49

bgs - Below ground surface.
msl - Mean Sea Level.
bmp - Below measuring point.

Vincent Uhl Associates

TABLE 3-9. AVAILABLE CONSTRUCTION DETAILS FOR NEARBY RESIDENTIAL/COMMERCIAL WELLS, BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL NUMBER	WELL LOCATION	WELL DEPTH (Feet, bgs)	CASING DEPTH (Feet, bgs)	DATE DRILLED (Year)	ESTIMATED YIELD (gpm)
RW-01	Meadow Park Road			1983	
RW-02	Meadow Park Road	285		1982	
RW-03	Meadow Park Road	140		1967	
RW-04	Meadow Park Road	250	151	1974	20
RW-05	Meadow Park Road	220	145	1964/5	20
RW-06	Meadow Park Road				
RW-07	Meadow Park Road				
RW-08	Meadow Park Road	220		1973	
RW-09	Meadow Park Road	245	180	1986	50
RW-10	Meadow Park Road				
RW-11	Meadow Park Road	250			
RW-12	Meadow Park Road	220		1964	
RW-13	Meadow Park Road				
RW-14	Meadow Park Road	190			
RW-15	Tomahawk Street	200			
RW-16	Meadow Park Road	205	155	1954	
RW-17	Tomahawk Street	185		1960	
RW-18	Meadow Park Road				
PW-1	Baldwin Place Mall	260	140	1965	60
PW-2	Baldwin Place Mall	400	121	1967	40
CW-19	Route 6				
CW-20	Route 6				
CW-21	Route 6				
CW-22	Route 6				
CW-23	Route 6				
CW-24	Route 6				
CW-25	Route 6				
CW-26	Route 6				
CW-27	Route 6	220			
RW-40	Kennard Road				
RW-41	Kennard Road	205	31	1984	6
RW-42/43	Kennard Road	100	21	1977	8

gpm - Gallons per minute.
bgs - Below ground surface.

Vincent Uhl Associates

TABLE 3-10. REMEDIAL INVESTIGATION SAMPLING FIELD PARAMETERS RESULTS SUMMARY; BALDWIN PLACE MALL, SOMERS, NEW YORK.

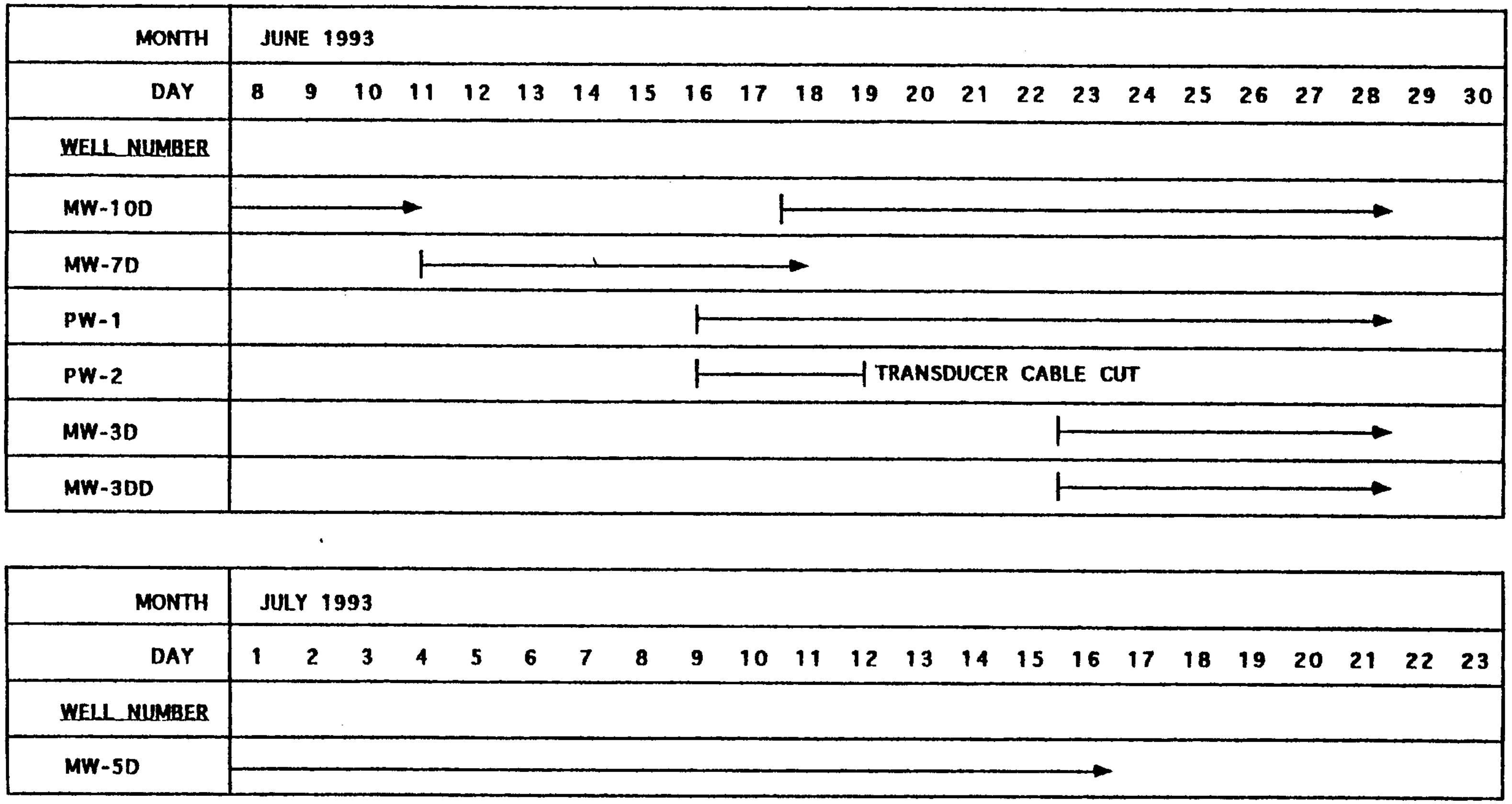
Location	Description	Sample Matrix	Sample Designation	Sample Date	pH (Standard Units)	Specific Conductance (umhos/cm)	Temperature (Celcius)	SAMPLE DESCRIPTION
MONITORING WELLS								
Monitoring Well MW-1S	Shallow	Groundwater	BPM-MW-1S-01	9/1/92	6.0	670	20	Cloudy/Brown
		Groundwater	BPM-MW-1S-02	5/20/93	7.8	760	11	Slightly Cloudly
Monitoring Well MW-1D	Bedrock	Groundwater	BPM-MW-1D-01	9/1/92	6.0	740	15	Cloudy/Brown
		Groundwater	BPM-MW-1D-02	5/20/93	7.6	840	13	Slightly Silty
Monitoring Well MW-2S	Shallow	Groundwater	BPM-MW-2S-01	9/1/92	5.5	1130	17	Silty/Brown
		Groundwater	BPM-MW-2S-02	5/19/93	6.8	1260	10	Slightly Cloudly
Monitoring Well MW-2D	Deep	Groundwater	BPM-MW-2D-01	9/1/92	10.5	600	13	Slightly Cloudy/Colorless
		Groundwater	BPM-MW-2D-02	5/19/93	7.8	460	10	Clear
Monitoring Well MW-3S	Shallow	Groundwater	BPM-MW-3S-01	8/31/92	7.4	-	18	Silty/Brown
		Groundwater	BPM-MW-3S-02	5/18/93	7.2	540	11	Clear
Monitoring Well MW-3D	Deep	Groundwater	BPM-MW-3D-01	8/31/92	9.3	880	17	Slightly Cloudy
		Groundwater	BPM-MW-3D-02	5/19/93	7.9	580	12	Slightly Cloudy
Monitoring Well MW-3DD	Bedrock	Groundwater	BPM-MW-3DD-01	8/31/92	8.1	400	14	Slightly Cloudy
		Groundwater	BPM-MW-3DD-02	5/19/93	7.6	620	12	Clear
Monitoring Well MW-4S	Shallow	Groundwater	BPM-MW-4S-01	8/31/92	11.3	1000	16	-
		Groundwater	BPM-MW-4S-02	5/19/93	7.6	1160	10	Cloudy
Monitoring Well MW-4D	Bedrock	Groundwater	BPM-MW-4D-01	9/1/92	5.5	500	12	Cloudy/Green-Brown
		Groundwater	BPM-MW-4D-02	5/19/93	7.7	680	12	Clear
Monitoring Well MW-5S	Shallow	Groundwater	BPM-MW-5S-01	9/1/92	7.0	730	20	Slightly Silty
		Groundwater	BPM-MW-5S-02	5/18/93	7.3	630	15	Silty/Light Green
Monitoring Well MW-5D	Deep	Groundwater	BPM-MW-5D-01	5/21/93	8.0	670	15	Clear
Monitoring Well MW-6S	Shallow	Groundwater	BPM-MW-6S-01	9/2/92	5.5	980	15	Cloudy
		Groundwater	BPM-MW-6S-02	5/18/93	8.3	980	11	Cloudy/Light Grey
Monitoring Well MW-7S	Shallow	Groundwater	BPM-MW-7S-01	9/2/92	5.5	925	17	Slightly Cloudy
		Groundwater	BPM-MW-7S-02	5/20/93	7.0	1010	13	Silty/Brown
Monitoring Well MW-7D	Bedrock	Groundwater	BPM-MW-7D-01	5/21/93	7.7	820	16	-
Monitoring Well MW-8S	Shallow	Groundwater	BPM-MW-8S-01	9/1/92	6.0	800	13	Silty/Brown
		Groundwater	BPM-MW-8S-02	5/19/93	7.6	1160	10	Slightly Cloudy
Monitoring Well MW-9S	Shallow	Groundwater	BPM-MW-9S-01	5/19/93	6.6	920	13	Slightly Silty/Very Light Green
Monitoring Well MW-9D	Bedrock	Groundwater	BPM-MW-9D-01	5/20/93	8.4	1000	13	Slightly Silty/Grey to Clear
Monitoring Well MW-10S	Shallow	Groundwater	BPM-MW-10S-01	5/20/93	7.6	960	13	Clear/Colorless
Monitoring Well MW-10D	Bedrock	Groundwater	BPM-MW-10D-01	5/20/93	7.0	1440	13	Slightly Cloudy
BPM PRODUCTION WELLS								
Production Well PW-1	Northeast Well	Groundwater	BPM-WELL1-01	2/24/93	7.7	677	8.1	
Production Well PW-2	Southwest Well	Groundwater	BPM-WELL2-01	2/24/93	7.9	709	6.5	
								Vincent Uhl Associates

TABLE 3-10. REMEDIAL INVESTIGATION SAMPLING FIELD PARAMETERS RESULTS SUMMARY; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Location	Description	Sample Matrix	Sample Designation	Sample Date	pH (Standard Units)	Specific Conductance (umhos/cm)	Temperature (Celcius)	SAMPLE DESCRIPTION
RESIDENTIAL & COMMERCIAL WELLS								
Residential Well RW-01	Meadow Park Road	Groundwater	BPM-RW-01-01	2/24/93	8.4	258	7.8	Clear
Residential Well RW-02	Meadow Park Road	Groundwater	BPM-RW-02-01	2/24/93	8.1	272	6.3	Clear
Residential Well RW-03	Meadow Park Road	Groundwater	BPM-RW-03-01	2/24/93	8.1	444	2.2	Clear
Residential Well RW-04	Meadow Park Road	Groundwater	BPM-RW-04-01	2/24/93	8.1	330	7.0	Clear
Residential Well RW-05	Meadow Park Road	Groundwater	BPM-RW-05A-01	2/24/93	8.2	306	6.5	Clear
Residential Well RW-07	Meadow Park Road	Groundwater	BPM-RW-07A-01	2/24/93	8.3	290	2.9	Clear
Residential Well RW-08	Meadow Park Road	Groundwater	BPM-RW-08A-01	2/24/93	8.3	299	6.7	Clear
Residential Well RW-09	Meadow Park Road	Groundwater	BPM-RW-09A-01	2/24/93	8.3	360	2.4	Clear
Residential Well RW-10	Meadow Park Road	Groundwater	BPM-RW-10A-01	2/24/93	8.3	208	7.0	Clear
Residential Well RW-11	Meadow Park Road	Groundwater	BPM-RW-11-01	2/24/93	8.5	226	3.3	Clear
Residential Well RW-12	Meadow Park Road	Groundwater	BPM-RW-12-01	2/24/93	8.3	270	1.5	Clear
Residential Well RW-13	Meadow Park Road	Groundwater	BPM-RW-13-01	2/24/93	8.4	226	9.9	Clear
Residential Well RW-14	Meadow Park Road	Groundwater	BPM-RW-14-01	2/24/93	8.5	186	5.9	Clear
Residential Well RW-15	Tomahawk Street	Groundwater	BPM-RW-15-01	2/24/93	8.4	240	4.0	Clear
Residential Well RW-16	Meadow Park Road	Groundwater	BPM-RW-16-01	2/24/93	8.4	320	8.0	Clear
Residential Well RW-17	Tomahawk Street	Groundwater	BPM-RW-17-01	2/24/93	8.3	327	4.0	Clear
Residential Well RW-18	Meadow Park Road	Groundwater	BPM-RW-18-01	2/24/93	8.3	271	7.6	Clear
Commercial Well CW-19	Route 6;	Groundwater	BPM-CW-19-01	3/11/93	-	-	-	-
Commercial Well CW-20	Route 6;	Groundwater	BPM-CW-20-01	3/11/93	6.8	650	11.1	Clear
			BPM-CW-20-02	4/22/93	6.3	920	12	Clear
Commercial Well CW-21	Route 6;	Groundwater	BPM-CW-21-01	3/11/93	7.5	500	9	Slightly Reddish
			BPM-CW-21-02	4/22/93	7.0	1010	10	Clear
Commercial Well CW-23	Route 6;	Groundwater	BPM-CW-23-01	3/11/93	7.5	459	10.5	Clear
Commercial Well CW-25	Route 6;	Groundwater	BPM-CW-25-01	3/11/93	7.3	700	9.1	Clear/Colorless
Commercial Well CW-27	Route 6;	Groundwater	BPM-CW-27-01	4/22/93	6.6	380	11	Clear
SURFACE WATER								
Eastern Stream	Adjacent to SG-1 (North).	Surface Water	BPM-SW-01	6/2/93	7.7	680	15	Clear
Eastern Stream	WW treatment plant outfall.	Surface Water	BPM-SW-02	6/2/93	7.8	560	13	Clear
Eastern Stream	South of Bridge.	Surface Water	BPM-SW-03	6/2/93	7.9	560	12	Clear
Western Stream	Just North of Route 6.	Surface Water	BPM-SW-04	6/2/93	7.5	700	12	Clear
Western Stream	Upstream of First Pond.	Surface Water	BPM-SW-06	10/15/93	6	1,090	-	Clear
Western Stream	Downstream of First Pond.	Surface Water	BPM-SW-07	10/15/93	6	530	-	Clear
Western Stream	Upstream of Lake Baldwin.	Surface Water	BPM-SW-08	10/15/93	6	510	-	Fairly Clear
Drainage to Western Stream	BPM Intersection.	Surface Water	BPM-SW-09	10/15/93	6-7	1,070	-	Clear
Drainage to Western Stream	Near Seepage at Route 6	Surface Water	BPM-SW-10	12/9/93	7	330	6.6	Clear
Drainage to Western Stream	West on Route 6	Surface Water	BPM-SW-11	12/9/93	7	400	3.8	Clear

Vincent Uhl Associates

TABLE 3-11. BACKGROUND MONITORING SCHEDULE FOR INDIVIDUAL OBSERVATION WELLS.
BALDWIN PLACE MALL, SOMERS, NEW YORK



Vincent Uhl Associates

TABLE 4-1. SPECIFIC CAPACITY AND ESTIMATED AQUIFER TRANSMISSIVITY DERIVED FROM MONITORING WELL SHORT-TERM PUMPING TESTS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL NUMBER	TEST DURATION (min)	PUMPING RATE (gpm)	tc (min)	DRAWDOWN (feet)	Q/s (gpm/ft)	DRAWDOWN t=30 min. (feet)	Q/s t=30 min. (gpm/ft)	TRANSMISSIVITY 30 min. Q/S (GPD/FT)	TRANSMISSIVITY TIME DRAWDOWN PLOT (GPD/FT)
Overburden Wells									
MW-2S	HB	NA	NA	NA	NA	NA	NA	NA	NA
MW-3S	75	0.5	53	3.01	0.17	2.9	0.17	**	200
MW-4S	HB	NA	NA	NA	NA	NA	NA	NA	NA
MW-5S	30	1.2	7	1.09	1.1	1.09	1.1	1250	1130
MW-6S	160	0.5	*	11.34	0.04	6.34	0.08	**	*
MW-7S	80	1.0	30	3.35	0.29	3.28	0.3	350	***
MW-8S	HB	NA	NA	NA	NA	NA	NA	NA	NA
Weathered Bedrock Wells									
MW-1S	30	3.5	3.5	1.55	2.26	1.55	2.26	2900	3080
MW-9S	30	2.0	4	1.03	1.94	1.03	1.94	2400	***
MW-10S	35	3.0	*	39.78	0.075	39.38	0.075	**	*
MW-2D	90	5.0	40	24.21	0.21	22.04	0.23	**	275
MW-3D	72	5.0	*	46.27	0.11	36.74	0.14	**	*
MW-5D	80	2.0	*	35.40	0.056	29.50	0.067	**	*
Bedrock Wells									
MW-1D	55	2.0	*	80.17	0.025	44.79	0.045	**	*
MW-3DD	100	4.0	*	155.62	0.025	102.39	0.04	**	*
MW-4D	50	7.5	*	27.03	0.28	27.73	0.27	**	*
MW-7D	120	2.0	*	55.75	0.036	21.26	0.094	**	*
MW-9D	130	1.25	*	40.54	0.031	15.87	0.078	**	*
MW-10D	120	3.0	70	10.80	0.28	7.81	0.38	**	190

* - Casing storage exceeds duration of the test.

** - Casing storage exceeds 30-minutes.

*** - Test data could not be analyzed due to limited water-level drawdown response after tc.

HB - Well was hand bailed for sampling.

Transmissivity values were derived from the 30-minute specific capacity data using an empirical equation developed by Walton (1984); Q/s= T/264 log(T/2693r^2S)-66.1.

Vincent Uhl Associates

TABLE 4-2. BALDWIN PLACE MALL PRODUCTION WELLS RECORD OF PUMPING; SOMERS, NEW YORK.

Date	Time	Meter Reading	Gallons Pumped	Comments
6/11/93	1210	4893200		Start of Record
6/12/93	0900	4898800	5600	
6/13/93	1000	4898800	0	
6/14/93	0930	4898800	0	
6/15/93	1030	4904500	5700	
6/15/93	1700	4910100	5600	Pump Turned Off
6/18/93	1800	4914900	4800	Step Test Pumpage
6/28/93	1430	4914900	0	Prior to Startup of Constant Rate Test
6/29/93	1330	4968400	53500	1380 minutes into the Constant Rate Test
6/30/93	1430	5024300	53900	End of Constant Rate Test
7/15/93	1800	5024300	0	Transducer removed from MW-5D
11/11/93	1200	5671000	646700	Translates to a pumping rate of 5,434 gallons per day for a 119 day period of record (3.77 gallons per minute).

Vincent Uhl Associates

TABLE 4-3. RESULTS OF STEP-DRAWDOWN TEST AT PRODUCTION WELL PW-1; BALDWIN PLACE MALL, SOMERS, NEW YORK.

Step	Q (gpm)	Delta s (ft)	sw (ft)	Q/sw (gpm/ft)	sw/Q (ft/gpm)
1	39	62.90	62.90	0.62	1.61
2	32	14.00	48.90	0.65	1.53
3	22	18.00	30.90	0.71	1.40

Step	Q (gpm)	BQ (ft)	CQ^2 (ft)	BQ+CQ^2 (ft)
1	39	43.68	18.25	61.93
2	32	35.84	12.29	48.13
3	22	24.64	5.80	30.44

Notes:
B = 1.12 ft/gpm
C = 0.012 ft/gpm^2

Vincent Uhl Associates

TABLE 4-4. AQUIFER COEFFICIENTS DERIVED FROM THE LEAKY ARTESIAN METHOD ANALYSIS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

		Match Points									
WELL	W(u,r/B)	u	r/B	t	s	r	T	S	P'/M'	P'	M'
MW-2D	1	0.1	0.4	1150	2.9	620	1540	0.00017	0.00064	0.050	76
MW-3D	1	0.1	0.4	4200	4.3	540	1040	0.00055	0.00057	0.043	76
MW-5D	1	0.1	0.5	4500	4.2	530	1064	0.00063	0.00095	0.050	50

W(u,r/B) = Well function for a leaky artesian aquifer (dimensionless); Match Point.

u = 2693r^2S/Tt; Match Point.

r/B = r/Sq.Rt. T/(P'/M') (dimensionless).

t = Time after pumping started (minutes); Match Point.

s = Drawdown at any point in the vicinity of a well discharging at a constant rate (feet); Match Point.

r = Radial distance from pumping well (feet).

T = Aquifer transmissivity (gpd/ft).

S = Aquifer storativity (dimensionless).

P' = Vertical permeability of aquitard (gpd/ft^2).

M' = Saturated aquitard thickness (feet).

Vincent Uhl Associates

TABLE 4-5. Aquifer Coefficients Derived from the Theis Method Analysis.

WELL	W(u)	u	t	s	r	T	S
PW-2	1	0.1	690	6	175	745	0.00062
MW-3DD	1	0.1	8000	1.9	580	2352	0.0021

W(u)	Well function (dimensionless); match point.
u	2693r^2S/Tt; match point
t	Time after pumping started (minutes); match point.
s	Drawdown at any point in the vicinity of the well discharging at a constant rate (feet); match point.
r	Radial distance from the pumping well (feet).
T	Aquifer Transmissivity (gpd/ft).
S	Aquifer Storativity (dimensionless).

Vincent Uhl Associates

TABLE 4-6. AQUIFER COEFFICIENTS DERIVED FROM THE COOPER-JACOB MODIFIED NON-EQUILIBRIUM METHOD ANALYSIS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL	t (min.) @ u<0.05	tc	Delta s	to	T	S
PW-1	NA	30	11	NA	940	NA
PW-2	689	NA	13.6	100	760	0.00054
MW-2D	>2880	NA	NA	NA	NA	NA
MW-3D	>2880	NA	NA	NA	NA	NA
MW-5D	>2880	NA	NA	NA	NA	NA
MW-10D	>2880	NA	NA	NA	NA	NA
MW-3DD	>2880	NA	NA	NA	NA	NA

t(min.)@ u<0.05 = Time at which Cooper-Jacob Modified Non-Equilibrium Analysis becomes valid (minutes).
tc = Time at which casing storage becomes negligible (minutes).
Delta s = The difference in drawdown over one log cycle (feet).
to = Time at which drawdown is zero (minutes).
T = Aquifer Transmissivity (gpd/ft).
S = Aquifer Storativity (dimensionless).

Vincent Uhl Associates

TABLE 4-7.	SUMMARY OF AQUIFER COEFFICIENTS; PW-1 AQUIFER PUMPING TEST;		
	BALDWIN PLACE MALL, SOMERS, NEW YORK.		
WELL NO.	ANALYTICAL METHOD	TRANSMISSIVITY (gpd/ft)	STORATIVITY (Dimensionless)
PW-1 (Pumping Well)	Cooper-Jacob	940	NA
PW-2	Cooper-Jacob	760	5.4 x 10-4
	Theis	745	6.6 x 10-4
MW-3DD	Theis	2,350	2.5 x 10-3
MW-2D	Hantush-Jacob	1,540	1.7 x 10-4
MW-3D	Hantush-Jacob	1,040	5.5 x 10-4
MW-5D	Hantush-Jacob	1,060	6.3 x 10-4

TABLE 5-1. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SOIL BORINGS (UNSATURATED ZONE); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-TB-1	BPM-TB-1 (DL)	BPM-TB-2	BPM-TB-3	BPM-TB-4	BPM-TB-5	BPM-TB-6	BPM-TB-7	BPM-TB-7 (DL)	BPM-TB-8
	2 to 4 ft. bgs	2 to 4 ft. bgs	2 to 4 ft. bgs	0 to 1.5 ft. bgs	4 to 6 ft. bgs	4 to 6 ft. bgs	2 to 3 ft. bgs	0 to 2 ft. bgs	0 to 2 ft. bgs	0 to 2 ft. bgs
SAMPLE DATE	4/12/93	4/12/93	4/12/93	4/12/93	4/14/93	4/14/93	4/14/93	4/13/93	4/13/93	4/13/93
TARGET COMPOUND LIST										
VOLATILE ORGANIC COMPOUNDS										
Acetone	0.003 J					0.014				0.007 J
Chlorobenzene	0.003 J									
Chloroethane								0.002 J		
1,2-Dichloroethylene (Total)				0.007 J						
Ethylbenzene	0.006 J									
Tetrachloroethylene	9.7 J	1,200	660	0.027 J	0.003 B	0.002 B	0.004 B	1.4 J	12	0.026
Toluene	0.007 J									
1,1,1-Trichloroethane						0.001 J				
Trichloroethylene	0.260 J			0.007 J				0.002 J		
Xylene (Total)	0.005 J							0.003 J		
TENTATIVELY IDENTIFIED										
VOLATILE ORGANIC COMPOUNDS	ND	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*

	BPM-TB-9	BPM-TB-11	BPM-TB-12	BPM-TB-13	BPM-TB-14	BPM-TB-15	BPM-TB-6 FB
	2 to 4 ft. bgs	4 to 6 ft. bgs	0 to 2 ft. bgs	0 to 2 ft. bgs	0 to 2 ft. bgs	0 to 2 ft. bgs	Field Blank
SAMPLE DATE	4/13/93	4/14/93	4/14/93	4/14/93	4/14/93	4/14/93	4/14/93
TARGET COMPOUND LIST							
VOLATILE ORGANIC COMPOUNDS							ND
Acetone	0.007 J		0.033 J			0.023 J	
Chlorobenzene							
Chloroethane							
1,2-Dichloroethylene (Total)							
Ethylbenzene							
Tetrachloroethylene	0.008 B	0.004 B	0.005 B	0.007 B	0.007 B		
Toluene							
1,1,1-Trichloroethane		0.002 J	0.002 J				
Trichloroethylene							
Xylene (Total)							
TENTATIVELY IDENTIFIED							
VOLATILE ORGANIC COMPOUNDS	ND*					ND*	ND*
Unknown (s)		0.006 J*	0.001 J*	0.015 J*	0.008 J*		

ft. bgs - Feet below ground surface.
All concentrations are shown in milligrams per kilogram (mg/Kg), except for the aqueous field blank which is shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 5-2. **SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SOIL BORINGS (SATURATED ZONE); BALDWIN PLACE MALL, SOMERS, NEW YORK.**

	BPM-TB-1	BPM-TB-2	BPM-TB-3	BPM-TB-4	BPM-TB-5	BPM-TB-6	BPM-TB-7	BPM-TB-8	BPM-TB-9	BPM-TB-6 FB 2
	6 to 8 ft. bgs	8 to 10 ft. bgs	5.5 to 7.5 ft. bgs	6 to 8 ft. bgs	6 to 8 ft. bgs	3 to 6 ft. bgs	14 to 16 ft. bgs	6 to 6.5 ft. bgs	4 to 6 ft. bgs	Field Blank
SAMPLE DATE	4/12/93	4/12/93	4/12/93	4/14/93	4/14/93	4/14/93	4/13/93	4/13/93	4/13/93	4/14/93
TARGET COMPOUND LIST										
VOLATILE ORGANIC COMPOUNDS										
Acetone		0.008 J								
Chloroethane									0.001 J	
Tetrachloroethylene	4,500 B	0.014 B	0.009 B	0.009 J	0.003 J	0.003 J	0.96	410	0.073	
1,1,1-Trichloroethane				0.028 B		0.027 B			0.002 J	26 B
Toluene										2 J
Vinyl Chloride									0.002 J	

ft. bgs - Feet below ground surface.
All concentrations are shown in milligrams per kilogram (mg/Kg), except for the aqueous field blank which is shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The analytical data reports are provided in Appendix F.
B - Analyte was also found in the associated laboratory blank sample.
J - Estimated value less than the reported detection limit.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 5-3. **SUMMARY OF RI ANALYTICAL RESULTS FOR BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS IN SOIL BORINGS (UNSATURATED ZONE); BALDWIN PLACE MALL, SOMERS, NEW YORK.**

	BPM-TB-1	BPM-TB-4	BPM-TB-6	BPM-TB-6 FB
	2 to 4 ft. bgs	0 to 6 ft. bgs	0 to 3 ft. bgs	Field Blank
SAMPLE DATE	4/12/93	4/14/93	4/14/93	4/14/93
TARGET COMPOUND LIST				
BASE/NEUTRAL AND ACID				
EXTRACTABLE ORGANIC COMPOUNDS	ND	ND		ND
Benzo (a) Anthracene			0.065 J	
Benzo (b) Fluoranthene			0.100 J	
Chrysene			0.064 J	
Fluoranthene			0.100 J	
Pyrene			0.110 J	
TENTATIVELY IDENTIFIED				
BASE/NEUTRAL AND ACID				
EXTRACTABLE ORGANIC COMPOUNDS				
2-Propanol, 1-(2-methoxypropoxy)				3 J
Unknown Alkanes	0.220 J			
Unknown (s)	0.185 J	0.408 J	0.186 J	

ft. bgs - Feet below ground surface.

All concentrations are shown in milligrams per kilogram (mg/Kg), except for the aqueous field blank which is shown in micrograms per liter (µg/L).

Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.

J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.

Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 5-4. SUMMARY OF RI ANALYTICAL RESULTS FOR PESTICIDES AND PCBs IN SOIL BORINGS (UNSATURATED ZONE); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-TB-1	BPM-TB-4	BPM-TB-6	BPM-TB-6 FB
	2 to 4 ft. bgs	0 to 6 ft. bgs	0 to 3 ft. bgs	Field Blank
SAMPLE DATE	4/12/93	4/14/93	4/14/93	4/14/93
TARGET COMPOUND LIST				
PESTICIDES AND PCBs				
alpha Chlordane	0.00077 J		0.00032 J	
gamma Chlordane	0.00065 J		0.00025 J	
4,4'-DDD	0.0035 J			
4,4'-DDE	0.0037 J			
4,4'-DDT	0.042 J		0.00083 J	
Dieldrin	0.00092 J			
Endosulfan I	0.00033 J			
Endosulfan II	0.0016 B	0.00026 B	0.00034 B	
Endosulfan Sulfate	0.0088 J	0.0022 B	0.0026 B	0.034 J
Endrin	0.00037 J			

ft. bgs - Feet below ground surface.
All concentrations are shown in milligrams per kilogram (mg/Kg), except for the aqueous field blank which is shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Quantitation is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 5-5. SUMMARY OF RI ANALYTICAL RESULTS FOR TARGET ANALYTE LIST METALS AND INORGANICS IN SOIL BORINGS (UNSATURATED ZONE); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-TB-1	BPM-TB-4	BPM-TB-6	BPM-TB-6 FB
	2 to 4 ft. bgs	0 to 6 ft. bgs	0 to 3 ft. bgs	Field Blank
SAMPLE DATE	4/12/93	4/14/93	4/14/93	4/14/93
TARGET COMPOUND LIST				
METALS AND INORGANICS				
Aluminum	1,690 J	1,730 J	2,610 J	22.2 J
Antimony				
Arsenic				
Barium	36.3 J	44.0 J	60.8 J	
Beryllium	0.14 B	0.12 B	0.11 B	
Cadmium	1.3 B	1.7 B	2.2 J	
Calcium	2,050 J	2,580 J	2,650 J	92.0 J
Chromium	3.9 J		5.9 J	
Cobalt				
Copper	4.3	3.8	4.8	5.8
Cyanide (Total)				
Iron	1,750 J	1,870 J	3,430 J	25.1 J
Lead	4.1	2.4	3.0	
Magnesium	908 J	1,250 J	1,740 J	
Manganese	120 J	98.0 J	202 J	1.3 J
Mercury				
Nickel			5.7 B	16.8 J
Potassium	197	331	133	
Selenium				
Silver	0.59 B	0.42 B		
Sodium	161 B	115 B	396 J	193 J
Thallium		0.16 B		
Vanadium	5.2	6.6	9.9	
Zinc	11.7 B	11.3 B	17.1 J	12.5 J

ft. bgs - Feet below ground surface.
All concentrations are shown in milligrams per kilogram (mg/Kg), dry weight, except for the aqueous field blank which is shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Quantitation is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 5-6. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: ANALYTICAL RESULTS FOR PCE, TCE AND 1,2-DCE IN TEST BORINGS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16	BPM-TB-16
	6 to 8 ft. bgs	8 to 10 ft. bgs	10 to 10.7 ft. bgs	12 to 13 ft. bgs	14 to 15 ft. bgs	16 to 18 ft. bgs	18 to 20 ft. bgs	22 to 24 ft. bgs	26 to 28 ft. bgs	30 to 32 ft. bgs	32 to 34 ft. bgs
SAMPLE DATE	11/15/93	11/15/93	11/15/93	11/15/93	11/15/93	11/16/93	11/16/93	11/16/93	11/17/93	11/17/93	11/17/93
TETRACHLOROETHYLENE	130	0.160	500	270	1,300	0.0031	0.0062	0.0012	0.0059	0.250	0.0031
TRICHLOROETHYLENE	-	0.0079	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHYLENE	-	-	-	-	-	-	-	-	-	-	-

	BPM-TB-17	BPM-TB-17	BPM-TB-17	BPM-TB-17	BPM-TB-17	BPM-TB-17	BPM-TB-17	BPM-TB-17	BPM-TB-17
	1 to 2 ft. bgs	2 to 4 ft. bgs	8 to 10 ft. bgs	14 to 16 ft. bgs	16 to 18 ft. bgs	18 to 20 ft. bgs	20 to 22 ft. bgs	24 to 26 ft. bgs	28 to 30 ft. bgs
SAMPLE DATE	11/18/93	11/18/93	11/18/93	11/18/93	11/19/93	11/19/93	11/19/93	11/19/93	11/19/93
TETRACHLOROETHYLENE	0.130	0.160	43	0.190	2.2	1.7	6.1	0.040	0.040
TRICHLOROETHYLENE	0.0011	-	-	-	-	-	-	-	-
1,2-DICHLOROETHYLENE	-	-	-	-	-	-	-	-	-

	BPM-TB-18	BPM-TB-18	BPM-TB-18	BPM-TB-18	BPM-TB-18	BPM-TB-18	BPM-TB-18
	0 to 2 ft. bgs	6 to 8 ft. bgs	10 to 12 ft. bgs	12 to 14 ft. bgs	14 to 16 ft. bgs	16 to 18 ft. bgs	20 to 22 ft. bgs
SAMPLE DATE	12/2/93	12/2/93	12/2/93	12/2/93	12/2/93	12/2/93	12/2/93
TETRACHLOROETHYLENE	-	0.0018	-	0.0022	0.0072	0.034	0.0066
TRICHLOROETHYLENE	-	-	-	-	-	-	-
1,2-DICHLOROETHYLENE	-	-	-	-	-	-	-

	BPM-TB-19	BPM-TB-19	BPM-TB-19	BPM-TB-19	BPM-TB-19
	1 to 3 ft. bgs	7 to 9 ft. bgs	13 to 15 ft. bgs	19 to 21 ft. bgs	23 to 25 ft. bgs
SAMPLE DATE	11/30/93	11/30/93	11/30/93	11/30/93	11/30/93
TETRACHLOROETHYLENE	-	0.0021	-	-	-
TRICHLOROETHYLENE	-	-	-	-	-
1,2-DICHLOROETHYLENE	-	-	-	-	-

	BPM-TB-20	BPM-TB-20	BPM-TB-20	BPM-TB-20	BPM-TB-20
	0 to 2 ft. bgs	2 to 4 ft. bgs	4 to 6 ft. bgs	6 to 8 ft. bgs	8 to 10 ft. bgs
SAMPLE DATE	12/1/93	12/1/93	12/1/93	12/1/93	12/1/93
TETRACHLOROETHYLENE	-	0.0023	0.0047	0.0082	0.0044
TRICHLOROETHYLENE	-	-	-	-	-
1,2-DICHLOROETHYLENE	-	-	-	-	-

	BPM-TB-21	BPM-TB-21	BPM-TB-21
	0 to 2 ft. bgs	2 to 4 ft. bgs	4 to 6 ft. bgs
SAMPLE DATE	12/1/93	12/1/93	12/1/93
TETRACHLOROETHYLENE	-	-	-
TRICHLOROETHYLENE	-	-	-
1,2-DICHLOROETHYLENE	-	-	-

ft. bgs - Feet below ground surface.
All soil sample concentrations are shown in milligrams per kilogram (mg/Kg).
- Not detected.
NA - Not analyzed due to laboratory error.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 5-6. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: ANALYTICAL RESULTS FOR PCE, TCE AND 1,2-DCE IN TEST BORINGS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-TB-22	BPM-TB-22	BPM-TB-22
	1 to 3 ft. bgs	3 to 5 ft. bgs	5 to 7 ft. bgs
SAMPLE DATE	12/2/93	12/2/93	12/2/93
TETRACHLOROETHYLENE	0.012	0.0012	0.003
TRICHLOROETHYLENE	-	-	-
1,2-DICHLOROETHYLENE	-	-	-

	BPM-TB-16FB	BPM-TB-17FB	BPM-TB-20FB	BPM-TB-22FB
	Field Blank	Field Blank	Field Blank	Field Blank
SAMPLE DATE	11/18/93	11/19/93	12/1/93	12/2/93
TETRACHLOROETHYLENE	NA	-	-	-
TRICHLOROETHYLENE	NA	-	-	-
1,2-DICHLOROETHYLENE	NA	-	-	-

ft. bgs - Feet below ground surface.
All soil sample concentrations are shown in milligrams per kilogram (mg/Kg).
- Not detected.
NA - Not analyzed due to laboratory error.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 5-7. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: ANALYTICAL RESULTS FOR PCE, TCE AND 1,2-DCE IN SOURCE AREA MONITORING WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	MW-11S SHALLOW	MW-11S (DL) SHALLOW	MW-11SR SHALLOW	MW-11S (DL) SHALLOW	MW-11D DEEP	MW-11D (DL) DEEP	TRIP BLANK
SAMPLE DATE	12/22/93	12/22/93	12/22/93	12/22/93	12/22/93	12/22/93	12/22/93
TETRACHLOROETHYLENE	44,000 E	24,000	4,800 E	24,000	2,400 E	3,200	-
TRICHLOROETHYLENE	160	-	170	-	15	-	-
1,2-DICHLOROETHYLENE	-	-	-	-	-	-	-

All sample concentrations are shown in micrograms per liter (µg/L).
- Not detected.
E - Concentration was outside calibration range; sample consequently diluted and reanalyzed (DL).
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 5-8. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: TEST BORING SOIL SAMPLE PID SCREENING RESULTS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	TB-16			TB-17			TB-18	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
0 to 2	4	70	0 to 2	30	400	0 to 2	0	1
2 to 4	50 to 70	300	2 to 4	6	300	2 to 4	0.5	1.5
4 to 6	100 to 300	300 to 350	4 to 6	15	450	4 to 6	0.5	1
6 to 8	250	360	6 to 8	30	400	6 to 8	1	1
8 to 10	10 to 15	400	8 to 10	120	500	8 to 10	0	1.5
10 to 12	10 in sand	400	10 to 12	15	500	10 to 12	1	3
	5 below	200	12 to 14	20	200	12 to 14	20	80
12 to 13	0	400	14 to 16	50	250	14 to 16	20	30
14 to 15	0	380	16 to 18	1	60	16 to 18	10	11
15 to 17	NA	4	18 to 20	5	100	18 to 20	0	0
16 to 18	0	100	20 to 22	2	40	20 to 22	0	1
18 to 20	0.4	12	22 to 24	0	4	22 to 24	NR	NR
20 to 22	0	2	24 to 26	0	35			
22 to 24	0	1.8	26 to 28	0	12			
24 to 26	0	10	28 to 30	0	13			
26 to 28	0	0						
28 to 30	0	0.5						
30 to 32	0	1						
32 to 34	0	0						

Samples were screened with an HNu photoionization detector (PID).
bgs - Below ground surface.
ppm - Parts per million.
NR - No or insufficient recovery.

Vincent Uhl Associates

TABLE 5-8. SOURCE AREA ADDITIONAL DATA COLLECTION PROGRAM: TEST BORING SOIL SAMPLE PID SCREENING RESULTS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	TB-19			TB-20			TB-21	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)	Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
1 to 3	0	0	0 to 2	0	5	0 to 2	0	0.5
3 to 5	0	0	2 to 4	0	3	2 to 4	0	1
5 to 7	0	0	4 to 6	6	60	4 to 6	0.5	1
7 to 9	0	0	6 to 8	5	65	6 to 8	NR	NR
9 to 11	0	0	8 to 10	4	85			
11 to 13	0	0	9 to 11	NR	NR			
13 to 15	0	0.5						
15 to 17	0	0.5						
17 to 19	0	0						
19 to 21	0	0.2						
21 to 23	0	0						
23 to 25	0	0						

	TB-22	
Depth Interval (feet bgs)	Initial PID Screening (ppm)	Head Space Reading (ppm)
1 to 3	0	0.5
3 to 5	1	0.5
5 to 7	0	NR
5.5 to 7.5	0	0

Samples were screened with an HNu photoionization detector (PID).
bgs - Below ground surface.
ppm - Parts per million.
NR - No or insufficient recovery.

Vincent Uhl Associates

TABLE 6-1. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN MONITORING WELLS (FIRST ROUND); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1S	BPM-MW-1D	BPM-MW-2S	BPM-MW-2D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4S	BPM-MW-4D	BPM-MW-5S	BPM-MW-5S
	01	01	01	01	01	01	01R	01	01	01	01	01R
	Shallow	Bedrock	Shallow	Deep	Shallow	Deep	Deep	Bedrock	Shallow	Bedrock	Shallow	Shallow
SAMPLE DATE	9/1/92	9/1/92	9/1/92	9/1/92	8/31/92	8/31/92	8/31/92	8/31/92	8/31/92	9/1/92	9/1/92	9/1/92
TARGET COMPOUND LIST												
VOLATILE ORGANIC COMPOUNDS												
Acetone			8 J	31 J		20 J	27 J					
1,2-Dichloroethylene (total)					4 J						23	28
Methylene Chloride			35	55		85	94		20	7 B	1 B	
Methyl tert Butyl Ether	2 J	1 J			1 J			1 J	2 J			
Styrene				2 J								
1,1,2,2-Tetrachloroethane					2 B			2 B				
Tetrachloroethylene		1 J			12						64	74
Toluene		9 J	2 J	2 J		5 J	5 J		3 J			
Trichloroethylene					4 J			1 J			25	27
TENTATIVELY IDENTIFIED												
VOLATILE ORGANIC COMPOUNDS	ND	ND	ND	ND	ND			ND	ND	ND	ND	ND
Unknown						5 J	13 J					

	BPM-MW-6S	BPM-MW-7S	BPM-MW-8S	BPM-MW-3D	BPM-MW-8S	TB 8/31	TB 9/1	TB 9/2
	01	01	01	01B	01B			
				Field	Field	Trip	Trip	Trip
	Shallow	Shallow	Shallow	Blank	Blank	Blank	Blank	Blank
SAMPLE DATE	9/2/92	9/2/92	9/2/92	8/31/92	9/2/92	8/31/92	9/1/92	9/2/92
TARGET COMPOUND LIST								
VOLATILE ORGANIC COMPOUNDS					ND	ND		ND
Acetone								
1,2-Dichloroethylene (total)								
Methylene Chloride	16		8 B	1 J				
Methyl tert Butyl Ether	1 J							
Styrene								
1,1,2,2-Tetrachloroethane							1 J	
Tetrachloroethylene		12						
Toluene	4 J		2 J					
Trichloroethylene								
TENTATIVELY IDENTIFIED								
VOLATILE ORGANIC COMPOUNDS	ND	ND	ND	ND	ND	ND	ND	ND
Unknown								

ND- None Detected.
All concentrations are shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 6-2. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN MONITORING WELLS (SECOND ROUND); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1S	BPM-MW-1D	BPM-MW-2S	BPM-MW-2D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4S	BPM-MW-4D
	02	02	02	02	02	02	02	02	02
	Shallow	Bedrock	Shallow	Deep	Shallow	Deep	Bedrock	Shallow	Bedrock
SAMPLE DATE	5/20/93	5/20/93	5/19/93	5/19/93	5/18/93	5/19/93	5/19/93	5/19/93	5/19/93
TARGET COMPOUND LIST									
VOLATILE ORGANIC COMPOUNDS				ND			ND		ND
Acetone			9 J						
Benzene									
Carbon Disulfide			1 J						
Chloroform									
1,2-Dichloroethylene (total)					2 J				
Methylene Chloride									
Methyl tert Butyl Ether	3 J	1 J						4 J	
Tetrachloroethylene		2 J			7 J				
Toluene						2 J			
Trichloroethylene					1 J				
Xylene (Total)									
TENTATIVELY IDENTIFIED									
VOLATILE ORGANIC COMPOUNDS	ND	ND	ND*	ND*	ND*	ND*	ND*	ND*	ND*

	BPM-MW-5S	BPM-MW-5S	BPM-MW-5D	BPM-MW-5D	BPM-MW-5D	BPM-MW-5D	BPM-MW-6S	BPM-MW-7S
	02	02 (DL)	01	01 (DL)	01R	01R (DL)	02	02
	Shallow	Shallow	Deep	Deep	Deep	Deep	Shallow	Shallow
SAMPLE DATE	5/18/93	5/18/93	5/21/93	5/21/93	5/21/93	5/21/93	5/18/93	5/20/93
TARGET COMPOUND LIST								
VOLATILE ORGANIC COMPOUNDS								
Acetone			11 J		18 J			
Benzene	2 J	3 J						
Carbon Disulfide		3 J						
Chloroform	1 J							
1,2-Dichloroethylene (total)	55	61						
Methylene Chloride	1 J							
Methyl tert Butyl Ether							3 J	
Tetrachloroethylene	260 J	300	780 J	910	790 J	840		30
Toluene			6 J		5 J			
Trichloroethylene	180	190	57	40 J	57	36 J		
Xylene (total)			2 B					
TENTATIVELY IDENTIFIED								
VOLATILE ORGANIC COMPOUNDS	*	--	ND	ND	ND	ND	ND*	ND
Dodecane	5 J							

ND- None Detected.
All concentrations are shown in micrograms per liter (μg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 6-2. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN MONITORING WELLS (SECOND ROUND); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-7D	BPM-MW-7D	BPM-MW-8S	BPM-MW-9S	BPM-MW-9S	BPM-MW-9D	BPM-MW-9D	BPM-MW-10S	BPM-MW-10D
	01	01R	02	01	01 (DL)	01	01 (DL)	01	01
	Bedrock	Bedrock	Shallow	Shallow	Shallow	Bedrock	Bedrock	Shallow	Bedrock
SAMPLE DATE	5/21/93	5/21/93	5/19/93	5/19/93	5/19/93	5/20/93	5/20/93	5/20/93	5/20/93
TARGET COMPOUND LIST									
VOLATILE ORGANIC COMPOUNDS			ND						
Acetone									
Benzene									
Carbon Disulfide									1 J
Chloroform									
1,2-Dichloroethylene (total)				20	20 J	10	7 J		1 J
Methylene Chloride						1 B			
Methyl tert Butyl Ether						3 J		15	3 J
Tetrachloroethylene	3 J	2 J		640 J	850	290 J	300		37
Toluene									
Trichloroethylene				14	17 J	10	7 J		1 J
Xylene (Total)									
TENTATIVELY IDENTIFIED									
VOLATILE ORGANIC COMPOUNDS	ND	ND	ND*	ND*	--	ND	ND		ND
Unknown								6 J	

	BPM-MW-3S	BPM-MW-5D	TB 5/18	TB 5/19	TB 5/21
	02B	01B			
	Field Blank	Field Blank	Trip Blank	Trip Blank	Trip Blank
SAMPLE DATE	5/18/93	5/21/93	5/18/93	5/19/93	5/21/93
TARGET COMPOUND LIST					
VOLATILE ORGANIC COMPOUNDS	ND		ND	ND	ND
Methylene Chloride		2 J			
TENTATIVELY IDENTIFIED					
VOLATILE ORGANIC COMPOUNDS	ND*	ND	ND*	ND*	ND

ND- None Detected.
All concentrations are shown in micrograms per liter (μg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 6-3. SUMMARY OF RI ANALYTICAL RESULTS FOR BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS IN MONITORING WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1S	BPM-MW-1D	BPM-MW-2S	BPM-MW-2D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4S	BPM-MW-4D	BPM-MW-6S	BPM-MW-3D
	01	01	01	01	01	01	01R	01	01	01	01	01B
	Shallow	Bedrock	Shallow	Deep	Shallow	Deep	Deep	Bedrock	Shallow	Bedrock	Shallow	Field Blank
SAMPLE DATE	9/1/92	9/1/92	9/1/92	9/1/92	8/31/92	8/31/92	8/31/92	8/31/92	8/31/92	9/1/92	9/1/92	8/31/92
TARGET COMPOUND LIST BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS	ND		ND		ND	ND	ND	ND	ND	ND	ND	ND
bis (2-Ethyl Hexyl) Phthalate		7 J		11								
TENTATIVELY IDENTIFIED BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS												
Unknown(s)		2 J	25 J	12 J		36 J	42 J			6 J	6 J	
Blank Contaminant	8 B	10 B	21 B	29 B	4 B			5 B	5 B	6 B	9 B	
Saturated Hydrocarbon(s)	4 J	11 J	18 J	44 J	3 J	4 J	9 J	3 J	3 J	8 J	16 J	4 J
Unsaturated Hydrocarbon(s)		2 J										
Octadecanol			2 J									
Octanoic Acid							2 J					
Carboxylic Acid				3 J								
Dimethylethylphenyl Isomer			3 J									
Pentachlorofluorobenzene			2 J									
Tetraethylstanane			3 J									
Phthalate Ester			3 J									
2-amino-8-methoxy-phenazine						55 J	62 J					
2-ethylhexanoic Acid				3 J								
2-methylpropylester octanoic Acid										8 J		
2-(2H-benzotriazol-2-yl)-4-methylphenol				10 J								
2,6-bis(1,1-dimethylethyl)-4-ethylphenol						3 J	3 J					
4-morpholineethanol						2 J	5 J					
4-morpholineethanthiol				2 J								

ND- None Detected.
All concentrations are shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 6-4. SUMMARY OF RI ANALYTICAL RESULTS FOR PESTICIDES AND PCBs IN MONITORING WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1S	BPM-MW-1D	BPM-MW-2S	BPM-MW-2D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3D	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4S	BPM-MW-4D
	01	01	01	01	01	01	01 (DL)	01R	01	01	01
	Shallow	Bedrock	Shallow	Deep	Shallow	Deep	Deep	Deep	Bedrock	Shallow	Bedrock
SAMPLE DATE	9/1/92	9/1/92	9/1/92	9/1/92	8/31/92	8/31/92	8/31/92	8/31/92	8/31/92	8/31/92	9/1/92
TARGET COMPOUND LIST PESTICIDES AND PCBs	ND	ND			ND				ND		ND
beta-BHC							0.06 J				
delta-BHC								0.02 J			
alpha Chlordane				0.02 J				0.01 J		0.05 J	
gamma Chlordane				0.068 J		0.97 J	0.80 J	0.83 J			
4,4'-DDD			0.03 J								
4,4'-DDE										0.03 J	
4,4'-DDT			0.02 J								
Dieldrin			0.03 R	0.02 J		0.04 J	0.04 J	0.04 J		0.04 J	
Endosulfan II			0.02 R	0.02 J		0.03 J		0.02 J		0.04 J	
Endosulfan Sulfate						0.01 J				0.03 J	
Endrin			0.01 J	0.03 J		0.05 J					
Heptachlor			0.02 J					0.033 J		0.01 J	
Heptachlor Epoxide			0.01 R	0.01 J		0.01 J				0.04 J	

	BPM-MW-8S	BPM-MW-8S	BPM-MW-3D
	01	01 (DL)	01B
			Field
	Shallow	Shallow	Blank
SAMPLE DATE	9/1/92	9/1/92	8/31/92
TARGET COMPOUND LIST PESTICIDES AND PCBs			
beta-BHC			
delta-BHC		0.02 J	
alpha Chlordane	0.13 R	0.12 J	
gamma Chlordane	0.03 R		0.01 J
4,4'-DDD		0.04 J	
4,4'-DDE	0.05 R	0.04 J	
4,4'-DDT			
Dieldrin	0.11 R	0.10 J	
Endosulfan II	0.19 R		
Endosulfan Sulfate	0.05 R		
Endrin	0.34 R	0.14 J	
Heptachlor	0.03 R		
Heptachlor Epoxide	0.078 R		

ND- None Detected.
All concentrations are shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
R - Unreliable result. Compound may or may not be present in the sample.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 6-5. SUMMARY OF RI ANALYTICAL RESULTS FOR TARGET ANALYTE LIST METALS AND INORGANICS (TOTAL) IN MONITORING WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1S	BPM-MW-1D	BPM-MW-2S	BPM-MW-2D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4S	BPM-MW-4D	BPM-MW-6S	BPM-MW-3D
	01	01	01	01	01	01	01R	01	01	01	01	01B
												Field
	Shallow	Bedrock	Shallow	Deep	Shallow	Deep	Deep	Bedrock	Shallow	Bedrock	Shallow	Blank
SAMPLE DATE	9/1/92	9/1/92	9/1/92	9/1/92	8/31/92	8/31/92	8/31/92	8/31/92	8/31/92	9/1/92	9/1/92	8/31/92
TARGET ANALYTE LIST METALS AND INORGANICS												
Aluminum	11,300 J	1,200 J	6,280 J	482 J	3,980 J	423 J	407 J	72.1 B	3,940 J	226 J	6,880 J	41.1 J
Antimony	21.4 J		19.9 J		18.6 B				30.2 B		18.3 J	
Arsenic	4.4 B	3.0 B	8.3 B	2.0 B			2.9 J			3.2 B	3.8 B	
Barium	599	296	377	76.4	114	106	104	189	274	85.0	394	2.7
Beryllium	0.62 B		0.42 B		0.63 B			0.80 B	0.88 B		0.89 B	0.72
Cadmium		3.1 B	2.9 B	2.1 B				2.9 B	2.6 B		3.7 B	2.7 J
Calcium	66,500	82,800	159,000	33,900	57,000	33,900	33,200	55,900	122,000	58,400	128,000	4,730
Chromium	8.6 J	9.1 J	8.1 J								7.6 J	
Cobalt	20.9		8.8		7.6			15.4	6.6		3.7	
Copper	53.5	28.3	44.9	25.2 B	15.5 B	9.5 B	10.2 B	8.8 B	26 B	9.9 B	35.4	5.3
Cyanide (Total)	NA		NA									
Iron	15,800	42,600	35,600	1,100	4,910 J	480 J	468 J	3,900 J	5,870 J	19,300	10,400	13.4
Lead	9.9	13.8	47.2	14.1	9.4	13.4	15.1	2.3 B	7.0 B	3.2 B	20.5	1.3
Magnesium	26,300	23,800	53,600	7,330	19,800	3,460	3,940 J	17,200	51,000	17,700	49,800	88.3
Manganese	1,040	439	6,540	116	421	23.7 J	24.2 J	404	525	639	1,160	4.5
Mercury												
Nickel			13.9								20.6	
Potassium	6,890	19,500	7,130	77,500	1,840 J	111,000 J	105,000 J	4,950 J	7,770 J	7,010	7,920	322 J
Selenium				2.1 J							1.8 J	
Silver	3.7 B	3.4 B		2.3 B	2.8 B			4.8 B	4.4 B	2.7 B	3.0 B	3.3 J
Sodium	50,200	51,000	36,500	28,000	22,700	43,300	41,400	15,000	44,400	26,300	74,900	168
Thallium			0.60 J	0.77 J		0.63 B		0.80 B	0.50 B	5.5 J	0.47 J	
Vanadium	52.9	27.6 B	49.4	16.1 B	24.2 B	14.0 B	14.2 B	19.3 B	37.5	17.0 B	45.8	5.9
Zinc	48.2 B	50.4 B	144 B	12.0 B	74.8 B	47.1 B	53.8 B	101 B	44.1 B	53.8 B	79.4 B	83.3 J

All concentrations are shown in micrograms per liter (µg/L).
The complete analytical data spreadsheets are provided in Appendix B.
NA - Not analyzed.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 6-6. SUMMARY OF RI ANALYTICAL RESULTS FOR TARGET ANALYTE LIST METALS AND INORGANICS (DISSOLVED) IN MONITORING WEL
BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4D	BPM-MW-8S
	01	01	01	01R	01	01	01
	Bedrock	Shallow	Deep	Deep	Bedrock	Bedrock	Shallow
SAMPLE DATE	9/1/92	8/31/92	8/31/92	8/31/92	8/31/92	9/1/92	9/1/92
TARGET ANALYTE LIST							
METALS AND INORGANICS							
Aluminum		36.9 B	16.3 B		22.1 B		15.7 B
Antimony							18.0 J
Arsenic	2.6 B					3.0 B	2.6 B
Barium	185	24.3	83.4	75.7	178	83.1	168
Beryllium							
Cadmium		2.6 B	1.9 B		2.5 B		
Calcium	74,300	51,500	28,400	27,800	50,900	56,900	79,400
Chromium			7.9				
Cobalt					5.1		
Copper	3.4 B	22.6 B	3.7 B	2.7 B	4.1 B	2.9 B	
Iron	468	27.7 B	17.2 B	7.5 B	272	3,980	26.3 B
Lead	1.9 B	1.8 B	1.4 B	2.0 B		2.3 B	2.6 B
Magnesium	22,900	16,700	3,570	4,500 J	16,800	18,500	28,600
Manganese	235	7.0 B			380	516	234
Mercury							
Nickel							
Potassium	18,900	1,020 B	94,700 J	83,700 J	4,750 J	7,630	5,480
Selenium						1.7 J	
Silver	2.8 B	3.2 B			3.2 B		
Sodium	50,600	22,200	38,400	35,400	14,700	28,600	73,100
Thallium		0.53 B	0.60 B	0.45 B	0.60 B		
Vanadium	14.4 B	13.2 B	14.4 B	13.1 B	14.2 B	9.6 B	13.2 B
Zinc	12.7 B	49 B	7.1 B	3.8 B	20.9 B	3.1 B	17.4 B

All concentrations are shown in micrograms per liter (µg/L).
The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 6-7. SUMMARY OF RI ANALYTICAL RESULTS FOR GROUNDWATER CHEMISTRY PARAMETERS IN MONITORING WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-MW-1D	BPM-MW-3S	BPM-MW-3D	BPM-MW-3DD	BPM-MW-4S	BPM-MW-4D
	01	01	01	01	01	01
	Bedrock	Shallow	Deep	Bedrock	Shallow	Bedrock
SAMPLE DATE	9/1/92	8/31/92	8/31/92	8/31/92	8/31/92	9/1/92
LIST OF PARAMETERS						
Alkalinity (total)	240	210	98 (a)	160	240	210
Chlorides	92	20	93	38	210	43
Nitrate/Nitrite	2.4	ND (0.2)	ND (0.2)	0.27	1.2	ND (0.2)
Sulfate	45	21	40	27	65	21
Total Dissolved Solids	390	230	310	250	600	300
Total Hardness	270	230	57	200	460	230
pH	7.5	7.2	11.4	7.8	7.6	7.5

ND (X) - Not detected at detection limit X.

(a) - Bicarbonate alkalinity = 32 mg/L. Bicarbonate alkalinity equals total alkalinity for all other samples.

All concentrations are shown in milligrams per liter (mg/L).

The analytical data reports are provided in Appendix J.

Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 6-8. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN MEADOW PARK ROAD RESIDENTIAL WELLS AND BPM PRODUCTION WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-RW-01	BPM-RW-01	BPM-RW-02	BPM-RW-03	BPM-RW-04	BPM-RW-05A	BPM-RW-05A	BPM-RW-07A	BPM-RW-08A	BPM-RW-08A	BPM-RW-09A	BPM-RW-09A
	01	01RE	01	01	01	01	01R	01	01	01 (DL)	01	01 (DL)
SAMPLE DATE	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93
TARGET COMPOUND LIST												
VOLATILE ORGANIC COMPOUNDS	ND	ND	ND	ND	ND							
Acetone									2.0 B			
1,2-Dichloroethylene (Total)												
Tetrachloroethylene						16	13	4.6	33 J	33 J	31 J	32
Trichloroethylene						0.9 J	0.8 J		1.8	1.8 J	1.6 J	1.9 J
TENTATIVELY IDENTIFIED												
VOLATILE ORGANIC COMPOUNDS	ND*	ND*	ND*	ND*	ND*	ND	ND	ND	ND*	--	ND	--

	BPM-RW-10A	BPM-RW-11	BPM-RW-12	BPM-RW-13	BPM-RW-14	BPM-RW-15A	BPM-RW-16	BPM-RW-16	BPM-RW-16	BPM-RW-17	BPM-RW-18
	01	01	01	01	01	01	01	01 RE	01 R	01	01
SAMPLE DATE	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93
TARGET COMPOUND LIST											
VOLATILE ORGANIC COMPOUNDS				ND							ND
Acetone										1.2 B	
1,2-Dichloroethylene (Total)											
Tetrachloroethylene	13	3.5	0.8 J		1.8	8.7	5.2 J	4.6 J	4.2	1.1	
Trichloroethylene	0.6 J					0.6 J					
TENTATIVELY IDENTIFIED											
VOLATILE ORGANIC COMPOUNDS	ND	ND*	ND*	ND*	ND*	ND	ND	ND*	ND*	ND	ND

	BPM-WELL 1	BPM-WELL 1	BPM-WELL 2	BPM-WELL 2	TB 2/24
	01	01 (DL)	01	01 (DL)	
SAMPLE DATE	2/24/93	2/24/93	2/24/93	2/24/93	2/24/93
TARGET COMPOUND LIST					
VOLATILE ORGANIC COMPOUNDS					
Acetone	1.9 B				2.4 J
1,2-Dichloroethylene (Total)	0.8 J				
Tetrachloroethylene	100 J	93	30 J	39 J	
Trichloroethylene	6.5	6.3	1.9	2.5 J	
TENTATIVELY IDENTIFIED					
VOLATILE ORGANIC COMPOUNDS	ND*	--	ND*	--	ND

ND- None Detected.
All concentrations are shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

TABLE 6-9. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN ROUTE 6 COMMERCIAL WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-CW-19 01	BPM-CW-20 01	BPM-CW-20 01 (DL)	BPM-CW-21 01	BPM-CW-21 01 (DL)	BPM-CW-23 01	BPM-CW-23 01 (DL)	BPM-CW-23 01 R	BPM-CW-23 01 R (DL)	BPM-CW-25 01	BPM-CW-27 01	TB 3/11 Trip Blank	TB 4/22 Trip Blank
SAMPLE DATE	3/11/93	3/11/93	3/11/93	3/11/93	3/11/93	3/11/93	3/11/93	3/11/93	3/11/93	3/11/93	4/22/93	3/11/93	4/22/93
TARGET COMPOUND LIST													
VOLATILE ORGANIC COMPOUNDS										ND	ND	ND	ND
Tetrachloroethylene		48 J	47	48J	47	40 J	45	40 J	46 J				
Trichloroethylene		1		3.0	4 J	0.7 J		0.9 J					
Methyl tert butyl ether	15	46 J	44	4.0	4 J	1		2					
TENTATIVELY IDENTIFIED													
VOLATILE ORGANIC COMPOUNDS	ND		--	ND	--	ND	--	ND	--	ND	ND*	ND	ND*
2,2,4-Trimethylpentane		1 J											

ND- None Detected.
All concentrations are shown in micrograms per liter (µg/L).
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotest Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 6-10. COMPILATION OF HISTORICAL ANALYSES FOR BALDWIN PLACE MALL PRODUCTION WELLS; SOMERS, NEW YORK.

DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	Supply Well(s) (Non-Specific)	LOCATION
3/14/79	WCHD	WCEHC	PCE 37	Liquor Store
1/12/82	WCHD	WCDL&R	PCE 5.3	Bakery
			TCE 3.6	
7/16/84	WCHD	WCDL&R	PCE 35*	Deli
			TCE 3.6	
7/26/84	WCHD	WCDL&R	PCE 39*	House
			TCE 4.6	
4/15/85	WCHD	WCDL&R	PCE 1.9	Deli
			TCE 1.7	

DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	Supply Well(s) (Non-Specific)	PW-1 (East)	PW-2 (West)
8/13/88	LBG	Envirotest 601/602	PCE 30		
6/20/88	LBG	Envirotest 601 &	PCE 70/32		
		Envirite	TCE 3.9/ND		
11/22/88	WCHD	WCDL&R	PCE 12		
			TCE 0.67		
11/30/88	WCHD	WCDL&R		PCE 32	PCE 6.4
				TCE 1.5	TCE 1.5
11/30/88	NYSDEC	Camo 503.1		PCE 14	PCE 38
					TCE 2
2/22/89	WCHD	WCDL&R	PCE 16		
3/15/89	NYSDEC			PCE 41	PCE 15
				TCE 2.0	TCE 0.89
				MTBE 1.2	MTBE 1.5
7/12/89	JRFA	Envirotest 503.1	PCE 14		
			TCE 1.2		
8/11/89	JRFA	Envirotest 503.1	PCE 53		
			TCE 4.1		
11/3/89	JRFA	Envirotest 503.1	PCE 70/71		
			TCE 5.5/5.4		
12/13/89	JRFA	Envirotest 503.1	PCE 36		
			TCE 2.6		
6/14/90	JRFA	Envirotest 503.1	PCE 48		
			TCE 3.8		
9/18/90	L & H	Envirotest 503.1	PCE 85		
			TCE 8.0		
10/19/90	L & H	Envirotest 503.1	PCE 73		
			TCE 9.4		
11/19/90	L & H	Envirotest 503.1	PCE 110		
			TCE 10		
12/14/90	L & H	Envirotest 503.1	PCE 71		
			TCE 5.8		
1/17/91	L & H	Envirotest 503.1	PCE 60		
			TCE 9.2		
2/5/91	L & H	Envirotest 503.1	PCE 190		
			TCE 12		

DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	Supply Well(s) (Non-Specific)	PW-1 (East)	PW-2 (West)
3/8/91	L & H	Envirotest 503.1	PCE 96		
			TCE 9.5		
4/9/91	L & H	Envirotest 503.1	PCE 86		
			TCE 6.3		
5/9/91	L & H	Envirotest 503.1	PCE 77		
			TCE 5.6		
6/13/91	L & H	Envirotest 503.1	PCE 12		
			TCE 1.3		
7/18/91	L & H	Envirotest 503.1	PCE 170		
			TCE 13		
8/22/91	L & H	Envirotest 503.1	PCE 85		
			TCE 7.4		
9/11/91	L & H	Envirotest 503.1	ND (0.5)		
10/17/91	L & H	Envirotest 503.1	PCE 110		
			TCE 6.9		
12/17/91	L & H	Envirotest 503.1	PCE 59		
			TCE 6.4		
1/27/92	L & H	Envirotest 503.1	PCE 85		
			TCE 7.3		
2/21/92	VUA	Envirotest 524.2		PCE 66	PCE 4.7
				TCE 5.3	
5/11/92	BIG V	Envirotest 502.1 & 503.1	PCE 90/98		
			TCE 4.5/4.9		
8/11/92	BIG V	Envirotest 502.1 & 503.1	PCE 66/72		
			TCE 3.1/3.7		
			1,2-DCE 0.5/-		
11/10/92	BIG V	Envirotest 502.1 & 503.1	PCE 80/85		
			TCE 3.8/4.2		
2/24/93	VUA	Envirotest 91.4 (a)		PCE 93	PCE 39
				TCE 6.5	TCE 2.5
				1,2-DCE 0.8	
5/24/93	BIG V	Envirotest 502.1 & 503.1	PCE 81/89		
			TCE 5.1/9.2		
			1,2-DCE 0.5/-		
8/9/93	BIG V	Envirotest 502.1 & 503.1	PCE 68/78		
			TCE 4.1/4.2		
11/9/93	BIG V	Envirotest 502.1 & 503.1	PCE 45/63		
			TCE 3.2/5.3		
			MTBE 2.0		
2/22/94	BIG V	Envirotest 502.1 & 503.1	PCE 60/66		
			TCE 3.5/3.6		
5/14/94	BIG V	Envirotest 502.1 & 503.1	PCE 46/47		
			TCE 2.7/3.0		

Concentrations are shown in micrograms per liter (µg/L).

(a) - Remedial Investigation data set.

WCHD - Westchester County Health Department.
WCEHC - Winchester County Environmental Health Center, Albany,New York.
WCDL&R - Westchester County Department of Laboratories and Research, Valhalla, New York.
Envirite - Envirite Analytical Services, Watertown, Connecticut.
CAMO - CAMO Laboratories, Poughkeepsie, New York.
LBG - Leggette, Brashears & Graham.
JRFA - J. Robert Folchetti & Associates.
L & H - Landau and Heyman.
VUA - Vincent Uhl Associates.
Big V - Big V Supermarkets.
Envirotest - Envirotest Laboratories, Newburgh, New York.
* Some Trihalomethanes also detected.

Vincent Uhl Associates.

TABLE 6-11. COMPILATION OF HISTORICAL ANALYSES FOR RESIDENTIAL WELLS ON MEADOW PARK ROAD, BALDWIN PLACE MALL; SOMERS, NEW YORK.

DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	RW-01	RW-02	RW-03	RW-04	RW-05	RW-06	RW-07	RW-08	RW-09	RW-10
11/22/88	WCHD	WCDL&R 502 & 503				All ND (0.5)		All ND (0.5)	PCE T < 0.5	-	PCE 12 TCE T < 0.5	
11/30/88	WCHD	WCDL&R 502 & 503					PCE 28 TCE 1.4					PCE 0.7
12/9/88	WCHD	WCDL&R 502 & 503	All ND (0.5)				PCE 27 TCE 1.8				PCE 15 TCE 1.5	
12/21/88	WCHD	WCDL&R 502 & 503		All ND (0.5)					PCE 0.82	PCE 4.9		
1/12/89	WCHD	WCDL&R 502 & 503										PCE 1.1
2/23/89	WCHD	WCDL&R 502 & 503					PCE 18 TCE 1.1	All ND (0.5)				PCE 1.5
2/24/89	WCHD	WCDL&R 502 & 503	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)					PCE 14 TCE T < 0.5	
3/7/89	WCHD	WCDL&R 502 & 503										
3/15/89	WCHD	WCDL&R 502 & 503	All ND (0.5)							PCE 7.2 TCE 1.2		
5/23/89	WCHD	WCDL&R 502 & 503	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)		All ND (0.5)	PCE 0.77	PCE 8.3 TCE T < 0.5	PCE 16 TCE 0.86	PCE 2.7
7/12/89	WCHD	WCDL&R 502 & 503					PCE 25 TCE 0.87					
10/18/89	WCHD	WCDL&R		All ND (0.5)								
11/22/89	WCHD	WCDL&R 503.1	All ND (0.5)		All ND (0.5)					PCE 14 TCE 0.81	PCE 12 TCE 0.64	PCE 3.9
11/29/89	WCHD	WCDL&R 503.1				All ND (0.5)		All ND (0.5)	PCE 1.8			
3/5/90	WCHD	WCDL&R 502 & 503					PCE 12 TCE 0.64					
5/15/90	WCHD	WCDL&R 502 & 503				All ND (0.5)			PCE 1.4	PCE 11 TCE T < 0.5	PCE 4.1	All ND (0.
6/26/90	WCHD	WCDL&R 502 & 503										
7/26/90	WCHD	WCDL&R 502/503					PCE 6.0					
8/9/90	WCHD	WCDL&R 502/503				All ND (0.5)						
10/25/90	WCHD	WCDL&R 502/503			PCE 1.2							
1/15/91	WCHD	WCDL&R 524				All ND (0.5)						
6/5/91	WCHD	WCDL&R 524					PCE 14 TCE 0.61					
8/5/91	WCHD	WCDL&R 503+	All ND (0.5)	All ND (0.5)	MTBE 1.0				PCE 4.6*		PCE 48 TCE 2.7	PCE 15 TCE 0.64
8/15/91	WCHD	WCDL&R 503+			All ND (0.5)						PCE 52 TCE 2.7	
8/28/91	WCHD	WCDL&R 503+								PCE 33 TCE 1.6		
10/30-11/4/91	VUA	Envirotest 524.2	All ND (0.5)	All ND (0.5)	All ND (0.5)		PCE 11 TCE 0.64		PCE 4.3/4.3	PCE 28 TCE 1.6	PCE 40/37 TCE 2.2/2.3	PCE 9.3
(split)	NYSDOH	Wad L&R 502.2		All ND (0.5)			PCE 11 TCE 0.8		PCE 6.0			PCE 16 TCE 0.6
2/92	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 13		PCE 4	PCE 38 TCE 1.4	PCE 39 TCE 1.8	PCE 12
5/92	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 9		PCE 5	PCE 31 TCE 1.3	PCE 32 TCE 1.4	PCE 14
8/92	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 54 (a) TCE 3.1	All ND (0.5) (b)	PCE 4.2	PCE 36 TCE 1.6	PCE 35 TCE 1.6	PCE 12
11/92	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 35 TCE 1.9		PCE 4.8	PCE 32 TCE 1.3	PCE 28 TCE 1.1	PCE 13
2/93	VUA	Envirotest 91.4 (c)	All ND (1)	All ND (1)	All ND (1)	All ND (1)	PCE 16/13 TCE 0.9/0.8		PCE 4.6	PCE 33 TCE 1.8	PCE 32 TCE 1.6	PCE 13 TCE 0.6
5/93	BIG V	Envirotest 502.1	Chloroform 0.5	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 6.1		PCE 5.1	PCE 34 TCE 1.6	PCE 39 TCE 1.7	PCE 12
8/93	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 22 TCE 1.2	All ND (0.5)	PCE 6.4	PCE 27 TCE 1.2	PCE 30 TCE 1.8	PCE 13
11/93	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)	All ND (0.5)	PCE 61 TCE 3.6	All ND (0.5)	PCE 8.1	PCE 32 TCE 1.1	PCE 21	PCE 11
2/94	BIG V	Envirotest 502.1	All ND (0.5)	All ND (0.5)	All ND (0.5)		PCE 140 TCE 5.8	All ND (0.5)	PCE 9.8	PCE 46 TCE 1.6	PCE 43 TCE 1.3	PCE 15
5/94	BIG V	Envirotest 502.1	All ND (0.5)	Chloroform 0.7	Chloroform 2.6	All ND (0.5)	PCE 300 TCE 10 DCE 0.5	All ND (0.5)	PCE 14 Chloroform 1	PCE 43 TCE 1.9	PCE 38 TCE 1.8	PCE 18

Concentrations are shown in micrograms per liter (μg/L).
WCHD - Westchester County Health Department.
WCDL&R - Westchester County Department of Laboratories and Research.
VUA - Vincent Uhl Associates.
NYSDOH Wad L&R - New York State Department of Health Wadsworth Center for Laboratories and Research.
BIG V - BIG V Supermarkets.

ND (X) - Not detected at quantitation limit X.
T < X - Trace concentration detected below quantitation limit X.
ND - Not Detected.
NT - Not Tested.

* - Laboratory report notes that other VOCs pr
** - Laboratory report notes that an unknown
*** - Toluene (1.7 μg/L) was detected in rep
(a) - Sampled collected in 10/92.
(b) - Sample collected in 7/92.
(c) - Remedial Investigation data set.
(d) - Sample Collected in April 1993.

TABLE 6-12. COMPILATION OF HISTORICAL ANALYSES FOR COMMERCIAL WELLS ON ROUTE 6 BETWEEN BPM AND MAHOPAC AVENUE.
BALDWIN PLACE MALL; SOMERS, NEW YORK.

DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	CW-19 (b)	CW-20	CW-21	CW-22	CW-23	CW-24	CW-25	CW-26	CW-27
11/30/88	NYSDEC	CAMO/503.1	MTBE 150								
12/15/88	NYSDEC	CAMO/503.1	MTBE 220	PCE 9	PCE 3	PCE 19	PCE 28				
				MTBE 10	Benzene 1						
1/3/89	WCHD	WCDL&R 502 & 503				PCE 18	PCE 17				
							TCE 0.53				
1/3/89	NYSDEC	CAMO/503.1	MTBE 150								
1/30/89	NYSDEC	CAMO/503.1	MTBE 180								
3/2/89	NYSDEC	CAMO/503.1	MTBE 150								
3/8/89	NYSDEC	CAMO/503.1		PCE 9							
				MTBE 11							
3/15/89	WCHD	WCDL&R 502 & 503		PCE 7.5							
				MTBE 14							
4/17/89	NYSDEC	CAMO/503.1	MTBE 120								
10/18/89	WCHD	WCDL&R 503	MTBE 92								
6/20/90	WCHD	WCDL&R					PCE 21				
6/20/90	EPA	/503					PCE 23				
							TCE 0.56				
8/22/90	WCHD	WCDL&R 502 & 503									All ND (0.5)
10/25/90	WCHD	WCDL&R 502/503				PCE 55					
						TCE 0.53					
						MTBE 2.6					
11/20/90		YORKTOWN/502.2					All ND				
1/15/91	WCHD	WCDL&R 524					PCE 19				
							TCE T				
2/24/93	NYSDOH	WCDL&R 502			PCE 43 *					All ND (0.5)	
		& Ketones			TCE 4.7						
3/11/93	VUA	Envirotest 91.4 (a)	MTBE 15	PCE 47	PCE 47 *		PCE 45/46		All ND (1)		
				TCE 1	TCE 4		TCE 0.7/0.9				
				MTBE 46	MTBE 4		MTBE 1/2				
4/22/93	VUA	Envirotest 91.4 (a)									All ND (1)
4/22/93	VUA	Envirotest 502.1 (c)		PCE 45	PCE 2.7 *						
				TCE 1.7							
8/26/93	BIG V	Envirotest 502.1 (c)		PCE 55	PCE 37*						
				TCE 1.9	TCE 1.7						
				DCE 1.1							
11/9/93	BIG V	Envirotest 502.1		PCE 65	PCE 1.4*						
				TCE 1.7							
				DCE 1.1							
				MTBE 53							
2/22/94	BIG V	Envirotest 502.1		PCE 80	PCE 11*						
				TCE 1.0	MTBE 2J						
				DCE 0.8							
				MTBE 37							
5/14/94	BIG V	Envirotest 502.1		PCE 63	PCE 9.9						
				TCE 1.7	MTBE 2J						
				DCE 1.4							
				MTBE 36							

Concentrations are shown in micrograms per liter (µg/L).
WCHD - Westchester County Health Department.
WCDL&R - Westchester County Department of Laboratories and Research.
NYSDOH - New York State Department of Health.
VUA - Vincent Uhl Associates.
BIG V - Big V Supermarkets, Inc.
ND (X) - Not detected at quantitation limit x for most compounds (including PCE and TCE). The MTBE quantitation limit is typically higher.
* - Trace Trihalomethanes associated with chlorination system were also detected.
J - Estimated concentration below the reported detection limit.

(a) - Remedial Investigation data set.
(b) - Results are shown for only those samples which were tested for chlorinated volatile organic compounds.
(c) - MTBE not analyzed in this event.

Vincent Uhl Associates

TABLE 6-13. COMPILATION OF HISTORICAL ANALYSES FOR OTHER NEARBY RESIDENTIAL, COMMERCIAL AND LAKE BALDWIN COMMUNITY SUPPLY WELLS, BALDWIN PLACE MALL; SOMERS, NEW YORK (a).

			Tomahawk Street and Lounsbury Drive/Cornelius Lane								Mahopac Avenue (North of Route 6)			
DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	RW-28	RW-29	RW-30	RW-31	RW-32	RW-33	RW-34	CW-35	RW-36	CW-37	RW-38	RW-39
11/22/88	WCHD	WCDL&R					All ND (0.5)							
11/30/88	WCHD	WCDL&R 502 & 503	All ND (0.5)											
12/7/88	WCHD					All ND (0.5)								
1/3/89	WCHD			All ND (0.5)	All ND (0.5)									
1/4/89	WCHD	WCDL&R											PCE T < 0.5	All ND (0.5)
1/31/89	WCHD	WCDL&R 502 & 503									All ND (0.5)	All ND (0.5)		
3/15/89	WCHD	WCDL&R 502 & 503								All ND (0.5)				
5/23/89	WCHD			All ND (0.5)										
10/18/89	WCHD	WCDL&R 503.1										All ND (0.5)		
12/14/90	WCHD	WCDL&R 502.2						All ND (0.5)						
8/15/91	WCHD	WCDL&R 503+	All ND (0.5)						All ND (0.5)					
8/28/91	WCHD	WCDL&R 503+				All ND (0.5)								

						Kennard Road					Route 118			
DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	RW-40 (a)	RW-41 (a)	RW-42	RW-43	PW-44 Community	RW-45	RW-46	CW-47	CW-48	CW-49	CW-49A	CW-50
10/3/88	PCHD	WCDL&R 503					All ND (0.5)							
10/20/88	PCHD	WCDL&R 502 & 503	MTBE 38*	MTBE 200		MTBE 7.0	MTBE T							
11/9/88	PCHD	WCDL&R 503		MTBE 160			MTBE T							
11/29/88	PCHD	WCDL&R 503						All ND (1)	TCE T					
11/30/88	NYSDEC	CAMO 503.1	MTBE 29	MTBE 120/110	All ND (1)	All ND (1)	All ND (1)				All ND (1)			
1/3/89	NYSDEC	CAMO 503.1	MTBE 40	MTBE 150										
1/30/89	NYSDEC	CAMO 503.1	MTBE 61	MTBE 160										
3/2/89	NYSDEC	CAMO 503.1	MTBE 37	MTBE 110										
3/8/89	NYSDEC	CAMO 503.1			All ND (1)	All ND (1)	All ND (1)	All ND (1)	All ND (1)	All ND (1)				
3/16/89		WCDL&R 503.1										All ND (0.5)	All ND (0.5)	MTBE 1.3
3/28/89	NYSDEC	CAMO 503.1					All ND (1)							
4/17/89	NYSDEC	CAMO 503.1		MTBE 81										
6/3/91	LBWD	WCDL&R 524					All ND (0.5)							
6/15/92	LBWD	WCDL&R 524					All ND (0.5)							
6/24/92	ERM	CAMO 601 & 602	MTBE 27											
8/20/92	ERM	CAMO 601 & 602		PCE 1.0 MTBE 59										
8/21/92	ERM	CAMO 601 & 602	MTBE 28											
4/20/93	LBWD	WCDL&R 524					All ND (0.5)							

			Route 118	Route 6
DATE SAMPLED	SAMPLED BY	ANALYZED BY/METHOD	RW-51	CW-52
6/20/88	LBG	Envirotest 601&602		PCE 21
7/11/88	MHPC	Envirotest		PCE 17
10/26/88	WCHD	WCDL&R 502 & 503		PCE 7.2 MTBE 320
11/30/88	NYSDEC	CAMO 503.1	All ND (1)	MTBE 320/290
1/3/89	NYSDEC	CAMO 503.1		PCE 6 MTBE 550
3/8/89	NYSDEC	CAMO 503.1	All ND (1)	
1/10/94	LTR	GTEL 503.1		PCE 1.3 (b)
2/10/94	LTR	GTEL 503.1		PCE 3.2 (b)
3/8/94	LTR	GTEL 503.1		PCE 9.9 (b)

Concentrations are shown in micrograms per liter (µg/L).
WCHD - Westchester County Health Department.
PCHD - Putnam County Health Department.
LBWD - Lake Baldwin Water District.
WCDL&R - Westchester County Department of Laboratories and Research.
CAMO - CAMO Laboratories, Poughkeepsie, New York.
MHPC - Mid Hudson Pollution Control.
LTR - Land Tech. Remedial, Inc., Monroe, Connecticut.
GTEL - GTEL Environmental Laboratories, Inc., Milford, New Hampshire.
* - Trace Trihalomethanes were detected.
(a) - Results are shown for only those samples which were tested for chlorinated volatile organic compounds.
(b) Results for MTBE were not shown on the data sheets provided.
ND (X) - Not detected at quantitation limit x for most compounds (including PCE and TCE).
The MTBE quantitation limit is typically higher.

Vincent Uhl Associates

TABLE 6-14. LIST OF OFF-SITE RESIDENTIAL, COMMERCIAL AND COMMUNITY WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL NO.	LOCATION	COUNTY	COMMENTS
RW-01	Meadow Park Road	Westchester	
RW-02	Meadow Park Road	Westchester	
RW-03	Meadow Park Road	Westchester	
RW-04	Meadow Park Road	Westchester	
RW-05	Meadow Park Road	Westchester	GAC Filter System installed by homeowner, maintained by Big V.
RW-06	Meadow Park Road	Westchester	
RW-07	Meadow Park Road	Westchester	GAC Filter System installed and maintained by Big V.
RW-08	Meadow Park Road	Westchester	GAC Filter System installed and maintained by Big V.
RW-09	Meadow Park Road	Westchester	GAC Filter System installed and maintained by Big V.
RW-10	Meadow Park Road	Westchester	GAC Filter System installed and maintained by Big V.
RW-11	Meadow Park Road	Westchester	GAC Filter System installed and maintained by Big V.
RW-12	Meadow Park Road	Westchester	
RW-13	Meadow Park Road	Westchester	GAC Filter System installed and maintained by homeowner.
RW-14	Meadow Park Road	Westchester	Well serves two residences.
RW-15	Tomahawk Street	Westchester	GAC Filter System installed and maintained by Big V.
RW-16	Meadow Park Road	Westchester	GAC Filter System installed and maintained by Big V.
RW-17	Tomahawk Street	Westchester	GAC Filter System installed and maintained by Big V.
RW-18	Meadow Park Road	Westchester	
CW-19	Route 6	Westchester	GAC Filter System installed and maintained by NYSDEC.
CW-20	Route 6	Westchester	GAC Filter System installed and maintained by Big V.
CW-21	Route 6	Westchester	GAC Filter System installed and maintained by Big V.
CW-22	Route 6	Westchester	GAC Filter System installed and maintained by owner.
CW-23	Route 6	Westchester	GAC Filter System installed and maintained by owner.
CW-24	Route 6	Westchester	
CW-25	Route 6	Westchester	
CW-26	Route 6	Westchester	
CW-27	Route 6	Westchester	
RW-28	Tomahawk Street	Westchester	
RW-29	Lounsbury Drive	Westchester	
RW-30	Lounsbury Drive	Westchester	
RW-31	Lounsbury Drive	Westchester	
RW-32	Lounsbury Drive	Westchester	
RW-33	Lounsbury Drive	Westchester	
RW-34	Lounsbury Drive	Westchester	
CW-35	Mahopac Ave.	Westchester	
RW-36	Mahopac Ave.	Westchester	

TABLE 6-14. LIST OF OFF-SITE RESIDENTIAL, COMMERCIAL AND COMMUNITY WELLS; BALDWIN PLACE MALL, SOMERS, NEW YORK.

WELL NO.	LOCATION	COUNTY	COMMENTS
CW-37	Mahopac Ave.	Westchester	
RW-38	Mahopac Ave.	Westchester	
RW-39	Mahopac Ave.	Westchester	
RW-40	Kennard Road	Putnam	GAC Filter System installed by NYSDEC; maintained by Spain Oil.
RW-41	Kennard Road	Putnam	GAC Filter System installed by NYSDEC; maintained by Spain Oil.
RW-42	Kennard Road	Putnam	
RW-43	Kennard Road	Putnam	
PW-44	Kennard Road	Putnam	
RW-45	Kennard Road	Putnam	
RW-46	Kennard Road	Putnam	
CW-47		Putnam	
CW-48	Route 118	Putnam	
CW-49	Route 118	Putnam	
CW-49A	Route 118	Putnam	
CW-50	Route 118	Putnam	
RW-51	Route 118	Putnam	
CW-52	Route 6 BPM	Westchester	GAC Filter System installed and maintained by Mobil Oil Corporation.
CW-53	Route 6	Westchester	
CW-54	Route 6	Putnam	GAC Filter System installed and maintained by NYSDEC.
CW-55	BPM Intersection	Putnam	
CW-56	BPM Intersection	Putnam	

TABLE 6-15.	SUMMARY OF THE QUARTERLY MONITORING RESULTS FOR MEADOW PARK ROAD RESIDENCES AND ROUTE 8 COMMERCIAL ESTABLISHMENTS WITH GAC FIL BALDWIN PLACE MALL, SOMERS, NEW YORK.															
DATE		RW-05			RW-07			RW-08			RW-09			RW-10		
		Before Filters	Between Filters	After Filters	Before Filters	Between Filters	After Filters	Before Filters	Between Filters	After Filters	Before Filters	Between Filters	After Filters	Before Filters	Between Filters	After Filters
November 1991	PCE	11	ND	ND		(a)		2.8	ND	ND	40/37	ND	ND	9.3	ND	ND
	TCE	0.64	ND	ND				1.6	ND	ND	2.2/2.3	ND	ND	ND	ND	ND
February 1992	PCE	13	ND	ND	4	ND	ND	38	ND	ND	39	ND	ND	ND	ND	ND
	TCE	ND	ND	ND	ND	ND	ND	1.4	ND	ND	1.8	ND	ND	12	ND	ND
May 1992	PCE	9	ND	ND	5	ND	ND	31	ND	ND	32	ND	ND	ND	ND	ND
	TCE	ND	ND	ND	ND	ND	ND	1.3	ND	ND	1.4	ND	ND	14	ND	ND
August 1992	PCE	(b) 54	ND	ND	4.2	ND	ND	36	ND	ND	35	ND	ND	ND	ND	ND
	TCE	3.1	ND	ND	ND	ND	ND	1.6	ND	ND	1.6	ND	ND	12	ND	ND
November 1992	PCE	35	ND	ND	4.8	ND	ND	32	ND	ND	28	ND	ND	ND	ND	ND
	TCE	1.9	ND	ND	ND	ND	ND	1.3	ND	ND	1.1	ND	ND	13	ND	ND
February 1993	PCE	16/13	ND	ND	4.6	ND	ND	33	ND	ND	32	ND	ND	ND	ND	ND
	TCE	0.9/0.8	ND	ND	ND	ND	ND	1.8	ND	ND	1.6	ND	(d) ND	13	ND	ND
May 1993	PCE	6.1	ND	ND	5.1	ND	ND	34	ND	ND	39	ND	ND	0.6	ND	ND
	TCE	ND	ND	ND	ND	ND	ND	1.6	ND	ND	1.7	ND	ND	12	ND	ND
August 1993	PCE	22	ND	ND	6.4	ND	ND	27	ND	ND	30	ND	ND	ND	ND	ND
	TCE	1.2	ND	ND	ND	ND	ND	1.2	ND	ND	1.8	ND	ND	13	ND	ND
November 1993	PCE	61	ND	ND	8.1	ND	3.5 (j)	32	ND	ND	21	ND	ND	ND	ND	ND
	TCE	3.6	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND	ND	11	ND	ND
February 1994	PCE	140	ND	ND	9.8	ND	ND	46	ND	ND	43	ND	ND	ND	ND	ND
	TCE	5.8	ND	ND	ND	ND	ND	1.6	ND	ND	1.3	ND	ND	15	ND	ND
May 1994	PCE	300	ND	ND	(d) 14	ND	ND	43	ND	ND	38	(d) ND	ND	ND	ND	ND
	TCE	10	ND	ND	ND	ND	ND	1.9	ND	ND	1.8	ND	ND	18	1.9	ND
	DCE	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

DATE		CW-20 (g)			CW-21 (g)		
		Before Filters	Between Filters	After Filters	Before Filters	Between Filters	After Filters
April 1993	PCE	45	ND	ND	(h) 2.7	ND	ND
	TCE	1.7	ND	ND	ND	ND	ND
August 1993	PCE	55	0.5	ND	(h) 37	(i) ND	ND
	TCE	1.9	ND	ND	1.7	ND	ND
	DCE	1.1	ND	ND	ND	ND	ND
October 1993	PCE	NT	ND	NT	NT	ND	NT
	MTBE	NT	1 J	NT	NT	ND	NT
November 1993	PCE	65	ND	ND	(h) 1.4	ND	ND
	TCE	1.7	ND	ND	ND	ND	ND
	DCE	1.1	ND	ND	ND	ND	ND
	MTBE	53	1 J	ND	ND	ND	ND
February 1994	PCE	80	ND	ND	(h) 11	ND	ND
	TCE	1	ND	ND	ND	ND	ND
	DCE	0.8	ND	ND	ND	ND	ND
	MTBE	37	2J	ND	2J	ND	ND
May 1994	PCE	63	ND	ND	(h) 9.9	(h) ND	ND
	TCE	1.7	ND	ND	ND	ND	ND
	DCE	1.4	ND	ND	ND	ND	ND
	MTBE	36	2J	ND	2J	ND	ND

ND - Not Detected.
NT - Not Tested.
J - Estimated concentration below reported detection limit.
Concentrations are shown in micrograms per liter (µg/L).
(a) - GAC filter system installed in December 1991.
(b) - RW-05 was sampled in October 1992.
(c) - Filter at RW-15 replaced in October 1992.
(d) - Trace chloroform (0.6 to 1.0 µg/L) was detected in sample.
(e) - GAC filter system installed in March 1993.
(f) - RW-16 was sampled in April 1993.
(g) - GAC filter system installed in April 1993.
(h) - Trihalomethanes were also detected in sample.
(i) - 4-Chlorotoluene (3.1µg/L) was detected in sample.
(j) - RW-07 was retested in December 1993; the between and after filter samples were both ND.
(k) - GAC filter system installed in March 1994.

TABLE 7-1. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER AND SEDIMENT (FIRST EVENT); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-SW-01 Eastern Stream North (SG-1)	BPM-SW-02 Eastern Stream WW Outfall	BPM-SW-03 Eastern Stream South (of Bridge)	BPM-SW-04 Western Stream Just North of Rt. 6	BPM-SW-04 R Western Stream Just North of Rt. 6	BPM-SW-04 B Field Blank	TRIP BLANK Trip Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS	ND						ND
Acetone		9 J					
Bromodichloromethane		46	31				
Chloroform		200	120				
Dibromochloromethane		11	8 J				
Methylene Chloride		1 B	1 B			1 J	
Methyl Tert Butyl Ether				18	17		
Tetrachloroethylene				1 J	1 J		
Toluene			2 J				
Xylene (Total)				7 J	6 J		
TENTATIVELY IDENTIFIED VOLATILE ORGANIC COMPOUNDS	ND*	ND*	ND*	*	*	ND*	ND*
2,3-dihydro-1H-Indene				6 J	5 J		
2,3-dihydro-4-methyl-1H-Indene				5 J			

	BPM-SD-01 Eastern Stream North (SG-1)	BPM-SD-02 Eastern Stream WW Outfall	BPM-SD-03 Eastern Stream South (of Bridge)	BPM-SD-04 Western Stream Just North of Rt. 6	BPM-SD-05 Catch Basin	BPM-SD-04 B Field Blank	TRIP BLANK Trip Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS							ND
Acetone	21 J	7 J	9 J	27 J	21 J		
Carbon Disulfide						5 J	
Chloroform		6 J					
Tetrachloroethylene				4 J			
Xylene (Total)					2 J		
TENTATIVELY IDENTIFIED VOLATILE ORGANIC COMPOUNDS				ND	ND		ND
2-Propanol	11 J R	19 J R	16 J R			7 J	

ND - None Detected.
Surface Water (SW), aqueous field blank (B) and trip blank sample concentrations are shown in micrograms per liter (µg/L).
Sediment (SD) sample concentrations are shown in micrograms per kilogram (µg/Kg), dry weight.
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
R - Unreliable result. Compound may or may not be present in sample.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 7-2. SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER AND SEDIMENT (SUPPLEMENTAL EVENTS); BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-SW-06 Western Stream Upstream of First Pond	BPM-SW-07 Western Stream Downstream of First Pond	BPM-SW-08 Western Stream Upstream of Lake Baldwin	BPM-SW-09 Drainage to Western Stream BPM Intersection	BPM-SW-08 B Field Blank	TRIP BLANK Trip Blank
SAMPLE DATE	10/15/93	10/15/93	10/15/93	10/15/93	10/15/93	10/15/93
TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS		ND	ND		ND	ND
Acetone				8 B		
Methyl Tert Butyl Ether	8 J			2 J		
Tetrachloroethylene	2 J					
TENTATIVELY IDENTIFIED VOLATILE ORGANIC COMPOUNDS	ND*	ND*	ND*	ND*	ND*	ND*

	BPM-SD-06 Western Stream Upstream of First Pond	BPM-SD-07 Western Stream Downstream of First Pond	BPM-SD-08 Western Stream Upstream of Lake Baldwin	BPM-SD-09 Drainage to Western Stream BPM Intersection	BPM-SD-08 B Field Blank	TRIP BLANK Trip Blank
SAMPLE DATE	10/15/93	10/15/93	10/15/93	10/15/93	10/15/93	10/15/93
TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS	ND					ND
Acetone		38	58 J			
Methylene Chloride				9 J		
1,1,1-Trichloroethane					1 J	
TENTATIVELY IDENTIFIED VOLATILE ORGANIC COMPOUNDS	ND		ND	ND	ND	ND*
Unknowns (Total)		14 J				

ND - None Detected.
Surface Water (SW), aqueous field blank (B) and trip blank sample concentrations are shown in micrograms per liter (μg/L).
Sediment (SD) sample concentrations are shown in micrograms per kilogram (μg/Kg), dry weight.
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

TABLE 7-2. **SUMMARY OF RI ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER AND SEDIMENT (SUPPLEMENTAL EVENTS); BALDWIN PLACE MALL, SOMERS, NEW YORK.**

	BPM-SW-10 Drainage to Western Stream Near Seepage at Route 6	BPM-SW-11 Drainage to Western Stream West on Route 6	TRIP BLANK Trip Blank
SAMPLE DATE	12/9/93	12/9/93	12/9/93
TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS		ND	ND
Tetrachloroethylene	1 J		
TENTATIVELY IDENTIFIED VOLATILE ORGANIC COMPOUNDS	ND*	ND*	ND*

	BPM-SD-10 Drainage to Western Stream Near Seepage at Route 6	BPM-SD-11 Drainage to Western Stream West on Route 6	TRIP BLANK Trip Blank
SAMPLE DATE	12/9/93	12/9/93	12/9/93
TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS		ND	ND
Acetone	8 J		
Tetrachloroethylene	4 J		
TENTATIVELY IDENTIFIED VOLATILE ORGANIC COMPOUNDS		ND*	ND*
Unknowns (Total)	7 J*		

ND - None Detected.
Surface Water (SW), aqueous field blank (B) and trip blank sample concentrations are shown in micrograms per liter (µg/L).
Sediment (SD) sample concentrations are shown in micrograms per kilogram (µg/Kg), dry weight.
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
* - Blank contaminants and/or laboratory artifacts are not shown.
Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

TABLE 7-3. **SUMMARY OF RI ANALYTICAL RESULTS FOR BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS IN SURFACE WATER AND SEDIMENT; BALDWIN PLACE MALL, SOMERS, NEW YORK.**

	BPM-SW-01 Eastern Stream North (SG-1)	BPM-SW-02 Eastern Stream WW Outfall	BPM-SW-03 Eastern Stream South (of Bridge)	BPM-SW-04 Western Stream Just North of Rt. 6	BPM-SW-04 R Western Stream Just North of Rt. 6	BPM-SW-04 B Field Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST	ND	ND	ND	ND	ND	ND
TENTATIVELY IDENTIFIED						ND
Ethylbenzene				2 J	2 J	
Triphenylphosphoranyl Formaldehyde	6 J	4 J		6 J		
1-Chloro-2-(1propenyl)cyclopropane		13 J				
Trans-1,2-dichlorocyclohexane		38 J				
2-Chlorocyclohexane			38 J			
Triphenyl phosphine oxide			6 J		6 J	
Unknowns (Total)	3 J	33 J	21 J	8 J	2 J	

	BPM-SD-01 Eastern Stream North (SG-1)	BPM-SD-02 Eastern Stream WW Outfall	BPM-SD-03 Eastern Stream South (of Bridge)	BPM-SD-04 Western Stream Just North of Rt. 6	BPM-SD-04 (DL) Western Stream Just North of Rt. 6	BPM-SD-04 B Field Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST			ND			ND
Acenaphthene				200 J		
Anthracene				990	1,000 J	
Benzo (a) Anthracene	120 J			4,200	4,200	
Benzo (b) Fluoranthene	210 J			4,200	4,800	
Benzo (k) Fluoranthene				2,200	2,000	
Benzo (g,h,i) Perylene				2,100	2,000	
Benzo (a) Pyrene	110 J			3,300	3,500	
bis (2-Ethyl hexyl) phthalate	370 B			1,400 B	1,400 B	
Butyl benzyl phthalate				480 B	450 B	
Carbazole				1,200	1,100 J	
Chrysene	160 J			3,800	4,300	
Dibenz (a,h) Anthracene				530 J		
Dibenzofuran				150 J		
Di-N-Butyl Phthalate		79 B		780 B	770 B	
Di-N-Octyl Phthalate	540					
Fluoranthene	260 J			8,400 J	8,500	
Fluorene				290 J		
Indeno (1,2,3-cd) Pyrene				1,900	1,800	
Phenanthrene				4,500	4,800	
Pyrene	290 J			8,500 J	9,400 J	
TENTATIVELY IDENTIFIED		ND		ND	ND	ND
1-(Ethenyloxy)-Octadecane			230 J			
1,2-Benzenedicarboxylic Acid	880 J					
Unknowns (Total)			478 J			

ND - None Detected.
Surface Water (SW) and aqueous field blank (B) sample concentrations are shown in micrograms per liter (µg/L).
Sediment (SD) sample concentrations are shown in micrograms per kilogram (µg/Kg), dry weight.
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria). Also used for tentatively identified compounds.
Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 7-4. SUMMARY OF RI ANALYTICAL RESULTS FOR PESTICIDES AND PCBs IN SURFACE WATER AND SEDIMENT; BALDWIN PLACE MALL, SOMERS, NEW YORK.

	BPM-SW-01 Eastern Stream North (SG-1)	BPM-SW-02 Eastern Stream WW Outfall	BPM-SW-03 Eastern Stream South (of Bridge)	BPM-SW-04 Western Stream Just North of Rt. 6	BPM-SW-04 R Western Stream Just North of Rt. 6	BPM-SW-04 B Field Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST PESTICIDES AND PCBs	ND			ND	ND	ND
alpha-BHC		0.011 J	0.009 J			
alpha-Chlordane		0.011 J				

	BPM-SD-01 Eastern Stream North (SG-1)	BPM-SD-02 Eastern Stream WW Outfall	BPM-SD-03 Eastern Stream South (of Bridge)	BPM-SD-04 Western Stream Just North of Rt. 6	BPM-SD-04 B Field Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST PESTICIDES AND PCBs					ND
beta-BHC	0.58 J				
alpha-Chlordane	0.60 J	0.83 J	0.37 J	0.62 J	
gamma-Chlordane	0.58 J	0.63 J		0.79 J	
4,4'-DDD	2.4 J	0.88 B	0.45 B	1.6 J	
4,4'-DDE	1.1 B	1.1 B	0.83 B		
4,4'-DDT	1.7 B	1.3 B	0.86 B	4.0 J	
Dieldrin	0.48 J			0.55 J	
Endosulfan Sulfate				1.6 J	
Endrin	0.48 J			1.0 J	
Endrin Aldehyde				3.1 J	
Endrin Ketone				4.8 J	
Methoxychlor				7.2 J	

ND - None Detected.
Surface Water (SW) and aqueous field blank (B) sample concentrations are shown in micrograms per liter (µg/L).
Sediment (SD) sample concentrations are shown in micrograms per kilogram (µg/Kg), dry weight.
Only those compounds detected are shown on the table. The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

TABLE 7-5. **SUMMARY OF RI ANALYTICAL RESULTS FOR TARGET ANALYTE LIST METALS AND INORGANICS (TOTAL) IN SURFACE WATER AND SEDIMENT; BALDWIN PLACE MALL, SOMERS, NEW YORK.**

	BPM-SW-01	BPM-SW-02	BPM-SW-03	BPM-SW-04	BPM-SW-04 R	BPM-SW-04 B
	Eastern Stream	Eastern Stream	Eastern Stream	Western Stream	Western Stream	Field Blank
	North (SG-1)	WW Outfall	South (of Bridge)	Just North of Rt. 6	Just North of Rt. 6	
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST						
METALS AND INORGANICS						
Aluminum	45.4 B	787	559			19.2
Antimony						
Arsenic	6.4					
Barium	51.6	8.9	18.6	127	127	1.4
Beryllium						
Cadmium						
Calcium	81,100	43,300	49,500	61,400	61,400	166
Chromium		20.8	12.4			
Cobalt						
Copper	8.4 B	16.4	11.5 B	24.8	22.1	2.8
Cyanide (Total)						
Iron	304 J	153 J	256 J	4,760 J	4,800 J	19.0 J
Lead	5.2 B	1.8 B	4.3 B	1.9 B	6.6 B	7.3
Magnesium	25,100	13,900	16,900	17,600	17,600	46.8
Manganese	475	20.5 B	88.1	3,430	3,440	5.9
Mercury						
Nickel						
Potassium	3,080	4,750	3,890	3,400	3,380	
Selenium						
Silver						
Sodium	22,200	48,500	42,500	63,500	63,100	114
Thallium				0.97 J		
Vanadium	4.7	5.5		4.3		
Zinc	15.1 B	23.1 B	19.7 B	95.2	78.3	7.2

ND - None Detected.

Surface Water (SW) and aqueous field blank (B) sample concentrations are shown in micrograms per liter (µg/L).

Sediment (SD) sample concentrations are shown in milligrams per kilogram (mg/Kg), dry weight.

The complete analytical data spreadsheets are provided in Appendix B.

B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.

J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).

Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

Vincent Uhl Associates

TABLE 7-5. **SUMMARY OF RI ANALYTICAL RESULTS FOR TARGET ANALYTE LIST METALS AND INORGANICS (TOTAL) IN SURFACE WATER AND SEDIMENT; BALDWIN PLACE MALL, SOMERS, NEW YORK.**

	BPM-SD-01 Eastern Stream North (SG-1)	BPM-SD-02 Eastern Stream WW Outfall	BPM-SD-03 Eastern Stream South (of Bridge)	BPM-SD-04 Western Stream Just North of Rt. 6	BPM-SD-05 Catch Basin	BPM-SD-04 B Field Blank
SAMPLE DATE	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93	6/2/93
TARGET COMPOUND LIST						
METALS AND INORGANICS						
Aluminum	3,080	1,680	2,860	540	2,880	
Antimony						
Arsenic	2.0				1.1	
Barium	92.8	41.4	56.8	24.6	178	0.92
Beryllium			0.30		0.30	
Cadmium					2.1 J	
Calcium	7,650	1,990	2,350	19,500	31,700	108
Chromium	3.2	2.4		9.5	7.7	
Cobalt	4.1					
Copper	13.6	8.3	5.0	10.3	225	
Cyanide (Total)					NA	
Iron	5,730 J	1,620 J	2,650 J	3,120 J	9,030 J	31.1 J
Lead	41.8	7.0	4.8	9.3	155	
Magnesium	3,610	782	914	9,640	5,500	28.1
Manganese	371	171	630	460	1,350	3.8
Mercury						
Nickel					6.9	
Potassium	360	109	115	94.8	215	
Selenium						
Silver						
Sodium	63.9 B	63.2 B	76.5 B	63.1 B	77.1 B	62.1
Thallium			0.33 J	0.21 J	0.30 J	
Vanadium	9.5	6.3	9.2	2.8	16.5	
Zinc	102	21.0	20.8	120	650	9.6

NA - Not Analyzed; insufficient material.
ND - None Detected.
Surface Water (SW) and aqueous field blank (B) sample concentrations are shown in micrograms per liter (µg/L).
Sediment (SD) sample concentrations are shown in milligrams per kilogram (mg/Kg), dry weight.
The complete analytical data spreadsheets are provided in Appendix B.
B - Result is qualitatively suspect since this compound was detected in field and/or laboratory blanks at similar levels.
J - Quantitation is approximate due to limitations identified during data validation (below the method quantitation limit or based on QC criteria).
Samples were analyzed by Envirotech Laboratories, Inc., Newburgh, New York.

Table 10-1
Summary of Hazard and Risk Calculations
Big V Supermarkets, Baldwin Place Mall, NY

Source/Pathway	Potentially Exposed Population	Total Hazard Index Upperbound	Total Cancer Risk Upperbound
Incidental Ingestion of soil	Construction Worker	7E-04	5E-08
Dermal Absorption from soil	Construction Worker	2E-04	1E-08
Inhalation of vapors due to excavation activities	Construction Worker	6E+00	1E-05
	Sub-Total	6E+00	1E-05
Inhalation of vapors from soil	Current Resident	7E-04	5E-09
Ingestion of groundwater	Current Resident	1E-02	1E-06
Dermal Absorption from groundwater	Current Resident	8E-03	1E-06
Inhalation of vapors and airborne chemicals from groundwater	Current Resident	6E-02	1E-06
	Sub-Total	8E-02	4E-06 (a)
Inhalation of vapors from soil infiltrating through building foundation	Future Worker	2E+00	9E-06
	Sub-Total	2E+00	9E-06
Incidental Ingestion of soil	Children	2E-03	2E-07
Dermal Absorption from soil	Children	6E-04	4E-08
Inhalation of vapors from soil	Children	1E-01	3E-07
Incidental Ingestion of sediment	Children	2E-08	6E-13
Dermal Absorption from sediment	Children	4E-09	1E-13
Incidental Ingestion of surface water	Children	7E-06	5E-10
Dermal Absorption from surface water	Children	3E-04	2E-08
Inhalation of vapors from surface water	Children	2E-06	4E-12
	Sub-Total	2E-01	5E-07
Ingestion of groundwater	Future Resident	1E-01	2E-05
Dermal Absorption from groundwater	Future Resident	1E-01	2E-05
Inhalation of vapors and airborne chemicals from groundwater	Future Resident	1E+00	9E-06
	Sub-Total	1E+00	5E-05

(a) Risk is attributable only to groundwater pathways which utilized Federal and NYSDEC/NYSDOH MCLs for Tetrachloroethylene and Trichloroethylene.