GLENN SPRINGS HOLDINGS, INC.
MILLER SPRINGS REMEDIATION MANAGEMENT, INC.

# QUARTERLY MONITORING REPORT
# FOURTH QUARTER -- 2001

- **NAPL AND APL PLUME CONTAINMENT SYSTEM**
- **OVERBURDEN BARRIER COLLECTION SYSTEM**
- **RESIDENTIAL COMMUNITY MONITORING PROGRAM**
- **LEACHATE TREATMENT SYSTEM**
- **NAPL ACCUMULATION AND RECOVERY**

**HYDE PARK RRT PROGRAM**
**NIAGARA FALLS, NEW YORK**

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# 1.0 INTRODUCTION

Reporting of monitoring data for the Non-Aqueous Phase Liquid (NAPL) Plume Containment System, Aqueous Phase Liquid (APL) Plume Containment System, and Overburden Barrier Collection System (OBCS) began in 1993. Monitoring reports for the NAPL and APL Plume Containment Systems as well as the OBCS have been submitted quarterly since 1996. These quarterly monitoring reports have also included data from the Leachate Treatment System, Residential Community Monitoring Program, and NAPL accumulation and recovery.

All monitoring data presented in this report have been collected and presented in accordance with the following documents:

i) "Stipulation on Requisite Remedial Technology Program" (RRT), dated November 13, 1995; and

ii) "Long-Term Monitoring Manual, Hydraulic (Water Levels), Physical (NAPL Presence-Seeps), Chemical (Groundwater Sampling), Hyde Park Landfill Site", dated October 9, 1998.

Miller Springs Remediation Management, Inc. (MSRM), has been assigned the responsibility of managing the Hyde Park RRT Program under the direction of Glenn Springs Holdings, Inc. (GSHI), a subsidiary of Occidental Petroleum Corporation.

## 1.1 REPORT ORGANIZATION

This report has been prepared to present monitoring data collected during the fourth quarter (October through December) 2001. The report is organized as follows:

- **Section 1.0 Introduction:** Section 1.0 presents a summary of the project, its administration, and the organization of the report.
- **Section 2.0 NAPL Plume Containment System:** Section 2.0 presents NAPL purge well operations data, performance monitoring data, statistical analyses of analytical data, and descriptions of non-routine investigations and activities performed during this reporting period. Recommendations for further investigation of the Site groundwater flow system are also presented in Section 2.0.
- **Section 3.0 APL Plume Containment System:** Section 3.0 presents APL purge well operations data, performance monitoring data, APL plume flux calculations where required, and descriptions of non-routine investigations and activities performed

during this reporting period. Recommendations for further investigation of the APL Plume Containment System are also presented in Section 3.0.

- **Section 4.0 Overburden Monitoring Data:** Section 4.0 presents performance data from the Overburden Barrier Collection System and Residential Community Monitoring Well Network, and descriptions of non-routine investigations and activities performed during this reporting period. Recommendations for further investigation, if deemed necessary, are also presented in Section 4.0.
- **Section 5.0 Leachate Treatment Facility:** Section 5.0 presents analytical data collected from the Leachate Treatment Facility.
- **Section 6.0 NAPL Accumulation:** Section 6.0 presents a summary of the volume of NAPL collected from the Bedrock and Overburden Containment Systems and volumes of NAPL shipped off-Site for incineration.

## 2.0 NAPL PLUME CONTAINMENT SYSTEM

The NAPL Plume Containment System consists of 12 fully operational purge wells, 5 newly installed purge wells that are undergoing commissioning and startup, and 42 performance monitoring wells installed in bedrock. The locations of the NAPL plume containment wells are shown on Figure 2.1. The locations of the monitoring wells in the upper, middle, and lower bedrock zones are shown on Figures 2.2 through 2.4, respectively.

The objective of the NAPL Plume Containment System as stated in the RRT is to design, install and monitor a system to contain, to the extent practicable, NAPL and APL within the NAPL Plume found in the Lockport Bedrock and to maximize collection of mobile NAPL.

Operation of the NAPL Plume Containment System commenced in 1994 and consisted of extraction from a series of six purge wells. The system has been modified over time to better achieve its objectives. The system presently consists of 17 NAPL Plume Containment Purge Wells (PWs) as shown on Figure 2.1. These wells are installed in three separate waterbearing zones within the Lockport bedrock formation. The zones are designated as upper, middle, and lower.

### 2.1 PURGE WELL OPERATIONS

The PW system was generally operated continuously during the fourth quarter of 2001. A summary of the "shut-down" periods for the PWs is noted in Table 2.1.

No maintenance of the PW system was required during the fourth quarter of 2001.

The average operating pumping rates and set point elevations at each of the bedrock purge wells during the past year and including the fourth quarter of 2001 are presented in Table 2.1.

The average operating pumping rate of the NAPL Plume Containment System during operation over the fourth quarter was 56.5 GPM; this flow rate is consistent with normal operating flow rates from previous quarters.

## 2.2 CONTAINMENT SYSTEM MONITORING

Performance monitoring conducted during this quarter consisted of hydraulic, chemical, and NAPL presence monitoring. The performance monitoring well network is as presented in the "NAPL Plume Assessment and System Design Recommendations" report, dated July 1995, and modified most recently during the fourth quarter of 2000.

During this reporting period, routine hydraulic, chemical and NAPL presence monitoring were conducted as described in Sections 2.2.1, 2.2.2, and 2.2.3 of this report.

### 2.2.1 HYDRAULIC MONITORING

Hydraulic monitoring of well pairs located at the perimeter of the NAPL plumes (referred to as bedrock performance well pairs) was established in the RRT to gather data to verify the effective performance of the NAPL Plume Containment System.

Two methods of data interpretation, hydraulic gradients and groundwater contours, have been used in the past to assess the effectiveness of the NAPL Plume Containment System. Beginning in 2000 and continuing to date, GSHI/MSRM has undertaken a significant effort to better understand the inter-relationship of the three bedrock zones and to develop monitoring methods that will provide representative data for the performance evaluation of the NAPL Plume Containment System. This work included the review of all monitoring wells to determine if they provide data representative of the monitored interval and a groundwater modeling study. The results of the groundwater modeling study have hypothesized that significant downward vertical groundwater flow occurs from the upper bedrock zone to the middle and lower bedrock zones and from the middle bedrock zone to the lower bedrock zone. Geological and geophysical investigations conducted during the summer of 2001 have confirmed the presence of eleven discreet bedding plane parallel flow zones within the bedrock monitored below the Site. The evaluations of the monitoring wells have shown that they are, in general, completed over a number of these flow zones. As a result of these findings, neither groundwater contours nor hydraulic gradients are believed to be appropriate for assessing the effectiveness of the NAPL Plume Containment System with the current monitoring network.

The hydraulic monitoring and data evaluation performed during this quarter are described in the following subsections.

### 2.2.1.1 WATER LEVEL MEASUREMENTS

Routine hydraulic monitoring was performed on October 19, November 6, and December 5, 2001 during PW operation. The measured water level depths were recorded on field data sheets and then converted to elevations based on surveyed reference points (tops of casings). The cumulative hydraulic monitoring data for the Site from 1993 through this report are included on the enclosed CD under the filename HIST.pdf.

### 2.2.1.2 CONTOUR EVALUATION

The use of groundwater contours to demonstrate the effectiveness of the NAPL Plume Containment System was proposed by MSRM as an alternate tool for hydraulic containment assessment. However, contouring and gradient monitoring relies on several basic assumptions: the monitoring points monitor consistent intervals between monitoring wells, and there is minimal or no vertical flow. As noted previously, the recently completed groundwater modeling and characterization studies have confirmed that the upper, middle and lower zones are not consistent across the site. With the recognition that the existing monitoring network provides misleading data and that interpreting the data in the existing context provides erroneous results, contour maps have not been prepared as part of this report.

### 2.2.1.3 HYDRAULIC GRADIENT EVALUATION

The RRT requires that the performance of the NAPL Plume Containment system be evaluated through the calculation and review of horizontal hydraulic gradients across the limits of the NAPL plumes. The gradient evaluation criteria are specified in the RRT, Section 4.3.7.3 (NAPL Plume Containment Performance Monitoring). Based on the evaluation of the monitoring wells, the groundwater modeling study, and recent characterization activities it was determined that the hydraulic gradient evaluation described in the RRT is not applicable in its present form. Nevertheless, the hydraulic gradient evaluation was conducted to meet the requirements of the RRT. MSRM/GSHI are continuing to evaluate monitoring programs that would be both practical and satisfactory to the Governments.

Horizontal hydraulic gradient head differentials were calculated using the water level elevation data collected during the October, November and December 2001 hydraulic monitoring events. For the purpose of this report, the calculated head differentials will be referred to as hydraulic gradients. Table 2.2 presents the calculated horizontal hydraulic gradients for the representative well pairs in the three bedrock zones.

A summary of the horizontal hydraulic gradients recorded for the fourth quarter 2001 is provided below.

Upper Bedrock Zone

All monitoring wells in the upper bedrock zone have been used in this quarter's gradient evaluations.

The monitoring well pairs that are used for the gradient evaluations in the upper bedrock zone are: A1U-A2U, BC3U-B1U, CMW-12SH-CD3U, D4U-D3U, E5U-E3U, F5UR-F4U, G3U-G4U, H3U-H1U, and J3U-J1U. The locations of these monitoring well pairs are shown on Figure 2.2.

Inward horizontal hydraulic gradients were present at eight of the nine monitoring well pairs (Vectors A, B, C, D, F, G, H, and J) during the fourth quarter 2001. The A-vector exhibited an inward gradient during the October monitoring event, the C-vector exhibited an inward gradient during the November monitoring event, the B, D, F, G, H, and J vectors exhibited inward gradients during each of the three monitoring events, and the E-vector did not exhibit any inward gradients during the three monitoring events.

Middle Bedrock Zone

All monitoring wells in the middle bedrock zone have been used for the gradient evaluations this quarter. Monitoring well F1M was noted as having inconsistent fluctuations in water level; however, this well was not classified as non-representative and is included in this gradient evaluation.

The monitoring well pairs that are used for the gradient evaluations in the middle bedrock zone are: BC3M-B1M, BC3M-C1M, D1M-D2M, E4M-E3M, F4M-F1M, G3M-G1M, H1M-H2M, and J1M-J2M. The locations of the monitoring wells used in the gradient evaluation of the middle bedrock zone are shown on Figure 2.3.

Inward horizontal hydraulic gradients were present at six of the eight well pairs (Vectors B, C, F, G, H, and J) during each monitoring event of the fourth quarter.

Lower Bedrock Zone

The Non-Representative Wells Investigation classified lower bedrock zone monitoring wells G3L, H3L, H4L, J3L, and J4L as non-representative. Therefore, these wells were not used in the gradient evaluation.

The representative monitoring well pairs that are used for the gradient evaluations in the lower bedrock zone are: B1L-B2L, C1L-C2L, and D4L-D1L. The locations of the monitoring well pairs used in the gradient evaluation of the lower bedrock zone are shown on Figure 2.4.

In the lower bedrock zone, an inward hydraulic gradient was present along the B and C vectors during the fourth quarter of 2001. Inward hydraulic gradients were observed along the B vector during the October and December monitoring events and along the C vector during the October monitoring event.

#### 2.2.1.4 GROUNDWATER CAPTURE SIMULATION

The First Quarter 2001 Monitoring Report presented an assessment of capture using the Site groundwater flow model and the average flow rate data for the quarter. This assessment was not performed for the second and third quarters of 2001 due to the limited pumping that occurred as a result of the treatment plant upgrade during the second quarter and the geophysical logging program that was conducted during the third quarter.

During the fourth quarter of 2001 installation of five new NAPL Plume Containment System purge wells was completed. In December, commissioning and testing of each of these purge wells commenced with continuous operation of each individual purge well occurring following startup. It was anticipated that the commissioning and startups of these new purge wells would be completed during the fourth quarter and a capture simulation would be performed using the Site groundwater flow model. Three of the five new purge wells were started during the fourth quarter and a decision was made to wait until after the remaining two purge wells were started prior to performing the capture simulation. The capture simulation will be performed during the first quarter of 2002 and will be submitted to the agencies in the first quarter 2002 report.

### 2.2.2 NAPL MONITORING

NAPL monitoring is performed to provide information to assist in the evaluation of containment system effectiveness. NAPL monitoring consists of:

i) the physical inspection of monitoring wells located both inside and outside the NAPL plumes for the presence of NAPL; and

ii) determination of the volume of NAPL removed by the NAPL Plume Containment System.

#### 2.2.2.1 NAPL PRESENCE CHECKS

Prior to any purging or sampling activities, a check for NAPL presence was performed at each well using a weighted tape measure with a length of cotton rope attached. This NAPL presence check methodology was summarized in the memorandum entitled "NAPL Presence Check Method Comparison, Hyde Park RRT Program" dated January 12, 2001. NAPL was not observed in any of the outer wells or those inner wells that are located beyond the limits of the bedrock NAPL plume definitions. Table 2.3 summarizes the findings of the NAPL presence checks.

#### 2.2.2.2 NAPL ACCUMULATION RATIO

In accordance with the Future Monitoring and Assessment Requirements document (1996), Section 4.1.2.2, a determination of the ratio of NAPL/APL extracted through the operation of the bedrock NAPL plume containment system the fourth quarter was made. Approximately 7.61 million gallons of APL were removed from the bedrock purge wells. During the same period, no measurable quantity of NAPL was removed from the bedrock purge wells. The current NAPL/APL ratio (0.0) and the ratios calculated from previous quarters are presented in Table 2.4. There is no apparent trend in the APL/NAPL ratio data.

### 2.2.3 CHEMICAL MONITORING

Groundwater samples are collected and analyzed each quarter to obtain data for use in the evaluation of the NAPL Plume Containment System. The groundwater monitoring consists of the collection of samples from the outer well of each of the bedrock performance well pairs. The results of the analyses of these samples were used for the quarterly comparisons presented in Section 2.2.3.2 of this report. The analytical data are also used in the statistical analyses presented in Section 2.2.3.3 of this report. The chemical monitoring was conducted between November 8 and 15, 2001. A well purging and sampling summary for the November 2001 sampling event is presented in Table 2.5.

#### 2.2.3.1 FIELD PROCEDURES

All monitoring well purging and sample collection activities were conducted in accordance with the procedures presented in the report entitled "Long-Term Monitoring Manual, Hydraulic (Water Levels), Physical (NAPL Presence-Seeps), Chemical (Groundwater Sampling), Hyde Park Landfill Site", dated October 9, 1998. Purging methods and well volumes removed from each well are summarized in Table 2.5. All purged groundwater was transported to the Hyde Park treatment facility for treatment and disposal. Table 2.5 also presents a sample key and water quality observations and measurements for the samples collected.

#### 2.2.3.2 ANALYTICAL RESULTS

The analytical results for the fourth quarter 2001 chemical monitoring event are summarized in Table 2.6. The cumulative analytical data for all quarterly chemical monitoring events dating back through 1996 are included on the enclosed CD under the filename HIST.pdf. The analytical data were reviewed for conformance to standard Quality Assurance/Quality Control (QA/QC) protocols and copies of the resultant data validations are kept on file at the Western New York MSRM Administration office.

#### 2.2.3.3 STATISTICAL ANALYSIS OF ANALYTICAL RESULTS

In accordance with Section 4.3.8.1-Lateral NAPL Plume Migration of the RRT Stipulation, a statistical evaluation on the NAPL Plume Containment Effectiveness Parameters (phenol, benzoic acid, chlorendic acid, total chlorobenzoic acid, and total organic halides [TOX]) analytical data from the outer well of each gradient pair was performed during the first quarter 2001 and was presented in the First Quarter 2001 Monitoring Report.

The statistical analyses of the analytical data is performed to look for evidence of increasing trends in gradient monitoring wells and is typically presented in the First Quarter Monitoring Report. The statistical analyses were previously presented in the

1999, 2000, and 2001 First Quarter Monitoring Reports. A linear regression analysis, using all available data, was previously used to evaluate the trends in the data. GSHI and CRA recognized that the use of linear regression method with all the data may be overly simplified given the magnitude of the data set. As a result, other statistical methods were reviewed. Revised statistical methods were presented in the First, Second, and Third Quarter 2001 Monitoring Reports. It is MSRM's and GSHI's intent to include a statistical evaluation of the data using the revised statistical methods in each subsequent quarterly report.

The Site groundwater monitoring data were assessed for trends (on an individual well basis) using either the Mann-Kendall trend test (if <50 percent non-detects) or logistic regression (for 50-99 percent non-detects). For the purposes of the Fourth Quarter 2001 data analysis, the analytical data from the 8 most recent sampling events (i.e. from February 2000 to present) were used. Analytes that were not detected at a given well (i.e., 100 percent non-detects) between February 2000 and the present were not evaluated. The results of the trend analysis are presented in Table 2.7. A memorandum presenting the fourth quarter statistical analysis, including descriptions of the statistical methods and concentration vs. time plots for each of the wells evaluated is contained in Appendix A of this report.

Three statistically significant ($P>0.05$) increasing trends were identified. Of these increasing trends, one was observed for chlorendic acid at B1U and two were observed for total chlorobenzoic acid at J2M and J3L. Four statistically significant ($P<0.05$) decreasing trends were also identified. Of these decreasing trends, three were observed for TOX, at wells B1U, C1M, and F4U and the fourth decreasing trend was for total phenolics at D2M.

Table 2.8 presents a comparison of the statistical trend analyses performed following the first, second, third, and fourth quarters of 2001. Only wells/analytes with a significant trend identified during at least one evaluation are presented. In 20 cases, the trends changed from statistically significantly decreasing to not significant or vice versa between the four quarters. The variability in the data as shown on Table 2.8 and the appearance of a few statistically increasing parameters is likely an effect of the shutdown tests as well as the movement of contaminants due to the operation of the additional purge wells. Further evaluations will be provided in future quarterly reports.

## 2.3 NON-ROUTINE INVESTIGATIONS AND FIELD ACTIVITIES

Field activities associated with non-routine monitoring that were completed during the fourth quarter of 2001 with respect to the NAPL Plume Containment System were:

i) During the fourth quarter 2001 commissioning of the newly installed Purge wells commenced. The commissioning of the Purge wells was performed in accordance with the Work Plan entitled "Work Plan for Data Collection During the Start of Operation of the 2001 Purge Wells", dated November 25, 2001. A copy of this work plan is contained in Appendix B of this report. During the fourth quarter 2001, three purge wells were commissioned and subsequently placed into active operation. Commissioning of the remaining two purge wells will be conducted early in the first quarter of 2002.

No other investigations were performed with respect to the NAPL plume containment system during the fourth quarter of 2001.

## 2.4 SUMMARY

The water levels in the operating bedrock purge wells were generally at or very close to their set point elevations during October, November, and December 2001. The average pumping rate for the system during operation over the third quarter was 56.5 GPM.

Even though MSRM/GSHI do not believe that the use of hydraulic gradient evaluation in its present form is appropriate, this evaluation was conducted to remain consistent with historic interpretation of the RRT. The evaluation indicates that eight of nine Upper Bedrock Zone monitoring well pairs and six of eight Middle Bedrock Zone monitoring well pairs achieved inward horizontal gradients during July, August, and September 2001. In the lower bedrock zone an inward hydraulic gradient was observed at two of the three well pairs during the fourth quarter of 2001.

NAPL monitoring indicates that NAPL is not present in any monitoring well located outside of the NAPL plume boundary in any of the three bedrock zones.

Chemical monitoring and statistical analyses indicate that chemical concentrations, where detected, are generally stable. There is limited variability in some parameters likely due to the impact of starting the recently installed purge wells.

## 2.5 ACTION ITEMS

Two investigations/activities that were scheduled to be performed during 2001 were delayed due outside issues. These investigations/activities are the installation of one APL Plume Containment System Purge Well (APW-3) and tracer testing of NAPL Plume Containment System Purge Well PW-7U. The tracer testing conceptualization and Workplan was based on the Upper, Middle and Lower Site Conceptual Model. Since this conceptualization is being revised the tracer test has been placed on hold. The installation of APW-3 is dependant on access agreements with the applicable property owners. APW-3 will be installed in 2002 once access has been granted for the well and forcemain installations.

## 3.0 APL PLUME CONTAINMENT SYSTEM

The APL Plume Containment System consists of two purge wells (APW-1 and APW-2) and four monitoring well pairs (ABP-1/ABP-2, ABP-3/ABP-4, ABP-5/ABP-6, and ABP-7/ABP-8). The locations of these wells are shown on Figure 3.1. The performance criteria for the APL Plume Containment System (remediated APL plume) is to achieve flow convergence towards the purge wells and eliminate seepage at the gorge face to the extent practicable.

Three clusters of APL Flux Monitoring Wells (AFW-1U/M/L, AFW-2U/M/L, and AFW-3U/M/L) oriented toward the west of the Site and located south of the remediated APL plume (as shown on Figure 3.2) monitor the remainder of the APL plume. The performance criteria for the APL Flux Monitoring Wells (AFWs) is to monitor the APL plume flux to the Niagara River through chemical monitoring and to determine whether the flux measured in these wells exceeds the Flux Action Levels specified in the RRT Stipulation.

### 3.1 APL PURGE WELL OPERATIONS

During the fourth quarter of 2001, automated pump operations were uninterrupted and groundwater levels within each purge well were generally maintained within their respective design settings. No maintenance activities were performed on APWs during this quarter.

### 3.2 PERFORMANCE MONITORING

#### 3.2.1 WATER LEVEL MEASUREMENTS

Outward hydraulic gradients were observed between the ABP-1/ABP-2 and ABP-5/ABP-6 monitoring well pairs during the fourth quarter of 2000; therefore, hydraulic monitoring has been performed weekly during operating periods of the first, second, third, and fourth quarters of 2001. The cumulative hydraulic monitoring data from March 1997 to present is included on the enclosed CD under the filename HIST.pdf.

Groundwater levels were also measured at the nine AFW monitoring wells prior to sample collection for APL flux monitoring. These levels are required as part of the hydraulic monitoring program, as well as to calculate the standing volume of groundwater in each well to determine the purge volume prior to sample collection.

The cumulative monitoring data for the AFW monitoring wells from 1993 to present is included on the enclosed CD under the filename HIST.pdf.

### 3.2.2 CONTOUR EVALUATION

As stated in Section 2.2.1.2 of this report, groundwater contour maps have not been prepared using fourth quarter 2001 hydraulic monitoring data.

### 3.2.3 GRADIENT EVALUATION

As previously stated, water level measurements were collected weekly at the ABP monitoring wells. Fourteen (14) sets of water level elevation data were collected from these wells during the fourth quarter of 2001. The calculated hydraulic head gradient differentials (referred to herein as hydraulic gradients) for the four ABP monitoring well pairs in the fourth quarter are presented in Table 3.1.

Monitoring well pairs ABP-3/ABP-4 and ABP-7/ ABP-8 maintained inward horizontal hydraulic gradients during each of the fourteen monitoring events. Outward horizontal hydraulic gradients were observed at well pairs ABP-1/ABP-2 and ABP-5/ABP-6 during each of the fourteen monitoring events of the fourth quarter.

The failure to maintain inward hydraulic gradients between monitoring well pairs ABP-1/ABP-2 and ABP-5/ABP-6 is likely due to the fact that these well pairs do not intersect the same flow zones within the bedrock.

### 3.2.4 SEEP FLOWS

The four gorge face seeps (GF-S1, GF-S2, GF-S3, and GF-S4 shown on Figure 3.3) were inspected monthly in conjunction with hydraulic monitoring events and the flow rate of each seep was visually estimated. A cumulative history of the flow rate estimations is included on the enclosed CD under the filename HIST.pdf. During the fourth quarter monitoring events the estimated gorge face seep flow rates were:

i) October - 0 GPM at GF-S1, 1 GPM at GF-S2, 0 GPM at GF-S3, and 0 GPM at GF-S4;

ii) November - 0 GPM at GF-S1, 1 GPM at GF-S2, 0 GPM at GF-S3, and 1 GPM at GF-S4; and

iii) December - 1 GPM at GF-S1, 1.5 GPM at GF-S2, 0 GPM at GF-S3, and 1.5 GPM at GF-S4.

Seep GF-S4 originates below the Rochester formation and is below any known Hyde Park influences.

### 3.2.5 CHEMICAL MONITORING

Analytical groundwater samples are collected each quarter from the APW and AFW wells in order to assist in the evaluation of the APL Plume Containment System and calculate the APL Plume flux when required. The APW wells are also sampled semi-annually in February and August for analysis of the Collected Liquids Monitoring Parameters as described in Section 9.9 of the RRT. The chemical monitoring was conducted on November 9, 2001.

#### 3.2.5.1 FIELD PROCEDURES

All monitoring well purging and sample collection activities were conducted in accordance with the procedures presented in the report entitled "Long-Term Monitoring Manual, Hydraulic (Water Levels), Physical (NAPL Presence-Seeps), Chemical (Groundwater Sampling), Hyde Park Landfill Site ", dated October 9, 1998. Purging methods and well volumes removed from each well are summarized in Table 3.2. All purged groundwater was transported to the Hyde Park treatment facility for treatment.

#### 3.2.5.2 AFW/APW FLUX COMPOSITE SAMPLING AND ANALYSES

In order to determine the APL flux to the Niagara River, a volume composite sample consisting of water from five AFW monitoring wells and the two APW purge wells is prepared. The required volume of the aliquot from each well for the composite sample is calculated prior to initiation of groundwater sample collection. The volumes required from each well are presented in Table 3.2. These volumes were calculated based on the percentage of cross-sectional contributing area of groundwater flow past each well as compared to the total groundwater flow toward the Niagara River Gorge Face represented by all seven wells.

Groundwater sampling was performed on August 9 and August 10, 2001 using the protocols previously described for the bedrock performance monitoring wells (Section 2.4.2), with the exception of the two APWs where samples are collected directly from the discharge of the operating pumps. The sample key, pH, conductivity, temperature, and water quality observations are summarized in Table 3.2.

The composite sample was prepared by collecting an individual water sample from each of the wells included in the AFW/APW flux program. The volume of sample collected from each well is listed in Table 3.2. The individual samples were all poured into a large glass container for mixing. Following mixing, the composite was poured into individual containers for shipment to the analytical laboratories. Samples collected for analysis of volatile organic compounds (VOCs) were submitted in individual containers for compositing at the analytical laboratory to ensure that any VOCs present were not lost due to field compositing. The laboratory was provided with the predetermined percentages listed in Table 3.3 for compositing. Analyses of the APL Plume Flux Parameters and APL Plume Monitoring Parameters defined in the RRT Stipulation (Sections 9.3 and 9.4) were performed by Ecology and Environment (E&E). The 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) analyses were performed by Alta Labs and polychlorinated biphenyls (PCB) analyses were performed by Triangle Labs. The results of the AFW/APW composite sampling are presented in Table 3.4.

#### 3.2.5.3 APW CLMP/ACIDS SAMPLING AND ANALYSES

In accordance with the RRT Stipulation (Section 11.1.3 Collected APL Monitoring and Section 9.9 Collected Liquids Monitoring Parameters), the APWs are sampled semi-annually during the first and third quarters for analysis of the Collected Liquids Monitoring Parameters (CLMP) as well as benzoic, monochlorobenzoic (sum o, p, and m isomers) and chlorendic acids. This sampling was conducted and reported during the First and Third Quarters of 2001.

#### 3.2.5.4 APL PLUME FLUX CALCULATIONS

As discussed previously, the performance criteria for the APL Plume Containment System beyond the boundary of the remediated APL Plume is based on no exceedance of the Flux Action Levels. When a parameter is reported at a concentration which exceeds its respective APL Plume Flux Parameter's detection limit in the composite sample collected from the two APWs and five AFWs, the chemical flux of that parameter to the Niagara River from the Lockport bedrock must be calculated. The calculated flux in grams per year (g/year) or pounds per day (lbs/day) is then compared to its Flux Action Level as required under the RRT Stipulation.

The composite sample analysis indicated that there were no exceedances of any of the required detection levels during the fourth quarter of 2001; therefore, calculation of the APL Plume Flux to the Niagara River was not required this quarter.

## 3.3 NON-ROUTINE INVESTIGATIONS AND ACTIVITIES

During the fourth quarter of 2001, there were no non-routine investigations or field activities conducted with regards to the APL Plume Containment System.

## 3.4 SUMMARY

Based on the hydraulic monitoring at the ABP monitoring wells, the APL Plume Containment System (remediated APL plume) did not achieve flow convergence throughout the system during this monitoring period. However, the reductions in flow at seeps GF-S3 and GF-S4 indicate that the APWs are working properly in reducing APL migration to the Niagara River.

The significant individual monitoring results from the APL Plume Containment System observed during this reporting period are:

i) inward horizontal gradients were achieved at two of the four ABP monitoring well pairs for all hydraulic monitoring events of this quarter; and

ii) during the second quarter, Gorge Face Seep flows remained lower than historic events.

The AFW/APW flux composite sample prepared during future APL Plume Containment System monitoring events will be comprised of aliquots from the same five AFWs and two APWs used during this monitoring period.

## 3.5 ACTION ITEMS

As discussed in Section 2.3 of this report, a drilling program commenced in June 2001. As part of this drilling program a new APL Purge Well (APW-3) will be installed in the vicinity of the AFW-1 monitoring well cluster.

# 4.0 OVERBURDEN MONITORING DATA

The required overburden monitoring reporting includes monitoring data for the following programs:

i) Overburden Barrier Collection System (Section 4.1); and

ii) Residential Community Monitoring Program (Section 4.2).

## 4.1 OVERBURDEN BARRIER COLLECTION SYSTEM

The Overburden Barrier Collection System (OBCS) consists of an overburden collection trench that extends around the north, west, and south of the Site and is located within the limits of the overburden APL plume. Eight pairs of OBCS monitoring wells (OMWs) are located beyond the OBCS alignment, with one well from each pair installed within the overburden APL plume limits and the second well from each pair installed outside of the overburden APL plume limits. The locations of the OMWs are shown on Figure 4.1.

### 4.1.1 PERFORMANCE MONITORING

Hydraulic and NAPL monitoring are performed at the OMWs in order to assess the performance of the OBCS system. Hydraulic data are used to determine whether or not an inward horizontal gradient across the APL plume boundary is being created by the OBCS or if a downward vertical gradient exists between the overburden and upper bedrock. NAPL monitoring is performed as an additional assessment in order to determine whether or not horizontal migration of overburden NAPL is occurring.

#### 4.1.1.1 GRADIENT EVALUATION

Hydraulic monitoring of the OBCS is performed by collecting water level measurements from the 16 OMWs installed around the Hyde Park Landfill. Hydraulic monitoring of the 16 OMWs was performed weekly in October, November and December 2001. Additionally, in order to demonstrate the presence of a downward vertical hydraulic gradient, some Upper Bedrock Zone monitoring wells were monitored monthly at locations where inward horizontal hydraulic gradients were historically not achieved. Table 4.1 summarizes the fourth quarter hydraulic head differential gradients (referred to herein as hydraulic gradients). The cumulative hydraulic monitoring data for the

OBCS from 1992 to present are included on the enclosed CD under the filename HIST.pdf.

The data presented in Table 4.1 demonstrate that an inward horizontal hydraulic gradient within the overburden regime was achieved this quarter at five of the eight monitoring well pairs during each of the monitoring events in which they were included. At one well pair, OMW-3 / OMW-4R, the inner well (OMW-3) remained dry for all of the fourth quarter. As a result of this, a hydraulic gradient could not be calculated using water level elevations. The bottom of the screen at OMW-3 was lower than the water level elevation at OMW-4R during each of the monitoring events which would indicate an inward hydraulic gradient. The well pairs in which inward horizontal hydraulic gradients were observed are:

i) OMW-1 / OMW-2;

ii) OMW-3 / OMW-4R;

iii) OMW-5R / OMW-6;

iv) OMW-10R / OMW-9; and

v) OMW-15 / OMW-16R

The data in Table 4.1 also indicate the presence of a downward vertical hydraulic gradient from the overburden to the upper bedrock at each of the monitoring well pairs that did not meet the inward hydraulic gradient criteria as follows:

i) B1U / OMW-8R2;

ii) D1U / OMW-11R; and

iii) E4U / OMW-14R.

#### 4.1.1.2 OVERBURDEN NAPL PRESENCE CHECKS

In accordance with Section 3.6.2.3 of the RRT Stipulation, a NAPL presence check was conducted at all overburden wells within the overburden APL plume but outside the defined (1996) overburden NAPL plume limit. Table 4.2 summarizes the results of the NAPL presence checks conducted since 1998. During the fourth quarter of 2001, NAPL was not observed in any of the overburden monitoring wells.

## 4.2 RESIDENTIAL COMMUNITY MONITORING PROGRAM

Eleven pairs of Community Monitoring Wells (CMWs), each consisting of one overburden and one shallow bedrock well, are located in the residential community areas around the Hyde Park Landfill Site. These wells provide an early warning for possible APL plume migration towards residential areas. The overburden (OB) wells are screened to within 1-foot of the bottom of the clay layer overlying the bedrock, while the shallow bedrock (SH) wells extend approximately 15 feet below the top of bedrock.

### 4.2.1 PERFORMANCE MONITORING

The performance monitoring activities required for the Residential Community Monitoring Program are as follows:

i) quarterly monitoring of overburden and bedrock groundwater elevations;

ii) analyses of soil air samples where no overburden groundwater is present; and

iii) annual groundwater sampling and analysis of CMW-2OB.

#### 4.2.1.1 HYDRAULIC MONITORING AND GRADIENT EVALUATION

For the fourth quarter of 2001 hydraulic monitoring of the CMWs was performed monthly in October, November, and December, 2001. Table 4.3 summarizes the vertical hydraulic head differential gradients (referred to herein as hydraulic gradients) for the fourth quarter. The cumulative hydraulic monitoring data for the CMWs from 1987 to present are included on the enclosed CD under the filename HIST.pdf.

The calculation of vertical hydraulic gradients shows that the required downward hydraulic gradients were present this past quarter at all of the well pairs where water was present in the overburden. Two overburden wells, CMW-7OB, and CMW-8OB, were dry for all of the fourth quarter. At each of the overburden wells that were dry, the elevation of the bottom of the well was higher than the groundwater elevation in the shallow bedrock well of the pair during each monitoring event.

#### 4.2.1.2 SOIL VAPOR SAMPLING

At two CMW well pair locations (CMW-7 and CMW-8), the overburden wells have historically contained little to no groundwater, indicating unsaturated conditions in the overburden soils in these areas. As a result, soil vapor samples are collected each quarter from the wells at these locations. Table 4.4 presents the analytical data for the soil vapor samples collected from CMW-7OB and CMW-8OB on November 15, 2001. All parameters were non-detect at each of these locations during the fourth quarter and have historically been non-detect.

#### 4.2.1.3 ANNUAL GROUNDWATER SAMPLING

Sampling of the Overburden well closest to the Site is performed each year as an early warning of migration in the overburden. Following the installation of CMW-12-OB in 2000, repeated attempts have been made to collect an adequate volume for a sample. Each event has proved futile. In lieu of a sample from CMW-12-OB a sample was collected from CMW-2-OB (next closest well to the Site). In 2001, CMW-2-OB was purged and sampled on August 16, 2001 (third quarter of 2001). Table 4.5 presents the analytical results from sampling of CMW-2-OB, all parameters with the exception of Total Organic Halides were non-detect during the fourth quarter and have historically been non-detect. The concentration of Total Organic Halides detected was 35 μg/L which is below the detection level set forth in the RRT Stipulation. The next sampling event at CMW-2-OB will occur during the third quarter of 2002.

## 4.3 NON-ROUTINE INVESTIGATIONS AND ACTIVITIES

During the fourth quarter of 2001, there were no non-routine investigations or field activities conducted with regards to the overburden systems.

## 4.4 SUMMARY

### 4.4.1 OVERBURDEN BARRIER COLLECTION SYSTEM

A review of the hydraulic monitoring data for the fourth quarter of 2001 indicates that inward horizontal hydraulic gradients were present at four of the eight monitoring well pairs. Downward vertical gradients were present at the four monitoring well pairs where an inward horizontal gradient was not maintained.

NAPL was not observed in any of the overburden monitoring wells, indicating that the OBCS continues to serve as an effective barrier to off-Site NAPL migration.

### 4.4.2 RESIDENTIAL COMMUNITY MONITORING PROGRAM

Downward vertical gradients were achieved at all of the monitored well pairs during the fourth quarter of 2001. Two monitoring wells, CMW-7-OB and CMW-8-OB remained dry for each of the monitoring events of the fourth quarter. No analytes were detected in the soil vapor samples collected from these wells. No analytes were detected in groundwater from CMW-2-OB.

## 4.5 ACTION ITEMS

From the monitoring data obtained during the fourth quarter of 2001, it has been determined that the overburden systems are operating properly and no further investigation or maintenance issues are evident at this time.

## 5.0 LEACHATE TREATMENT SYSTEM

In accordance with Section 11.1.4 of the RRT and Addendum I of the Settlement Agreement, the midpoint and effluent of the APL treatment system are monitored. Sampling is required at daily, weekly, and monthly intervals for various parameter groups in order to determine whether the APL Plume Flux is below the Flux Action Levels and whether and when the carbon beds need to be replaced or other maintenance activities need to be undertaken.

### 5.1 EFFLUENT ANALYSIS

The APL treatment system effluent was sampled daily, weekly, and monthly during the fourth quarter of 2001. The sample data is grouped by frequency of sample collection for discussion in the following subsections.

#### 5.1.1 DAILY SAMPLING

Table 5.1 summarizes the results of the daily composite sampling. No exceedances of the treatment levels were reported this quarter for any of the three daily parameters; pH, total organic carbon (TOC), and phenol.

#### 5.1.2 WEEKLY SAMPLING

Table 5.2 summarizes the results of the weekly composite sampling. No exceedances of the treatment levels were reported this quarter for any of the five weekly parameters or their isomers from the collected effluent samples.

#### 5.1.3 MONTHLY SAMPLING

Table 5.3 summarizes the results of the monthly composite sampling. No exceedances of the treatment levels were reported this quarter for any of the eight parameters or their isomers.

## 6.0 NAPL ACCUMULATION

The well extraction systems and manual NAPL removal collected approximately 1 gallon of NAPL during the fourth quarter of 2001. Monthly NAPL recovery identified by source is summarized in Table 6.1.

### 6.1 DECANTERS

Manual NAPL level measurements are conducted monthly in the three decanters. The levels are extrapolated to estimate the quantity of NAPL present in each of the decanters. A description of each decanter's source is provided below:

- Decanter No. 1 Bedrock Purge Well System
- Decanter No. 2 Overburden Barrier Collection System
- Decanter No. 3 Source Control System

NAPL accumulated during the fourth quarter of 2001 was 0 gallons.

NAPL measurements in the decanters are subject to a measurement error of ±6 inches which equates to ±188 gallons of NAPL.

### 6.2 MANUAL RECOVERY

In an effort to enhance NAPL recovery at the Site, MSRM has voluntarily initiated manual NAPL removal from monitoring wells where sufficient NAPL volumes exist. During the fourth quarter of 2001, MSRM recovered 1 gallon of NAPL from monitoring well CD1U.

### 6.3 INCINERATION

During the fourth quarter of 2001, 3,824 gallons of NAPL were shipped from the Hyde Park Site for incineration.

FIGURES

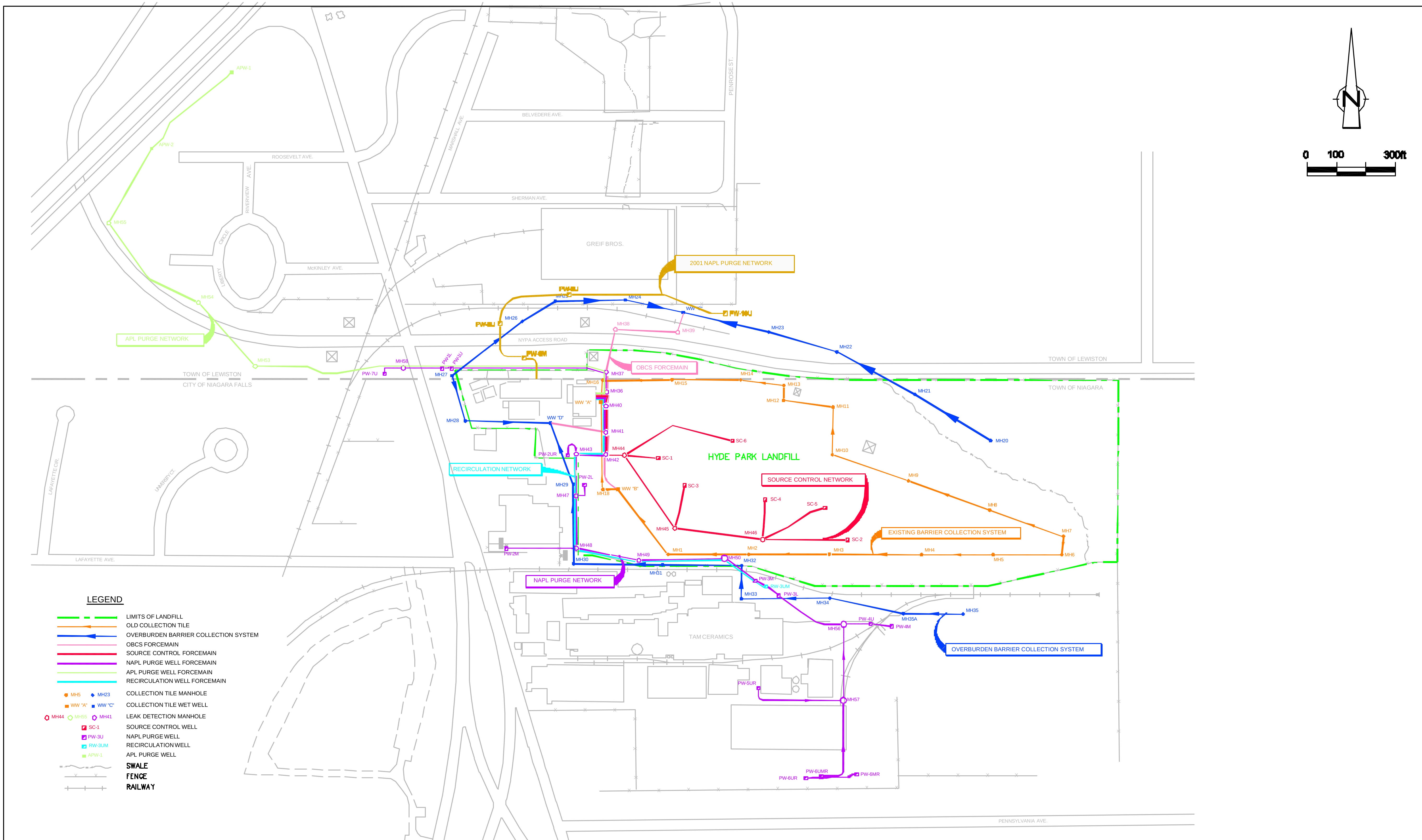


figure 2.1

APL/NAPL REMEDIAL ACTION ELEMENTS
HYDE PARK RRT SITE
*Miller Springs Remediation Management*

01069-20(304)GN-NF011 MAY 24/2002

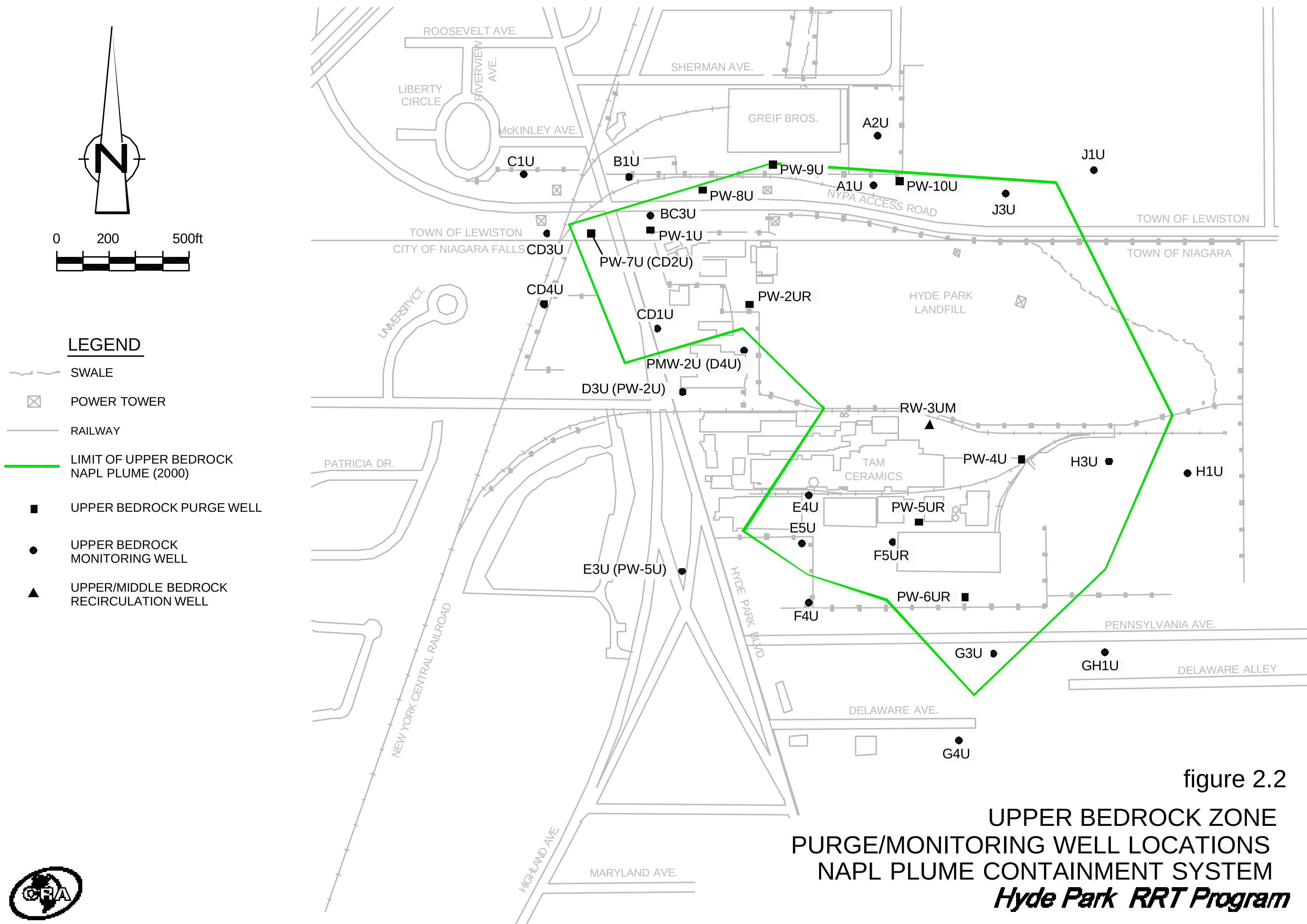


figure 2.2

UPPER BEDROCK ZONE
PURGE/MONITORING WELL LOCATIONS
NAPL PLUME CONTAINMENT SYSTEM
***Hyde Park RRT Program***

01069-20(304)GN-NF002 MAY 24/2002

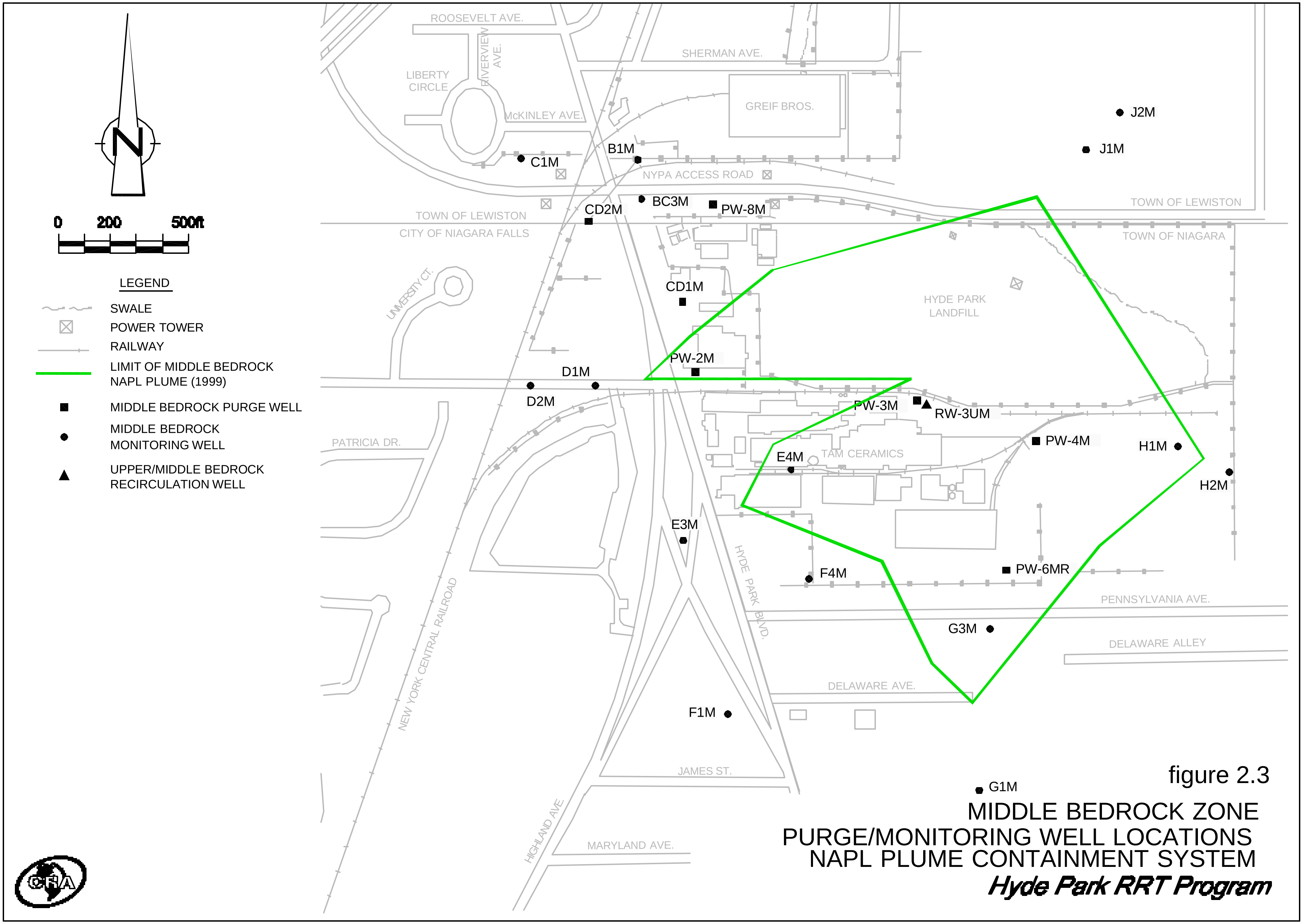


figure 2.3

MIDDLE BEDROCK ZONE
PURGE/MONITORING WELL LOCATIONS
NAPL PLUME CONTAINMENT SYSTEM

***Hyde Park RRT Program***

01069-20(304)GN-NF003 MAY 24/2002

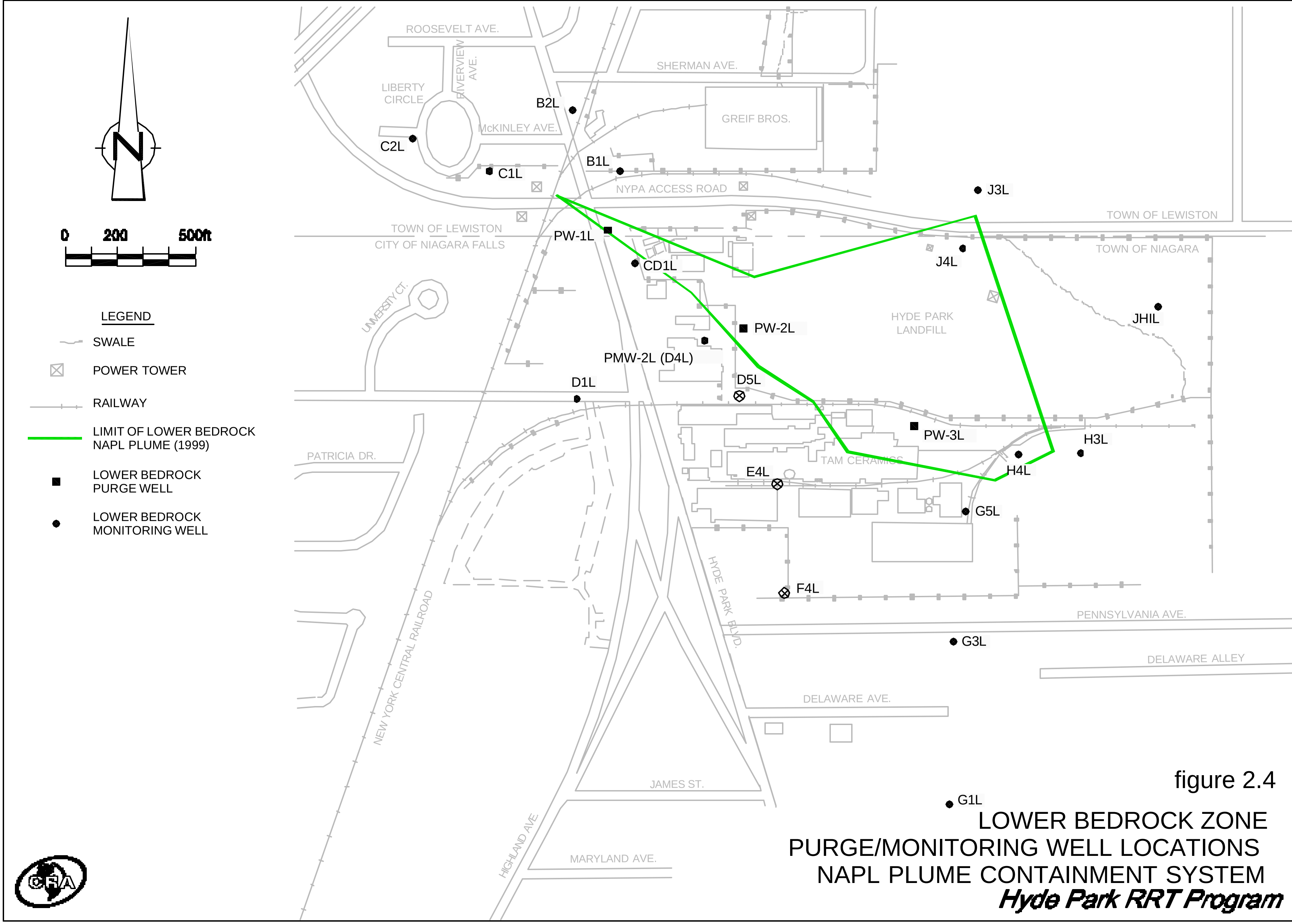


figure 2.4

LOWER BEDROCK ZONE
PURGE/MONITORING WELL LOCATIONS
NAPL PLUME CONTAINMENT SYSTEM
*Hyde Park RRT Program*

01069-20(304)GN-NF004 MAY 24/2002

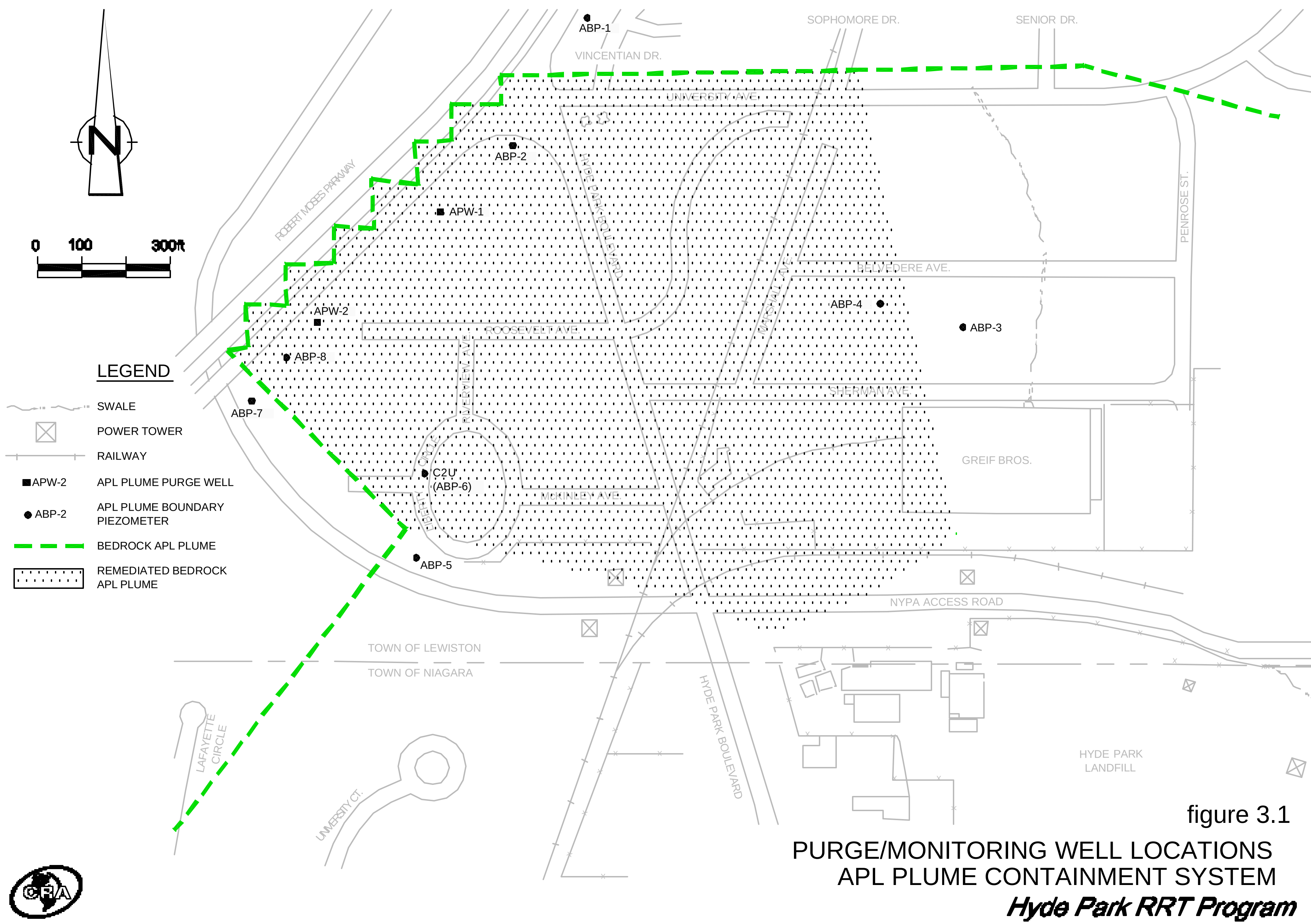


figure 3.1

PURGE/MONITORING WELL LOCATIONS
APL PLUME CONTAINMENT SYSTEM
***Hyde Park RRT Program***

01069-20(304)GN-NF005 MAY 24/2002

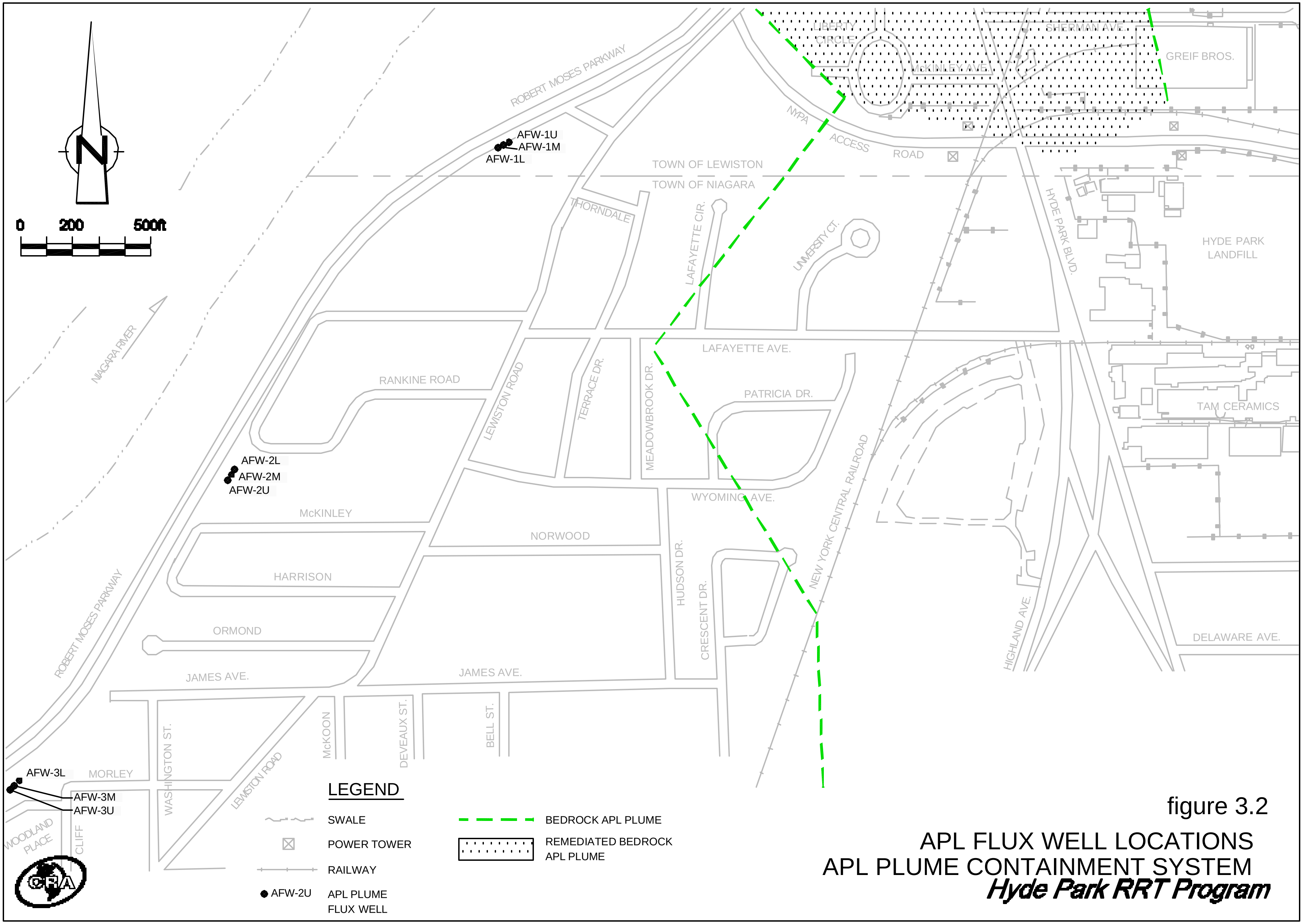


figure 3.2

APL FLUX WELL LOCATIONS
APL PLUME CONTAINMENT SYSTEM
*Hyde Park RRT Program*

01069-20(304)GN-NF006 MAY 24/2002

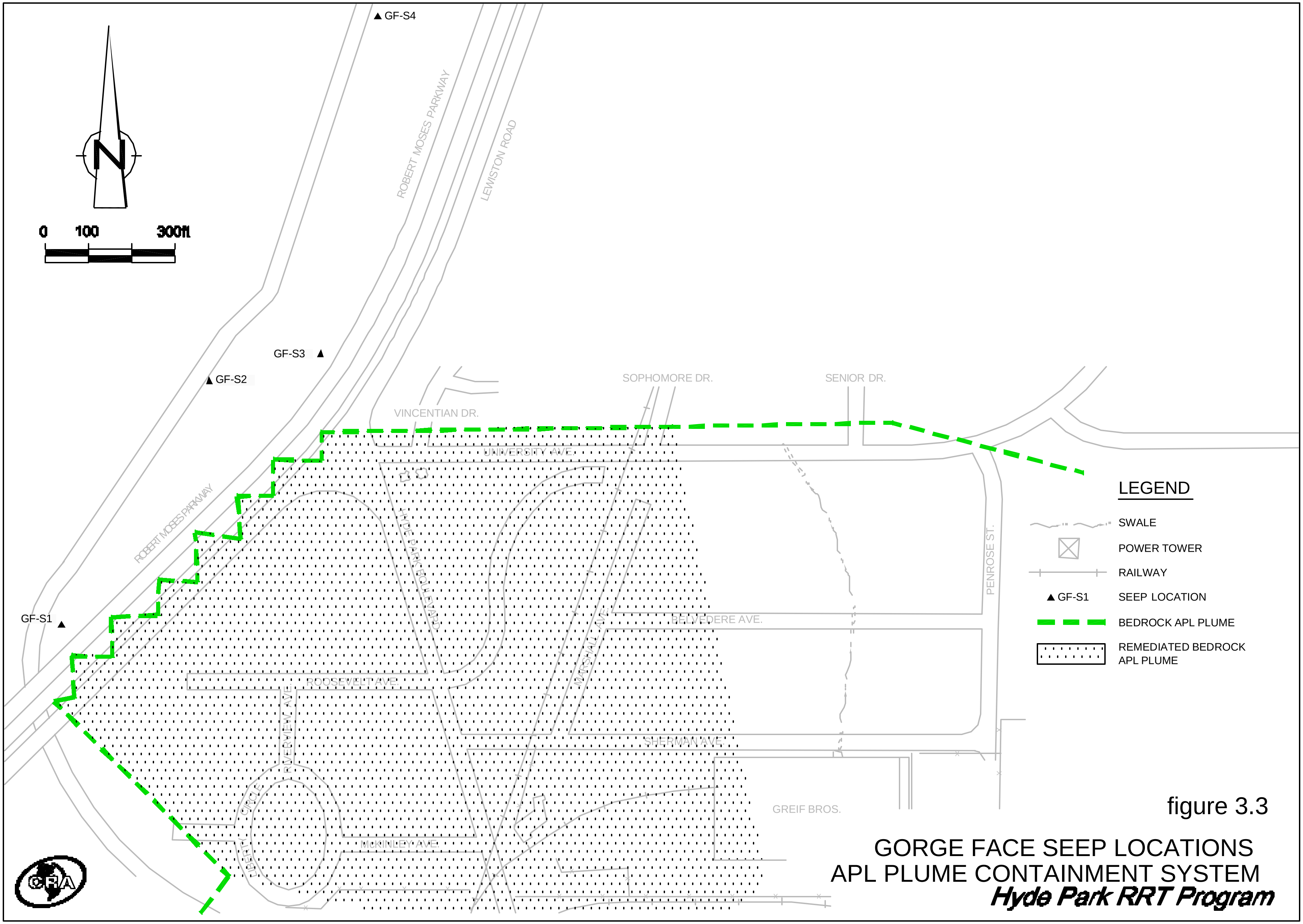


figure 3.3

GORGE FACE SEEP LOCATIONS
APL PLUME CONTAINMENT SYSTEM
***Hyde Park RRT Program***

01069-20(304)GN-NF007 MAY 24/2002

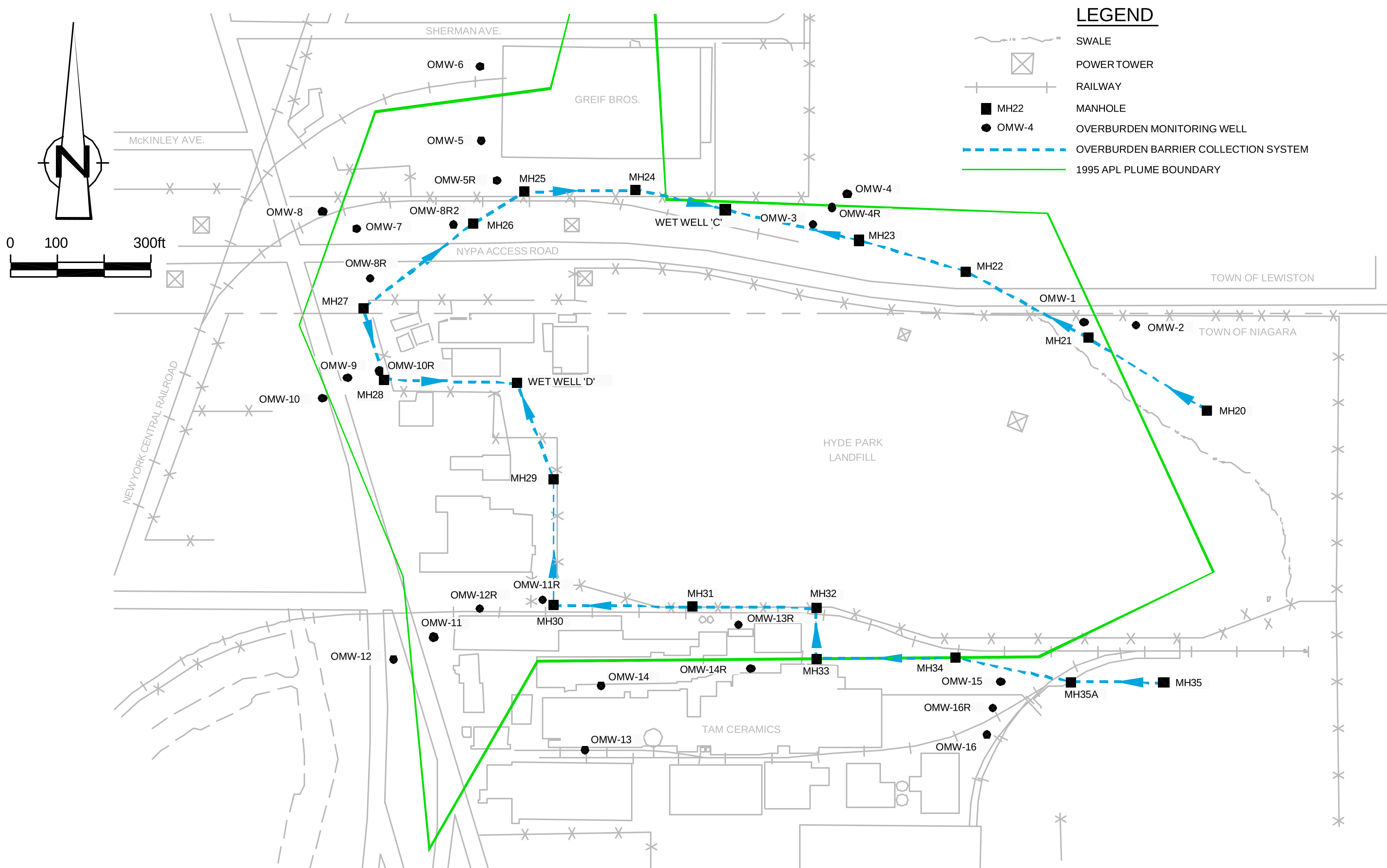


figure 4.1

OBCS MONITORING WELL LOCATIONS

***Hyde Park RRT Program***

01069-20(304)GN-NF008 MAY 24/2002

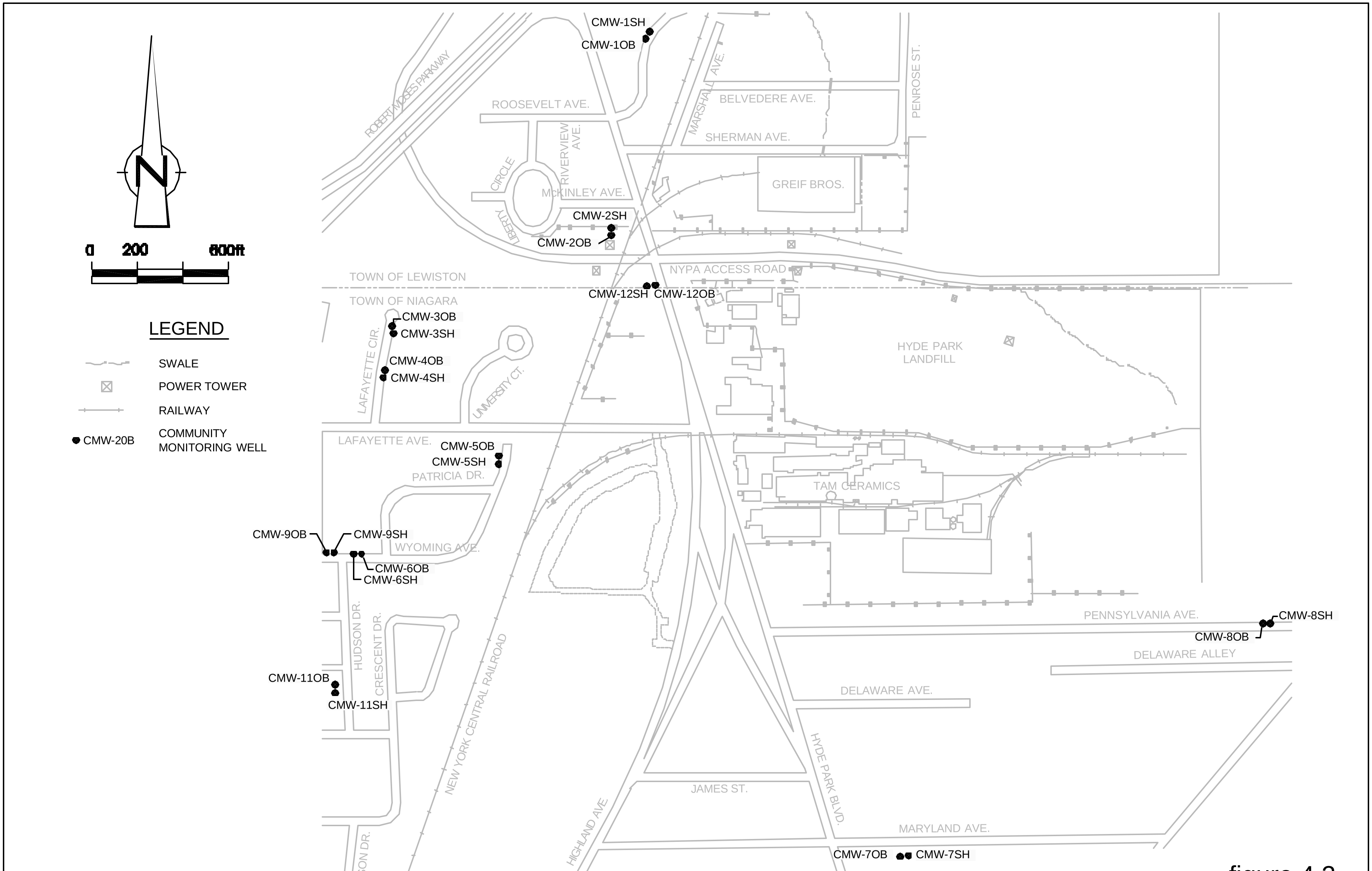


figure 4.2

COMMUNITY MONITORING WELL LOCATIONS

***Hyde Park RRT Program***

01069-20(304)GN-NF009 MAY 24/2002

TABLES

## TABLE 2.1

### MONTHLY AVERAGE PURGE WELL PUMPING RATES (GPM)
### NAPL PLUME CONTAINMENT SYSTEM
### FOURTH QUARTER - 2001
### HYDE PARK RRT PROGRAM

| ***Bedrock Purge Wells*** | ***Set Points*** *(Ft. AMSL)* | ***Jan*** | ***Feb*** | ***Mar*** | ***Apr*** | ***May*** | ***June*** | ***July*** | ***Aug*** | ***Sept*** | ***Oct*** | ***Nov*** | ***Dec*** | ***Monthly Average*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PW-1U | 549 | 0.4 | 0.4 | 0.4 | 0.4 | 0.0 (4) | 0.3 | 0.3 | 0.1 (10) | 0.1 | 0.4 | 0.4 | 0.4 | 0.3 |
| PW-1L | 527 | 5.6 | 6.2 | 6.7 | 8.9 | 4.0 (4) | 8.9 | 7.2 | 1.3 (10) | 6.0 | 10.5 | 8.1 | 7.8 | 1.2 |
| PW-2UR | 559 | 1.1 | 1.2 | 1.2 | 1.1 | 0.1 (4) | 3.5 | 0.4 | 1.4 | 0.6 | 0.6 | 0.7 | 0.8 | 1.1 |
| PW-2M | 532 | 25.4 | 26.8 | 27.4 | 24.0 | 5.1 (4) | 26.0 | 27.0 | 4.1 (10) | 18.2 | 32.0 | 36.8 | 35.5 | 5.2 |
| PW-2L | 505 | 1.1 | 1.3 | 1.4 | 1.6 | 0.4 (4) | 1.2 | 1.5 | 2.0 | 2.1 | 1.0 | 0.9 | 1.0 | 1.3 |
| PW-3M | 522 | 0.6 | 0.7 | 0.6 | 0.6 | 0.1 (4) | 0.5 | 0.3 (9) | 0.5 | 0.2 | 0.0 | 0.0 | 0.0 | 2.9 |
| PW-3L | 525 | 4.8 | 5.2 | 5.6 | 7.3 | 3.4 (4) | 8.2 | 6.7 (9) | 3.8 | 2.1 | 1.7 | 2.9 | 0.6 | 4.4 |
| PW-4U | 573 | 0.5 | 0.6 | 0.7 | 0.7 | 0.1 (4) | 0.5 (7) | 3.2 (8) | 0.8 | 0.3 | 0.3 | 0.4 | 0.4 | 0.7 |
| PW-4M | 522 | 0.0 (1) | 0.0 | 0.0 | 0.0 | 0.8 (4) | 0.3 | 0.7 (9) | 2.3 | 0.2 | 0.0 | 0.0 | 0.0 | 0.4 |
| PW-5UR | 555 | 3.9 | 3.5 (2) | 4.7 | 5.2 | 0.6 (4) | 3.7 (5) | 2.3 (9) | 0.8 | 2.7 | 3.0 | 3.8 | 3.4 | 3.1 |
| PW-6UR | 560 | 2.0 | 2.8 (3) | 4.0 | 4.2 | 0.4 (4) | 4.0 (6 | 2.1 (9) | 0.3 | 0.5 | 1.1 | 1.2 | 1.9 | 2.0 |
| PW-6MR | 505 | 3.9 | 3.9 | 3.8 | 3.3 | 0.2 (4) | 1.8 | 1.3 (9) | 1.1 | 5.0 | 4.1 | 3.8 | 4.2 | 3.0 |
| PW-7U | | - | - | - | - | - | - | - | - | - | - | - | - | |
| PW-8M | | - | - | - | - | - | - | - | - | - | - | - | - | |
| PW-8U | | - | - | - | - | - | - | - | - | - | - | - | 1.1 (11) | 1.1 |
| PW-9U | | - | - | - | - | - | - | - | - | - | - | - | 0.1 (11) | 0.1 |
| PW-10U | | | | | | | | | | | | | 1.6 (11) | 1.6 |
| Individual Total | | 49.3 | 52.4 | 56.5 | 57.2 | 15.1 | 58.9 | 52.9 | 18.5 | 38.0 | 54.8 | 58.9 | 55.9 | 47.4 |
| Combined Meter | | 53.5 | 55.0 | 61.3 | 64.9 | 15.4 | 66.1 | 48.1 | 19.0 | 35.6 | 52.5 | 54.0 | 50.6 | 48.0 |

Notes:

(1) Pump and Motor Replaced 1/16
(2) Pump and Motor Replacedon 2/14 and 2/27, Well bailed of NAPL/Sediment both times.
(3) Pump and Motor Replacedon 2/16, Well bailed of NAPL/Sediment.
(4) All Pumps Shut down May 4 for pump test.
Pumps restarted: 1L 5/21; 1U 6/3; 2L 5/25; 2M 5/29; 2UR 6/3; 3L 5/25; 3M 6/1; 4M 5/27; 4U 6/3; 5UR 6/4; 6MR 6/1; and 6UR 6/3.
(5) Pump and Motor Replaced 6/05 & 6/14
(6) Pump and Motor Replaced 6/11
(7) Pump and Motor Replaced 6/22
GPM Gallons per Minute
N/A Not Available

(8) 4U Replaced on 07/05/01, Pump & Motor
(9) 3M Bore Hole Investigation 7/23/01 returned 8/09/01
3L Bore Hole Investigation 7/24/01 returned 8/09/01
4M Bore Hole Investigation 7/16/01 returned 7/23/01
5UR Bore Hole Investigation 7/17/01 returned 8/24/01
6UR Bore Hole Investigation 7/17/01 returned 8/22/01
6MR Bore Hole Investigation 7/19/01 returned 8/22/01
(10) 1U Bore Hole Investigation 8/10/01 returned 9/07/01
1L Bore Hole Investigation 8/13/01 returned 9/07/01
2M Bore Hole Investigation 8/10/01 returned 9/10/01
(11) PW-8M, 8U, 9U & 10U Place into service.

**TABLE 2.2**

**HYDRAULIC GRADIENT SUMMARY**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well Pair* | *October 2001* | | | *November 2001* | | | *December 2001* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradient(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradient(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradient(1)* |
| A1U-A2U | 573.89 | 573.93 | -0.04 | 573.74 | 573.42 | 0.32 | 576.31 | 573.41 | 2.90 |
| BC3U-B1U | 564.98 | 566.50 | -1.52 | 564.51 | 566.50 | -1.99 | 564.71 | 567.06 | -2.35 |
| CMW-12SH-CD3U | 567.46 | 567.04 | 0.42 | 566.53 | 567.10 | -0.57 | 568.17 | 566.81 | 1.36 |
| D4U-D3U | 578.66 | 585.32 | -6.66 | 578.31 | 584.22 | -5.91 | 578.84 | 585.70 | -6.86 |
| E5U-E3U | 588.30 | 584.63 | 3.67 | 586.06 | 584.37 | 1.69 | 588.76 | 584.50 | 4.26 |
| F5UR-F4U | 585.30 | 586.87 | -1.57 | 585.09 | 585.85 | -0.76 | 585.38 | 589.30 | -3.92 |
| G3U-G4U | 587.37 | 598.38 | -11.01 | 588.48 | 599.51 | -11.03 | 594.20 | 601.33 | -7.13 |
| H3U-H1U | 599.73 | 605.75 | -6.02 | 599.72 | 605.75 | -6.03 | 604.03 | 607.76 | -3.73 |
| J3U-J1U | 583.85 | 592.41 | -8.56 | 583.15 | 592.22 | -9.07 | 586.57 | 593.76 | -7.19 |
| | | | | | | | | | |
| BC3M-B1M | 523.65 | 523.90 | -0.25 | 521.44 | 521.71 | -0.27 | 521.69 | 521.93 | -0.24 |
| BC3M-C1M | 523.65 | 525.44 | -1.79 | 521.44 | 524.69 | -3.25 | 521.69 | 524.32 | -2.63 |
| D1M-D2M | 523.78 | 523.77 | 0.01 | 522.43 | 521.60 | 0.83 | 521.86 | 521.70 | 0.16 |
| E4M-E3M | 537.20 | 523.70 | 13.50 | 537.06 | 521.46 | 15.60 | 536.27 | 521.80 | 14.47 |
| F4M-F1M | 523.74 | 540.92 | -17.18 | 521.34 | 538.08 | -16.74 | 521.63 | 539.19 | -17.56 |
| G3M-G1M | 529.02 | 566.17 | -37.15 | 526.26 | 565.43 | -39.17 | 526.46 | 566.21 | -39.75 |
| H1M-H2M | 556.84 | 576.18 | -19.34 | 553.04 | 574.57 | -21.53 | 551.91 | 573.27 | -21.36 |
| J1M-J2M | 553.68 | 554.26 | -0.58 | 552.51 | 558.52 | -6.01 | 552.24 | 558.24 | -6.00 |
| | | | | | | | | | |
| B1L-B2L | 518.09 | 518.30 | -0.21 | 517.33 | 514.30 | 3.03 | 517.04 | 517.28 | -0.24 |
| C1L-C2L | 518.48 | 518.64 | -0.16 | 514.30 | 514.29 | 0.01 | 517.50 | 514.58 | 2.92 |
| D4L-D1L | 522.64 | 521.94 | 0.70 | 522.53 | 522.02 | 0.51 | 523.09 | 521.94 | 1.15 |

Note:
(1) - Negative number indicates an inward gradient measured in feet.
N / A - Not available.
AMSL - Above Mean Sea Level.

**TABLE 2.3**

**NAPL PRESENCE CHECK**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well I.D.* | *1st Quarter 1998* | *2nd Quarter 1998* | *3rd Quarter 1998* | *4th Quarter 1998* | *1st Quarter 1999* | *2nd Quarter 1999* | *3rd Quarter 1999* | *4th Quarter 1999* | *1st Quarter 2000* | *2nd Quarter 2000* | *3rd Quarter 2000* | *4th Quarter 2000* | *1st Quarter 2001* | *2nd Quarter 2001* | *3rd Quarter 2001* | *4th Quarter 2001* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1U | - | - | - | - | - | - | NO | NO | NO | YES | NO | YES | YES | YES | YES | YES |
| A2U | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| B1L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| B1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| B1U | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| BC3L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| BC3M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| BC3U | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| C1L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| C1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| C1U | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| CD1L | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| CD1M | - | - | - | - | - | - | NO | NO | NO | NO | NO | - | NO | NO | NO | NO |
| CD1U | - | - | - | - | - | - | YES | NO | NO | YES | NO | YES | YES | YES | YES | YES |
| CD2U | - | - | - | - | - | - | - | - | NO | YES | NO | YES | YES | YES | NO | NO |
| CD3U | - | - | - | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO |
| D1L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D2M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D3U | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D4L | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D4U | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D5L | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| E3M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| E3U | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| E4L | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| E4U | YES | YES | YES | NO * | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES |
| E5U | - | - | - | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO |
| F1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F4L | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

**TABLE 2.3**

**NAPL PRESENCE CHECK**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well I.D.* | *1st Quarter 1998* | *2nd Quarter 1998* | *3rd Quarter 1998* | *4th Quarter 1998* | *1st Quarter 1999* | *2nd Quarter 1999* | *3rd Quarter 1999* | *4th Quarter 1999* | *1st Quarter 2000* | *2nd Quarter 2000* | *3rd Quarter 2000* | *4th Quarter 2000* | *1st Quarter 2001* | *2nd Quarter 2001* | *3rd Quarter 2001* | *4th Quarter 2001* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F4M | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F4U | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F5UR (2) | YES | NO | NO | NO * | NO | NO | YES | YES | YES | YES | YES | NO | NO | NO | NO | NO |
| G1L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| G1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| G3L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| G3M | YES | YES | YES | YES | YES | YES | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| G3U | NO | NO | NO | NO | YES | YES | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| G4U | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| GH1U | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| H1L | - | NO | NO | NO | NO | NO | NO | NO | NO | - | - | NO | NO | NO | NO | NO |
| H1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| H1U | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| H2L | - | NO | NO | NO | NO | NO | NO | NO | NO | - | - | NO | NO | NO | NO | NO |
| H2M | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| H3L | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | - | - | - | - |
| H3U | YES | NO | YES | YES * | YES | YES | YES | YES | NO | NO | YES | NO | YES | NO | YES | YES |
| J1M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| J1U | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| J2M | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| J3L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| J3U | NO | NO | YES | YES | YES | YES | YES | YES | NO | YES | YES | YES | YES | YES | YES | YES |
| J4L | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-1 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-10R | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-11 | NO | NO | NO | NO * | NO | NO | NO | NO | NO | - | - | | NO | NO | NO | NO |
| OMW-11R | - | - | - | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO |
| OMW-12R | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-13R | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW14R | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

**TABLE 2.3**

**NAPL PRESENCE CHECK**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well I.D.* | *1st Quarter 1998* | *2nd Quarter 1998* | *3rd Quarter 1998* | *4th Quarter 1998* | *1st Quarter 1999* | *2nd Quarter 1999* | *3rd Quarter 1999* | *4th Quarter 1999* | *1st Quarter 2000* | *2nd Quarter 2000* | *3rd Quarter 2000* | *4th Quarter 2000* | *1st Quarter 2001* | *2nd Quarter 2001* | *3rd Quarter 2001* | *4th Quarter 2001* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OMW-15 | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-16R | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-2 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-3 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-4R | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-5 | NO | NO | NO | NO | NO | NO | NO | NO | NO | - | - | - | NO | NO | NO | NO |
| OMW-5R | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-6 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-7 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-8R | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW-8R2 | - | - | - | - | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO |
| OMW-9 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| PMW-1L | - | - | - | - | - | - | - | - | - | NO | YES | YES | YES | YES | YES | YES |
| PMW-3M | - | - | - | - | - | - | - | - | NO | YES | YES | YES | YES | YES | NO | YES |
| PW-2L | - | - | - | - | - | - | - | - | - | NO | NO | NO | NO | NO | YES | NO |
| PW-3UM | - | - | - | - | - | - | - | - | - | YES | - | YES | YES | YES | YES | YES |
| PW-6UMR | - | - | - | - | - | - | YES | YES | NO | YES | NO | NO | YES | YES | NO | NO |

Notes:
(1) LNAPL found in well, no DNAPL (due to historic diesel fuel spill in well area).
(2) Not NAPL but Fuel Oil
\- Not Available
* Wells checked on 12/10/98, strike at TAM (wells located on TAM property).
Manual NAPL recoveries listed in Table 5.1 of this report.
LNAPL Light Aqueous Phase Liquid.
NAPL Non-Aqueous Phase Liquid.
NO Not Observed.

## TABLE 2.4

## NAPL/APL RATIO
## NAPL PLUME CONTAINMENT SYSTEM
## FOURTH QUARTER - 2001
## HYDE PARK RRT PROGRAM

| | *NAPL Gallons* | *APL Gallons* | *NAPL/APL Ratio* |
|---|---|---|---|
| First Quarter 1999 | 940 | 5,426,453 | 0.000173 |
| Second Quarter 1999 | 376 | 6,520,094 | 0.000058 |
| Third Quarter 1999 | 899 | 6,408,207 | 0.000140 |
| Fourth Quarter 1999 | 376 | 7,160,202 | 0.000053 |
| First Quarter 2000 | 0 | 7,791,656 | 0.000000 |
| Second Quarter 2000 | 188 | 7,259,189 | 0.000026 |
| Third Quarter 2000 | 94 | 6,506,615 | 0.000014 |
| Fourth Quarter 2000 | 2,350 | 6,642,719 | 0.000354 |
| First Quarter 2001 | 1,034 | 6,838,819 | 0.000151 |
| Second Quarter 2001 | 0 | 5,692,242 | 0.000000 |
| Third Quarter 2001 | 1,632 | 4,829,806 | 0.000338 |
| Fourth Quarter 2001 | 0 | 7,614,982 | 0.000000 |

Notes:
APL Aqueous Phase Liquid.
NAPL Non-Aqueous Phase Liquid.

**TABLE 2.5**

**WELL PURGING AND SAMPLING SUMARY**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well I.D.* | *Sample I.D.* | *Sample Date* | *Sample Tme* | *Initial Water Level (ft. BTOC)* | *Depth of Well (ft. BTOC)* | *Standing Well Volume (Gallons)* | *Purge Volume (Gallons)* | *Purge Method* | *Sample Parameters pH (s.u.)* | *Cond (uS/cm)* | *Temp (°C)* | *Turbidity (NTU)* | *Final Water Quality* | *Comments* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A2U | A2U1101 | 11/14/01 | 9:35 | 20.87 | 52.1 | 20.0 | 100 | | 7.34 | 992 | 12.8 | clear | clear, slight sulfur odor | |
| B1L | B1L1101 | 11/15/01 | 11:56 | 89.35 | 104 | 18.0 | 90 | | 6.76 | 836 | 12.5 | 8.1 | clear, sulfur odor | |
| B1M | B1M1101 | 11/12/01 | 8:00 | 69.90 | 83 | 9.0 | 45 | | 6.93 | 6110 | 11.8 | clear | clear, slight sulfur odor | |
| B1U | B1U1101 | 11/12/01 | 8:05 | 26.75 | 57 | 20.0 | 100 | | 7.28 | 1132 | 11.9 | clear | clear, odorless | |
| C1L | C1L1101 | 11/09/01 | 10:48 | 79.83 | 104 | 16.0 | 80 | | 7.35 | 977 | 11.3 | clear | clear, slight sulfur odor | |
| C1M | C1M1101 | 11/09/01 | 9:45 | 76.90 | 81.5 | 7.0 | 35 | | 7.42 | 990 | 11.2 | clear | clear, slight sulfur odor | |
| C1U | C1U1101 | 11/09/01 | 9:00 | 37.24 | 55.5 | 16.0 | 80 | | 7.38 | 950 | 11.2 | clear | clear, odorless | |
| CD3U | CD3U1101 | 11/15/01 | 11:15 | 38.10 | 61.7 | 32.0 | 160 | | 7.52 | 696 | 11.9 | clear | clear, odorless | |
| D1L | D1L1101 | 11/12/01 | 10:08 | 80.17 | 110 | 20.0 | 100 | | 6.29 | 83400 | 12.2 | 615 | cloudy, black | |
| D1U | D1U1101 | 11/12/01 | 9:10 | 24.94 | 50.1 | 22.0 | 110 | | 7.34 | 714 | 12.8 | clear | clear, odorless | |
| D2M | D2M1101 | 11/14/01 | 8:30 | 67.52 | 85.8 | 11.0 | 55 | | 7.41 | 1162 | 11.7 | clear | clear, slight sulfur odor | |
| D3U | D3U1101 | 11/08/01 | 8:15 | 33.40 | 48.3 | 192.0 | 771 | | 7.32 | 2780 | 13.5 | 26 | clear, odorless | |
| E1U | E1U1101 | 11/09/01 | 11:45 | 20.75 | 55.6 | 23.0 | 115 | | 7.55 | 809 | 11.5 | clear | clear, odorless | |
| E3M | E3M1101 | 11/09/01 | 11:42 | 72.40 | 94 | 14.0 | 70 | | 6.96 | 3470 | 11.5 | 29 | clear, slight sulfur odor | |
| E3U | E3U1101 | 11/14/01 | 11:00 | 11.80 | 46.7 | 230.0 | 1150 | | 6.99 | 176 | 12.6 | clear | clear, odorless | |
| F1M | F1M1101 | 11/12/01 | 11:10 | 64.86 | 110 | 29.0 | 174 | | 7.2 | 2630 | 10.9 | 3.4 | clear, odorless | |
| F4U | F4U1101 | 11/14/01 | 10:30 | 46.43 | 69.2 | 35.0 | 175 | | 7.56 | 157 | 15.1 | cloudy | cloudy slight sulfur odor | |
| G1L | G1L1101 | 11/13/01 | 8:00 | 49.22 | 147 | 71.0 | 355 | | 6.92 | 15200 | 10.1 | clear | clear, slight sulfur odor | |
| G1M | G1M1101 | 11/13/01 | 7:50 | 52.52 | 124 | 47.0 | 282 | | 6.91 | 167 | 9.9 | 11 | clear, odorless | |
| G4U | G4U1101 | 11/13/01 | 11:25 | 20.90 | 0 | 23.0 | 115 | | 7.43 | 694 | 12.1 | clear | clear, odorless | |
| H1U | H1U1101 | 11/13/01 | 9:05 | 23.70 | 57 | 26.0 | 156 | | 7.79 | 758 | 11.3 | clear | clear, odorless | |
| H2M | H2M1101 | 11/13/01 | 9:38 | 62.10 | 129 | 53.0 | 265 | | 7.03 | 250 | 10.8 | 3.3 | clear, slight sulfur odor | |
| H3L | H3L1101 | 11/13/01 | 10:15 | 61.20 | 138 | 51.0 | 255 | | 7.16 | 1744 | 11 | clear | clear, odorless | |
| J1U | J1U1101 | 11/08/01 | 9:05 | 25.60 | 45.4 | 18.5 | 65.5 | | 7.35 | 1250 | 12.5 | 9.4 | clear, odorless | |
| J2M | J2M1101 | 11/12/01 | 10:20 | 57.49 | 101 | 28.0 | 152 | | 7.22 | 990 | 11.1 | clear | clear, sewer odor | |
| J3L | J3L1101 | 11/14/01 | 12:20 | 57.67 | 120.5 | 46.0 | 230 | | 6.65 | 14210 | 11.5 | clear | clear, slight sulfur odor | |
| J1U | L1U1101 | 37203 | 9:33 | 25.6 | 45.4 | 18.5 | 65.5 | | 7.35 | 1250 | 12.5 | 9.4 | clear, odorless | Dup of J1U |
| C1U | L3U1101 | 37204 | 8:15 | 37.24 | 55.5 | 16 | 80 | | 7.38 | 950 | 11.2 | clear | clear, odorless | Dup of C1U |

Notes:

| | |
|---|---|
| (1) | All wells are 4"ϕ, except D3U and E3U (former purge wells PW-2U and PW-5U) which are 12"ϕ. |
| Cond | Specific Conductivity. |
| Dup | Duplicate Sample. |
| ft. BTOC | Feet Below Top of Casing. |
| MS/MSD | Matrix Spike / Matrix Spike Duplicate. |
| NTU | Normal Turbidity Units. |
| s.u. | Standard pH Units. |
| Temp | Temperature. |

**TABLE 2.6**
**ANALYTICAL RESULTS SUMMARY**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Sample Location:*** | | ***A2U*** | ***B1L*** | ***B1M*** | ***B1U*** | ***C1L*** | ***C1M*** | ***C1U*** | ***C1U*** | ***CD3U*** | ***D1L*** | ***D1U*** | ***D2M*** | ***D3U*** |
| ***Sample ID:*** | | ***A2U1101*** | ***B1L1101*** | ***B1M1101*** | ***B1U1101*** | ***C1L1101*** | ***C1M1101*** | ***C1U1101*** | ***L3U1101*** | ***CD3U1101*** | ***D1L1101*** | ***D1U1101*** | ***D2M1101*** | ***D3U1101*** |
| ***Sample Date:*** | | ***11/14/01*** | ***11/15/01*** | ***11/15/01*** | ***11/12/01*** | ***11/09/01*** | ***11/09/01*** | ***11/09/01*** | ***11/09/01*** | ***11/15/01*** | ***11/12/01*** | ***11/12/01*** | ***11/14/01*** | ***11/08/01*** |
| | | | | | | | | | ***Duplicate*** | | | | | |
| ***Parameter*** | ***Unit*** | | | | | | | | | | | | | |
| ***Acids*** | | | | | | | | | | | | | | |
| 2-Chlorobenzoic acid | mg/L | 3.13 | 0.260 U | 1.01 | 0.260 U | 0.0260 U | 0.0260 U | 0.333 | 0.330 | 1.27 | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U |
| 3-Chlorobenzoic acid | mg/L | 3.35 | 0.320 U | 0.320 U | 0.320 U | 0.0320 U | 0.0320 U | 0.534 | 0.518 | 0.320 U | 0.0320 U | 0.0320 U | 0.0320 U | 0.0320 U |
| 4-Chlorobenzoic acid | mg/L | 4.38 | 0.102 U | 0.100 U | 0.173 | 0.01 U | 0.0104 U | 0.739 | 0.711 | 0.100 U | 0.0105 U | 0.01 U | 0.01 U | 0.01 U |
| Benzoic acid | mg/L | 0.260 U | 0.260 U | 0.260 U | 0.260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U |
| Chlorendic acid | mg/L | 8.17 | 0.520 U | 0.520 U | 12.4 J | 0.0520 U | 0.0520 U | 2.13 | 1.91 | 6.02 | 0.0520 U | 0.0520 U | 0.473 | 0.998 |
| ***General Chemistry*** | | | | | | | | | | | | | | |
| Total Organic Halides (TOX) | ug/L | 8880 J | 1250 J | 1520 | 16700 | 1120 | 835 J | 2610 | 2420 | 6830 | 1090 | 611 | 527 J | 1030 J |
| Phenolics (Total) | mg/L | 0.0158 J | 0.0444 J | 0.0467 J | 0.0245 J | 0.0184 J | 0.0443 J | 0.0497 J | 0.0198 J | 0.469 J | 0.892 J | 0.0126 J | 0.0156 J | 0.0200 J |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Sample Location:*** | | ***E1U*** | ***E3M*** | ***E3U*** | ***F1M*** | ***F4U*** | ***G1L*** | ***G1M*** | ***G4U*** | ***H1U*** | ***H2M*** | ***H3L*** | ***J1U*** | ***J1U*** |
| ***Sample ID:*** | | ***E1U1101*** | ***E3M1101*** | ***E3U1101*** | ***F1M1101*** | ***F4U1101*** | ***G1L1101*** | ***G1M1101*** | ***G4U1101*** | ***H1U1101*** | ***H2M1101*** | ***H3L1101*** | J1U1101 | L1U1101 |
| ***Sample Date:*** | | ***11/09/01*** | ***11/09/01*** | ***11/14/01*** | ***11/12/01*** | ***11/14/01*** | ***11/13/01*** | ***11/13/01*** | ***11/13/01*** | ***11/13/01*** | ***11/13/01*** | ***11/13/01*** | ***11/08/01*** | ***11/08/01*** |
| | | | | | | | | | | | | | | ***Duplicate*** |
| ***Parameter*** | ***Unit*** | | | | | | | | | | | | | |
| ***Acids*** | | | | | | | | | | | | | | |
| 2-Chlorobenzoic acid | mg/L | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.206 J | 0.0260 U | 0.0260 U | 0.0260 U |
| 3-Chlorobenzoic acid | mg/L | 0.0320 U | 0.0320 U | 0.0320 U | 0.0320 U | 0.0320 U | 0.0320 U | 0.0320 U | 0.0320 U | 0.0823 J | 0.101 J | 0.0320 U | 0.0320 U | 0.0320 U |
| 4-Chlorobenzoic acid | mg/L | 0.01 U | 0.01 U | 0.01 U | 0.01 U | 0.0696 U | 0.0571 U | 0.0131 U | 0.01 U | 0.156 | 0.247 | 0.0404 U | 0.01 U | 0.01 U |
| Benzoic acid | mg/L | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U | 0.0260 U |
| Chlorendic acid | mg/L | 0.207 | 0.0520 U | 0.140 | 0.0520 U | 0.0520 U | 0.0520 U | 0.0520 U | 0.0520 U | 0.980 J | 0.0520 U | 0.0520 U | 0.0520 U | 0.0520 U |
| ***General Chemistry*** | | | | | | | | | | | | | | |
| Total Organic Halides (TOX) | ug/L | 356 | 160 | 207 | 456 | 210 | 700 | 33.3 J | 67.3 | 747 J | 210 | 546 | 30.0 U | 30.0 U |
| Phenolics (Total) | mg/L | 1.33 J | 0.0203 J | 1.29 J | 0.0106 J | 0.00926 J | 0.198 J | 0.0119 J | 0.00724 J | 0.792 J | 0.0204 J | 0.0373 J | 0.00708 J | 0.00714 J |

**TABLE 2.6**
**ANALYTICAL RESULTS SUMMARY**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | | | |
|---|---|---|---|
| ***Sample Location:*** | | ***J2M*** | ***J3L*** |
| ***Sample ID:*** | | ***J2M1101*** | ***J3L1101*** |
| ***Sample Date:*** | | ***11/12/01*** | ***11/14/01*** |
| ***Parameter*** | ***Unit*** | | |
| ***Acids*** | | | |
| 2-Chlorobenzoic acid | mg/L | 0.260 U | 1.68 |
| 3-Chlorobenzoic acid | mg/L | 9.44 J | 1.69 |
| 4-Chlorobenzoic acid | mg/L | 13.0 | 4.83 |
| Benzoic acid | mg/L | 11.3 J | 1.02 |
| Chlorendic acid | mg/L | 10.2 J | 0.520 U |
| ***General Chemistry*** | | | |
| Total Organic Halides (TOX) | ug/L | 12100 | 1800 J |
| Phenolics (Total) | mg/L | 16.4 J | 0.585 J |

Notes:
NDx - Non-detect at or above x.
J-Estimated.

**TABLE 3.1**

**HYDRAULIC GRADIENT SUMMARY**
**APL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | *10/03/01* | | | *10/10/01* | | | *10/17/01* | | | *10/19/01* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Well Pair*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** |
| **ABP-2-ABP-1** | 541.88 | 538.68 | 3.20 | 549.00 | 540.18 | 8.82 | 549.00 | 539.78 | 9.22 | 549.43 | 540.24 | 9.19 |
| **ABP-4-ABP-3** | 557.79 | 565.83 | -8.04 | 557.91 | 565.91 | -8.00 | 554.01 | 566.21 | -12.20 | 556.06 | 566.49 | -10.43 |
| **ABP-6-ABP-5** | 564.76 | 563.34 | 1.42 | 564.81 | 562.84 | 1.97 | 566.61 | 563.24 | 3.37 | 565.21 | 563.41 | 1.80 |
| **ABP-8-ABP-7** | 521.43 | 534.71 | -13.28 | 521.83 | 534.81 | -12.98 | 521.83 | 536.41 | -14.58 | 521.87 | 535.54 | -13.67 |

| | *10/24/01* | | | *10/31/01* | | | *11/06/01* | | | *11/14/01* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Well Pair*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** |
| **ABP-2-ABP-1** | 549.10 | 540.28 | 8.82 | 549.10 | 541.28 | 7.82 | 548.54 | 540.07 | 8.47 | 546.80 | 540.68 | 6.12 |
| **ABP-4-ABP-3** | 555.81 | 566.51 | -10.70 | 557.81 | 566.61 | -8.80 | 552.43 | 566.25 | -13.82 | 550.31 | 566.31 | -16.00 |
| **ABP-6-ABP-5** | 564.91 | 564.44 | 0.47 | 564.81 | 564.04 | 0.77 | 565.01 | 563.91 | 1.10 | 565.11 | 563.24 | 1.87 |
| **ABP-8-ABP-7** | 521.93 | 534.61 | -12.68 | 521.83 | 534.51 | -12.68 | 521.82 | 533.45 | -11.63 | 521.83 | 533.41 | -11.58 |

| | *11/20/01* | | | *11/28/01* | | | *12/05/01* | | | *12/12/01* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Well Pair*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** |
| **ABP-2-ABP-1** | 548.60 | 539.78 | 8.82 | 549.60 | 539.88 | 9.72 | 549.84 | 540.47 | 9.37 | 549.10 | 539.88 | 9.22 |
| **ABP-4-ABP-3** | 550.51 | 566.21 | -15.70 | 552.51 | 566.01 | -13.50 | 551.20 | 566.75 | -15.55 | 551.41 | 566.51 | -15.10 |
| **ABP-6-ABP-5** | 565.51 | 563.14 | 2.37 | 566.31 | 563.44 | 2.87 | 565.73 | 563.98 | 1.75 | 565.81 | 564.34 | 1.47 |
| **ABP-8-ABP-7** | 521.83 | 535.11 | -13.28 | 521.83 | 535.61 | -13.78 | 521.93 | 535.04 | -13.11 | 521.83 | 533.81 | -11.98 |

**TABLE 3.1**

**HYDRAULIC GRADIENT SUMMARY**
**APL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | *12/19/01* | | | *12/26/01* | | |
|---|---|---|---|---|---|---|
| ***Well Pair*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** | ***Inner Elevation (feet AMSL)*** | ***Outer Elevation (feet AMSL)*** | ***Hydraulic Gradient(1)*** |
| **ABP-2-ABP-1** | 551.90 | 540.38 | 11.52 | 552.10 | 540.08 | 12.02 |
| **ABP-4-ABP-3** | 551.41 | 567.21 | -15.80 | 551.61 | 567.51 | -15.90 |
| **ABP-6-ABP-5** | 566.91 | 564.44 | 2.47 | 567.11 | 564.44 | 2.67 |
| **ABP-8-ABP-7** | 522.03 | 536.11 | -14.08 | 521.83 | 535.91 | -14.08 |

Note:
(1) - Negative number indicates an inward gradient measured in feet.
N / A - Not available.
AMSL - Above Mean Sea Level.

**TABLE 3.2**

**WELL PURGING AND SAMPLING SUMARY**
**NAPL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well I.D.* | *Sample I.D.* | *Sample Date* | *Sample Tme* | *Initial Water Level (ft. BTOC)* | *Depth of Well (ft. BTOC)* | *Standing Well Volume (Gallons)* | *Purge Volume (Gallons)* | *Purge Method* | *Sample Parameters* | | | | *Final Water Quality* | *Comments* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | *pH (s.u.)* | *Cond (uS/cm)* | *Temp (°C)* | *Turbidity (NTU)* | | |
| AFW-1U | AFW-1U801 | 08/09/01 | 7:50 | 22.10 | | 6.1 | 10 | | 7.52 | 123.4 | 14 | 16.1 | clear, odorless | |
| AFW-1M | AFW-1M801 | 08/09/01 | 7:30 | 54.20 | | 4.0 | 7 | | 7.21 | 164.2 | 14.2 | 51 | clear, odorless | |
| AFW-2U | AFW-2U801 | 08/09/01 | 10:35 | 17.91 | | 27.0 | 83 | | 7.25 | 72.4 | 15.4 | 26.8 | clear, odorless | |
| AFW-3U | AFW-3U801 | 08/09/01 | 8:55 | 23.50 | | 18.0 | 90 | | 7.29 | 142 | 14 | 115 | clear, odorless | |
| AFW-3L | AFW-3L801 | 08/09/01 | 9:45 | 99.60 | | 3.6 | 18 | | 7.08 | 1380 | 14.7 | 236 | cloudy, slight odor | |
| APW-1 | APW1801 | 08/09/01 | 12:56 | | | | | | 7.33 | 1320 | 15.4 | 13.3 | clear, odorless | |
| APW-2 | APW2801 | 08/09/01 | 11:00 | | | | | | 7.09 | 125 | 16.3 | 16.2 | clear, odorless | |
| AFW-1U | AFW-4U801 | 08/09/01 | 8:15 | 22.10 | | 6.1 | 10 | | 7.52 | 123.4 | 14 | 16.1 | clear, odorless | |
| AFW-1M | AFW-4M801 | 08/09/01 | 7:00 | 54.20 | | 4.0 | 7 | | 7.21 | 164.2 | 14.2 | 51 | clear, odorless | |
| AFW-2U | AFW-5U801 | 08/09/01 | 9:30 | 17.91 | | 27.0 | 83 | | 7.25 | 72.4 | 15.4 | 26.8 | clear, odorless | |
| AFW-3U | AFW-6U801 | 08/09/01 | 12:15 | 23.50 | | 18.0 | 90 | | 7.29 | 142 | 14 | 115 | clear, odorless | |
| AFW-3L | AFW-6L801 | 08/09/01 | 11:00 | 99.60 | | 3.6 | 18 | | 7.08 | 1380 | 14.7 | 236 | cloudy, slight odor | |
| APW-1 | APW3801 | 08/09/01 | 14:50 | | | | | | 7.33 | 1320 | 15.4 | 13.3 | clear, odorless | |
| APW-2 | APW4801 | 08/09/01 | 14:00 | | | | | | 7.09 | 125 | 16.3 | 16.2 | clear, odorless | |
| AFW-1U | AFW-1U801 | 08/10/01 | 11:00 | 22.10 | | 6.1 | 10 | | 7.52 | 123.4 | 14 | 16.1 | clear, odorless | |
| AFW-1M | AFW-1M801 | 08/10/01 | 11:30 | 54.20 | | 4.0 | 7 | | 7.21 | 164.2 | 14.2 | 51 | clear, odorless | |

Notes:

| | |
|---|---|
| (1) | All wells are 4"ϕ, except D3U and E3U (former purge wells PW-2U and PW-5U) which are 12"ϕ. |
| Cond | Specific Conductivity. |
| Cont | Contribution. |
| Dup | Duplicate Sample. |
| ft. BTOC | Feet Below Top of Casing. |
| MS/MSD | Matrix Spike / Matrix Spike Duplicate. |
| NTU | Normal Turbidity Units. |
| s.u. | Standard pH Units. |
| Temp | Temperature. |

**TABLE 3.3**

**COMPOSITE SAMPLE VOLUME DETERMINATION**
**APL PLUME CONTAINMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well Identification* | *Cross-Sectional Flow Area* Width (Ft.) | Depth (Ft.) | Total (Ft.2) | *Percent of Total* | *Approximate Volume Required (L)* |
|---|---|---|---|---|---|
| APW-1 | 640 | 64 | 40,960 | 13.9 | 1.25 |
| APW-2 | 830 | 34 | 28,220 | 9.2 | 0.83 |
| AFW-1U | 1,470 | 22 | 32,340 | 11.1 | 1.00 |
| AFW-1M | 1,470 | 26 | 38,220 | 13.0 | 1.17 |
| AFW-2U | 1,550 | 45 | 69,750 | 24.1 | 2.17 |
| AFW-3U | 1,460 | 35 | 51,100 | 17.6 | 1.58 |
| AFW-3L | 1,460 | 22 | 32,120 | 11.1 | 1.00 |
| | | ***Totals*** | 292,710 | 100 | 9.0 |

**TABLE 3.4**

**ANALYTICAL RESULTS SUMMARY**
**APL PLUME CONTAINMENT SYSTEM - AFW/APW COMPOSITE**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | | | |
|---|---|---|---|
| | | ***Sample Location:*** | ***#1COMP*** |
| | | ***Sample ID:*** | ***#1COMP1101*** |
| | | ***Sample Date:*** | ***11/08/01*** |
| ***APL Plume Monitoring Parameter Units*** | ***Unit*** | ***Monitoring Level*** | |
| Phenolics (Total) | mg/L | 50 | 0.0141 |
| 2,4,5-Trichlorophenol | ug/L | 10 | 10.0 U |
| 2-Chlorophenol | ug/L | 10 | 10.0 U |
| Benzene | ug/L | 10 | 5.00 U |
| alpha-BHC | ug/L | | 10.0 U |
| beta-BHC | ug/L | | 10.0 U |
| delta-BHC | ug/L | | 10.0 U |
| gamma-BHC (Lindane) | ug/L | | 10.0 U |
| ***APL Flux Parameters*** | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | pg/l | 500 | 456 |
| Pentachlorobiphenyl | ppb | | 0.01 U |
| Tetrachlorobiphenyl | ppb | | 0.006 U |
| Trichlorobiphenyl | ppb | | 0.003 U |

Notes:
NDx - Not detected at or above x
* - Analyzed for alpha-, beta-, gamma-, and delta-Hexachlorocyclohexanes.
** - Analyzed for tri-, tetra-, and penta-chlorobiphenyls and reported as Aroclor 1248.

**TABLE 4.1**

**HYDRAULIC GRADIENT SUMMARY**
**OVERBURDEN BARRIER COLLECTION SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well Pair* | *10/03/01* | | | *10/10/01* | | | *10/17/01* | | | *10/24/01* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* |
| OMW-1-OMW-2 | Dry | Dry | N / A | 599.87 | 603.39 | -3.52 | 597.97 | 604.29 | -6.32 | 598.57 | 603.49 | -4.92 |
| OMW-3-OMW-4R | Dry | 588.63 | N / A | Dry | 588.13 | N / A | Dry | 588.03 | N / A | Dry | 588.03 | N / A |
| OMW-5R-OMW-6 | Dry | 586.57 | N / A | 580.95 | 587.17 | -6.22 | 582.15 | 586.97 | -4.82 | 582.35 | 585.87 | -3.52 |
| OMW-8R2-OMW-7 | 582.89 | 583.36 | -0.47 | 587.01 | 584.59 | 2.42 | 587.01 | 585.49 | 1.52 | 586.51 | 584.69 | 1.82 |
| OMW-10R-OMW-9 | 586.62 | 587.17 | -0.55 | 586.79 | 587.67 | -0.88 | 586.79 | 587.87 | -1.08 | 586.79 | 587.67 | -0.88 |
| OMW-11R-OMW-12R | 588.47 | 589.50 | -1.03 | 589.27 | 590.05 | -0.78 | 589.87 | 590.65 | -0.78 | 590.17 | 590.55 | -0.38 |
| OMW-13R-OMW-14R | 589.94 | 591.22 | -1.28 | 591.24 | 591.92 | -0.68 | 591.64 | 591.92 | -0.28 | 592.14 | 592.12 | 0.02 |
| OMW-15-OMW-16R | Dry | 604.13 | N / A | 600.04 | 603.93 | -3.89 | 600.44 | 604.33 | -3.89 | 600.64 | 604.13 | -3.49 |

| *Well Pair* | *10/31/01* | | | *11/06/01* | | | *11/14/01* | | | *11/20/01* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* |
| OMW-1-OMW-2 | 599.27 | 603.19 | -3.92 | 598.55 | 602.20 | -3.65 | 597.97 | 601.09 | -3.12 | 597.77 | 602.89 | -5.12 |
| OMW-3-OMW-4R | Dry | 587.93 | N / A | Dry | 588.03 | N / A | Dry | 588.03 | N / A | Dry | 588.13 | N / A |
| OMW-5R-OMW-6 | 582.35 | 585.77 | -3.42 | 582.02 | 585.67 | -3.65 | 581.95 | 585.67 | -3.72 | 581.95 | 585.97 | -4.02 |
| OMW-8R2-OMW-7 | 586.81 | 584.79 | 2.02 | 586.35 | 584.79 | 1.56 | 589.01 | 584.79 | 4.22 | 587.41 | 584.99 | 2.42 |
| OMW-10R-OMW-9 | 586.89 | 587.67 | -0.78 | 586.77 | 587.42 | -0.65 | 586.79 | 587.37 | -0.58 | 586.79 | 587.37 | -0.58 |
| OMW-11R-OMW-12R | 590.37 | 590.35 | 0.02 | 590.42 | 589.88 | 0.54 | 590.37 | 589.75 | 0.62 | 590.37 | 589.75 | 0.62 |
| OMW-13R-OMW-14R | 592.04 | 592.02 | 0.02 | 591.78 | 591.87 | -0.09 | 591.74 | 591.62 | 0.12 | 591.64 | 591.52 | 0.12 |
| OMW-15-OMW-16R | 600.94 | 603.93 | -2.99 | 600.97 | 603.61 | -2.64 | 600.74 | 603.83 | -3.09 | 600.74 | 604.13 | -3.39 |

| *Well Pair* | *11/28/01* | | | *12/05/01* | | | *12/12/01* | | | *12/19/01* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* |
| OMW-1-OMW-2 | 601.07 | 604.19 | -3.12 | 601.30 | 604.24 | -2.94 | 600.07 | 603.69 | -3.62 | 602.17 | 604.49 | -2.32 |
| OMW-3-OMW-4R | Dry | 588.03 | N / A | Dry | 588.29 | N / A | Dry | 589.33 | N / A | Dry | 589.53 | N / A |
| OMW-5R-OMW-6 | 582.45 | 587.27 | -4.82 | 582.70 | 585.92 | -3.22 | 582.25 | 585.67 | -3.42 | 583.35 | 586.27 | -2.92 |
| OMW-8R2-OMW-7 | 586.11 | 584.99 | 1.12 | 587.15 | 584.90 | 2.25 | 586.81 | 584.89 | 1.92 | 587.41 | 585.19 | 2.22 |
| OMW-10R-OMW-9 | 586.79 | 587.47 | -0.68 | 585.87 | 587.82 | -1.95 | 586.69 | 587.37 | -0.68 | 586.89 | 588.27 | -1.38 |
| OMW-11R-OMW-12R | 590.47 | 589.95 | 0.52 | 591.07 | 590.54 | 0.53 | 590.77 | 590.15 | 0.62 | 591.47 | 590.75 | 0.72 |
| OMW-13R-OMW-14R | 591.64 | 591.52 | 0.12 | 592.44 | 591.82 | 0.62 | 592.24 | 591.52 | 0.72 | 593.04 | 591.72 | 1.32 |
| OMW-15-OMW-16R | 600.94 | 604.13 | -3.19 | 601.44 | 604.03 | -2.59 | 601.64 | 603.93 | -2.29 | 602.14 | 604.13 | -1.99 |

**TABLE 4.1**

**HYDRAULIC GRADIENT SUMMARY**
**OVERBURDEN BARRIER COLLECTION SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well Pair* | *12/26/01* | | |
|---|---|---|---|
| | *Inner Elevation (feet AMSL)* | *Outer Elevation (feet AMSL)* | *Hydraulic Gradients(1)* |
| OMW-1-OMW-2 | 600.97 | 604.39 | -3.42 |
| OMW-3-OMW-4R | Dry | 589.33 | N / A |
| OMW-5R-OMW-6 | 582.45 | 585.77 | -3.32 |
| OMW-8R2-OMW-7 | 587.11 | 584.89 | 2.22 |
| OMW-10R-OMW-9 | 586.69 | 587.67 | -0.98 |
| OMW-11R-OMW-12R | 591.27 | 590.05 | 1.22 |
| OMW-13R-OMW-14R | 592.14 | 591.52 | 0.62 |
| OMW-15-OMW-16R | 601.64 | 603.93 | -2.29 |

| *Well Pair* | *October 2001* | | | *November 2001* | | | *December 2001* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Sh. Bedrock Elevation (feet AMSL)* | *Overburden Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Sh. Bedrock Elevation (feet AMSL)* | *Overburden Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Sh. Bedrock Elevation (feet AMSL)* | *Overburden Elevation (feet AMSL)* | *Hydraulic Gradients(1)* |
| B1U-OMW-6 | 566.50 | 585.99 | -19.49 | 566.50 | 585.99 | -19.49 | 566.50 | 585.99 | -19.49 |
| B1U-OMW-8R2 | 566.50 | 587.02 | -20.52 | 566.50 | 587.02 | -20.52 | 566.50 | 587.02 | -20.52 |
| B1U-OMW-9 | 566.50 | 587.76 | -21.26 | 566.50 | 587.76 | -21.26 | 566.50 | 587.76 | -21.26 |
| D1U-OMW-11R | 577.59 | 589.92 | -12.33 | 577.59 | 589.92 | -12.33 | 577.59 | 589.92 | -12.33 |
| E4U-OMW-14R | 588.43 | 591.87 | -3.44 | 588.43 | 591.87 | -3.44 | 588.43 | 591.87 | -3.44 |

Notes:
(1) - Negative number indicates an inward / downward gradient measured in feet.
N / A - not applicable.
AMSL - Above Mean Sea Level.

**TABLE 4.2**

**OVERBURDEN BARRIER COLLECTION SYSTEM**
**NAPL PRESENCE MONITORING**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well I.D.* | *1st Quarter 1998* | *2nd Quarter 1998* | *3rd Quarter 1998* | *4th Quarter 1998* | *1st Quarter 1999* | *2nd Quarter 1999* | *3rd Quarter 1999* | *4th Quarter 1999* | *1st Quarter 2000* | *2nd Quarter 2000* | *3rd Quarter 2000* | *4th Quarter 2000* | *1st Quarter 2001* | *2nd Quarter 2001* | *3rd Quarter 2001* | *4th Quarter 2001* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OMW1 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW2 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW3 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW4 | NO | NO | NO | NO | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW4R | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW5 | NO | NO | NO | NO | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW5R | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW6 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW7 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW8 | NO | NO | NO | NO | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW8R | - | - | - | - | - | NO | - | - | - | - | - | - | - | - | - | - |
| OMW8R2 | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW9 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW10 | NO | NO | NO | NO | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW10R | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW11 | NO | NO | NO | NO * | NO | NO | NO | NO | - | - | - | - | - | - | - | - |
| OMW11R | - | - | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW12 | NO | NO | NO | NO * | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW12R | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW13 | NO | NO | NO | NO * | NO | NO | - | - | - | - | - | - | - | - | - | - |
| OMW13R | - | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW14 | NO | NO | NO | NO * | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW14R | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW15 | NO | NO | NO | NO * | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| OMW16 | NO | NO | NO | NO * | NO | - | - | - | - | - | - | - | - | - | - | - |
| OMW16R | - | - | - | - | - | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

Notes:
- * NAPL checks performed on 12/10/98 due to work stoppage at TAM Ceramics (wells located on TAM's property).
- \- Not available.
- NO Not Observed.

**TABLE 4.3**

**HYDRAULIC GRADIENT SUMMARY**
**COMMUNITY MONITORING PROGRAM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Well Pair* | *October 2001* | | | *November 2001* | | | *December 2001* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Overburden Elevation (feet AMSL)* | *Bedrock Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Overburden Elevation (feet AMSL)* | *Bedrock Elevation (feet AMSL)* | *Hydraulic Gradients(1)* | *Overburden Elevation (feet AMSL)* | *Bedrock Elevation (feet AMSL)* | *Hydraulic Gradients(1)* |
| CMW-1OB-CMW-1SH | 564.16 | 570.23 | -6.07 | 563.53 | 570.43 | -6.90 | 563.98 | 570.76 | -6.78 |
| CMW-2OB-CMW-2SH | 566.03 | 571.70 | -5.67 | 566.05 | 572.85 | -6.80 | 566.66 | 588.72 | -22.06 |
| CMW-3OB-CMW-3SH | 552.25 | 569.14 | -16.89 | 552.97 | 568.89 | -15.92 | 552.28 | 568.36 | -16.08 |
| CMW-4OB-CMW-4SH | 565.52 | 574.10 | -8.58 | 565.29 | 574.24 | -8.95 | 566.07 | 573.81 | -7.74 |
| CMW-5OB-CMW-5SH | 573.57 | 578.31 | -4.74 | 575.61 | 577.81 | -2.20 | 577.01 | 579.33 | -2.32 |
| CMW-6OB-CMW-6SH | 562.10 | 570.30 | -8.20 | 562.02 | 569.90 | -7.88 | 562.30 | 570.59 | -8.29 |
| CMW-7OB-CMW-7SH | 598.45 | N / A | N / A | 598.53 | N / A | N / A | 599.58 | N / A | N / A |
| CMW-8OB-CMW-8SH | 607.40 | N / A | N / A | 607.69 | N / A | N / A | 608.29 | N / A | N / A |
| CMW-9OB-CMW-9SH | 560.37 | 570.48 | -10.11 | 560.24 | 570.87 | -10.63 | 560.37 | 570.41 | -10.04 |
| CMW-11OB-CMW-11SH | 561.36 | 573.45 | -12.09 | 561.72 | 573.45 | -11.73 | 565.76 | 570.21 | -4.45 |

Notes:
(1) - Negative number indicates an inward / downward gradient measured in feet.
N / A - not applicable.
AMSL - Above Mean Sea Level.

**TABLE 4.4**
**QUARTERLY SOIL AIR MONITORING ANALYTICAL RESULTS**
**COMMUNITY MONITORING PROGRAM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | | | |
|---|---|---|---|
| | ***Sample Location:*** | ***CMW-7*** | ***CMW-8*** |
| | ***Sample ID:*** | ***CMW71101*** | ***CMW81101*** |
| | ***Sample Date:*** | ***11/15/01*** | ***11/15/01*** |
| ***Parameter*** | ***Unit*** | | |
| 2-Chlorotoluene | mg/m3 | 0.26 UJ | 0.20 UJ |
| Chlorobenzene | mg/m3 | 0.26 U | 0.20 U |
| m-Monochlorobenzotrifluoride | mg/m3 | 0.26 UJ | 0.20 UJ |
| o-Monochlorobenzotrifluoride | mg/m3 | 0.26 U | 0.20 U |
| p-Monochlorobenzotrifluoride | mg/m3 | 0.26 U | 0.20 U |

Notes:
NDx-Non-detect at associated value.
mg/m3 - Milligrams per Cubic Meter.

**TABLE 4.5**
**CMW-2OB ANALYTICAL RESULTS**
**COMMUNITY MONITORING PROGRAM**
**HYDE PARK RRT PROGRAM**
**FOURTH QUARTER 2001 REPORT**

| | ***Sample Location:*** | | ***CMW-20B*** |
|---|---|---|---|
| | ***Sample ID:*** | ***Treatment*** | ***CMW20B801*** |
| | ***Sample Date:*** | ***Level*** | ***08/16/01*** |
| ***Parameter*** | ***Unit*** | | |
| Monochlorobenzoic acids | ug/L | 100 | 30.0 U |
| Monochlorotoluenes | ug/L | 10 | 3.0 U |
| Benzoic acid | ug/L | 100 | 100 U |
| Chlorendic acid | ug/L | 250 | 250 U |
| Monochlorobenzene | ug/L | 10 | 10.0 U |
| Monochlorobenzotriflourides | ug/L | 10 | 3.0 U |
| Total Organic Halides (TOX) | ug/L | 500 | 35.0 |

Notes:
ND -Non-detect at associated value.
mg/L - Milligrams per Liter.
ug/L - Micrograms per Liter.

**TABLE 5.1**
**LEACHATE TREATMENT SYSTEM DAILY EFFLUENT MONITORING DATA**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| Date | Operating Hours | TOC* - mg/L | | | | PHENOL** - mg/L | | | | Effluent | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C.B. Feed | 1st Instg. | 2nd Instg. | Effluent | C.B. Feed | 1st Instg. | 2nd Instg. | Effluent | pH | Gallons | Comments |
| 10/01/01 | | - | - | - | 1.5 | - | 0.0929 J | 0.0998 J | 0.111 J | 7.67 | 194000 | |
| 10/02/01 | | - | - | - | 1.6 | - | 0.103 J | 0.110 J | 0.0138 J | 7.82 | 169000 | |
| 10/03/01 | | - | - | - | 2.6 U | - | 0.0364 J | - | 0.0115 J | 7.29 | 89000 | |
| 10/04/01 | | - | - | - | 1.3 U | - | 0.126 J | - | 0.0166 J | 7.37 | 94000 | |
| 10/05/01 | | - | - | - | 1.2 U | - | 0.0262 J | - | 0.0457 J | 7.68 | 110000 | |
| 10/06/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/07/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/08/01 | | - | - | - | 4.0 | - | 0.165 J | 0.403 J | 0.483 J | 7.26 | 199000 | |
| 10/09/01 | | - | - | - | 2.0 U | - | 0.0350 J | - | 0.00934 J | 7.55 | 201000 | |
| 10/10/01 | | - | - | - | 1.6 U | - | 0.0606 J | - | 0.0141 J | 7.36 | 194000 | |
| 10/11/01 | | - | - | - | 1.1 | - | 0.0566 J | - | 0.0149 J | 7.61 | 198000 | |
| 10/12/01 | | - | - | - | 1.4 | - | 0.115 J | - | 0.111 J | 7.3 | 115000 | |
| 10/13/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/14/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/15/01 | | - | - | - | 1.4 | - | 0.151 J | 0.115 J | 0.107 J | 7.51 | 209000 | |
| 10/16/01 | | - | - | - | 1.7 | - | 0.0413 J | - | 0.00959 J | 6.89 | 172000 | |
| 10/17/01 | | - | - | - | 1.0 U | - | 0.0372 J | - | 0.0109 J | 7.54 | 172000 | |
| 10/18/01 | | - | - | - | 15 J | - | 0.0223 J | - | 0.00823 J | 7.99 | 180000 | |
| 10/19/01 | | - | - | - | 5.3 J | - | 0.0392 J | - | 0.0226 J | 7.91 | 118000 | |
| 10/20/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/21/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/22/01 | | - | - | - | 1.0 U | - | 0.0479 J | 0.0436 J | 0.0682 J | 7.78 | 207000 | |
| 10/23/01 | | - | - | - | 1.1 | - | 0.0582 J | - | 0.424 J | 7.63 | 199000 | |
| 10/24/01 | | - | - | - | 1.2 | - | 0.160 J | - | 0.344 J | 7.41 | 108000 | |
| 10/25/01 | | - | - | - | 1.5 | - | 0.0240 J | - | 0.385 J | 7.37 | 136000 | |
| 10/26/01 | | - | - | - | 1.4 | - | 0.0347 J | - | 0.242 J | 7.29 | 108000 | |
| 10/27/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/28/01 | | - | - | - | - | - | - | - | - | - | - | |
| 10/29/01 | | - | - | - | 1.7 | - | 0.0314 J | 0.0511 J | 0.0610 J | 7.67 | 208000 | |
| 10/30/01 | | - | - | - | 2.0 | - | 0.0218 J | - | 0.0144 J | 7.74 | 205000 | |
| 10/31/01 | | - | - | - | 1.0 U | - | 0.0390 J | - | 0.400 J | 7.83 | 140000 | |

**TABLE 5.1**
**LEACHATE TREATMENT SYSTEM DAILY EFFLUENT MONITORING DATA**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | *Operating* | *TOC* - mg/L* | | | | *PHENOL** - mg/L* | | | | *Effluent* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Date*** | ***Hours*** | ***C.B. Feed*** | ***1st Instg.*** | ***2nd Instg.*** | ***Effluent*** | ***C.B. Feed*** | ***1st Instg.*** | ***2nd Instg.*** | ***Effluent*** | ***pH*** | ***Gallons*** | ***Comments*** |
| 11/01/01 | | - | - | - | 1.2 | - | 0.0324 J | - | 0.351 J | 7.83 | 118000 | |
| 11/02/01 | | - | - | - | 2.8 | - | 0.0301 J | - | 0.317 J | 7.74 | 120000 | |
| 11/03/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/04/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/05/01 | | - | - | - | 2.2 | - | 0.0311 J | 0.0155 J | 0.0922 J | 7.9 | 239000 | |
| 11/06/01 | | - | - | - | 1.6 | - | 0.0455 J | 0.0137 J | 0.296 J | 7.86 | 202000 | |
| 11/07/01 | | - | - | - | 1.2 | - | 0.0240 J | - | 0.254 J | 7.77 | 84000 | |
| 11/08/01 | | - | - | - | 1.1 | - | 0.0230 J | - | 0.005 UJ | 7.87 | 72000 | |
| 11/09/01 | | - | - | - | 1.3 | - | 0.0191 J | - | 0.326 J | 7.93 | 127000 | |
| 11/10/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/11/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/12/01 | | - | - | - | 1.0 U | - | 0.204 J | 0.0298 J | 0.0173 J | 7.5 | 204000 | |
| 11/13/01 | | - | - | - | 2.3 | - | 0.0418 J | - | 0.318 J | 7.95 | 167000 | |
| 11/14/01 | | - | - | - | 1.0 U | - | 0.0177 J | - | 0.0515 J | 8.03 | 138000 | |
| 11/15/01 | | - | - | - | 1.1 | - | 0.410 J | - | 0.340 J | 7.13 | 76000 | |
| 11/16/01 | | - | - | - | 1.1 | - | 0.0664 J | - | 0.0255 J | 7.76 | 97000 | |
| 11/17/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/18/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/19/01 | | - | - | - | 1.1 | - | 0.0202 J | 0.0135 J | 0.00628 J | 7.74 | 208000 | |
| 11/20/01 | | - | - | - | 3.4 U | - | 0.0165 J | - | 0.0228 J | 7.26 | 192000 | |
| 11/21/01 | | - | - | - | 2.2 U | - | 0.0301 J | - | 0.0260 J | 7.56 | 78000 | |
| 11/22/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/23/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/24/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/25/01 | | - | - | - | - | - | - | - | - | - | - | |
| 11/26/01 | | - | - | - | 1.8 U | - | 0.0182 J | 0.0420 J | 0.0121 J | | 199000 | |
| 11/27/01 | | - | - | - | 4.8 | - | 0.0458 J | - | 0.00660 J | 7.41 | 204000 | |
| 11/28/01 | | - | - | - | 1.9 U | - | 0.125 J | - | 0.0120 J | 7.7 | 217000 | |
| 11/29/01 | | - | - | - | 1.8 U | - | 0.0250 J | - | 0.00720 J | 7.79 | 218000 | |
| 11/30/01 | | - | - | - | 2.0 U | - | 0.0337 J | - | 0.00800 J | - | 211000 | |

**TABLE 5.1**
**LEACHATE TREATMENT SYSTEM DAILY EFFLUENT MONITORING DATA**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| | *Operating* | *TOC* - mg/L* | | | | *PHENOL** - mg/L* | | | | *Effluent* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Date* | *Hours* | *C.B. Feed* | *1st Instg.* | *2nd Instg.* | *Effluent* | *C.B. Feed* | *1st Instg.* | *2nd Instg.* | *Effluent* | *pH* | *Gallons* | *Comments* |
| 12/01/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/02/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/03/01 | | - | - | - | 1.2 U | - | 0.0220 J | 0.0245 J | 0.153 J | 7.82 | 215000 | |
| 12/04/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/05/01 | | - | - | - | 3.1 U | - | 0.0241 J | 0.0267 J | 0.00760 J | 7.89 | 310000 | |
| 12/06/01 | | - | - | - | 1.0 U | - | 0.0153 J | - | 0.00570 J | 7.77 | 208000 | |
| 12/07/01 | | - | - | - | 2.5 U | - | 0.0175 J | - | 0.00586 J | 7.48 | 201000 | |
| 12/08/01 | | - | - | - | 1.2 U | - | 0.0319 J | - | 0.125 J | 7.5 | 107000 | |
| 12/09/01 | | - | - | - | 1.0 U | - | 0.0222 J | - | 0.115 J | 7.67 | 128000 | |
| 12/10/01 | | - | - | - | 1.0 U | - | 0.0664 J | 0.0288 J | 0.00565 J | 7.63 | 132000 | |
| 12/11/01 | | - | - | - | 2.0 UJ | - | 0.0216 J | - | 0.0675 J | 7.55 | 131000 | |
| 12/12/01 | | - | - | - | 1.4 UJ | - | 0.0221 J | - | 0.00770 J | 7.46 | 86000 | |
| 12/13/01 | | - | - | - | 1.8 UJ | - | 0.0185 J | - | 0.00830 J | 7.61 | 120000 | |
| 12/14/01 | | - | - | - | 1.6 UJ | - | 0.0185 J | - | 0.00910 J | 0 | 87000 | |
| 12/15/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/16/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/17/01 | | - | - | - | 1.0 U | - | 0.0144 J | 0.0106 J | 0.0101 J | 7.61 | 185000 | |
| 12/18/01 | | - | - | - | 1.3 | - | 0.0294 J | - | 0.00713 J | 7.6 | 201000 | |
| 12/19/01 | | - | - | - | 1.0 U | - | 0.0255 J | - | 0.00992 J | 7.51 | 383000 | |
| 12/20/01 | | - | - | - | 1.3 | - | 0.0656 J | - | 0.0729 J | 7.72 | 211000 | |
| 12/21/01 | | - | - | - | 1.0 U | - | 0.0750 J | - | 0.154 J | 7.69 | 181000 | |
| 12/22/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/23/01 | | - | - | - | 1.0 U | - | 0.0297 J | - | 0.0213 J | 7.48 | 145000 | |
| 12/24/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/25/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/26/01 | | - | - | - | 1.5 | - | 0.0414 J | 0.0249 J | 0.0163 J | 7.47 | 219000 | |
| 12/27/01 | | - | - | - | 1.0 U | - | 0.0318 J | - | 0.136 J | 7.45 | 380000 | |
| 12/28/01 | | - | - | - | 1.0 U | - | 0.0477 J | - | 0.114 J | 7.39 | 220000 | |
| 12/29/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/30/01 | | - | - | - | - | - | - | - | - | - | - | |
| 12/31/01 | | - | - | - | 1.0 U | - | 0.0202 J | 0.241 J | 0.0260 J | 7.32 | 210000 | |

Notes:
(1) TOC treatment level = 1000 mg/L.
(2) Phenol treatment level = 1 mg/L.
NA Not available.
TOC Total Organic Carbon.

**TABLE 5.2**
**ANALYTICAL RESULTS SUMARY**
**WEEKLY EFFLUENT COMPOSITE SAMPLES - LEACHATE TREATMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Parameter* | *Units* | *Treatment Level* | *10/05/01* | *10/12/01* | *10/19/01* | *10/26/01* | *10/31/01* | *11/02/01* | *11/09/01* | *11/16/01* |
|---|---|---|---|---|---|---|---|---|---|---|
| 2-Chlorotoluene | | 10 | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U |
| 3-Chlorotoluene | | 10 | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U |
| 4-Chlorotoluene | | 10 | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U |
| Chlorobenzene | | 10 | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U |
| m-Monochlorobenzotrifluoride | | 10 | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U |
| o-Monochlorobenzotrifluoride | | 10 | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U |
| p-Monochlorobenzotrifluoride | | 10 | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U | 3.00 U |
| Tetrachloroethene | | 10 | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U |
| Trichloroethene | | 10 | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U | 10.0 U |

| *Parameter* | *Units* | *Treatment Level* | *11/21/01* | *11/30/01* | *12/07/01* | *12/14/01* | *12/21/01* | *12/28/01* |
|---|---|---|---|---|---|---|---|---|
| 2-Chlorotoluene | | 10 | 30.0 U | 3.00 U | 3.00 U | 3.00 UJ | 3.00 U | 3.00 U |
| 3-Chlorotoluene | | 10 | 30.0 U | 3.00 U | 3.00 U | 3.00 UJ | 3.00 U | 3.00 U |
| 4-Chlorotoluene | | 10 | 30.0 U | 3.00 U | 3.00 U | 3.00 UJ | 3.00 U | 3.00 U |
| Chlorobenzene | | 10 | 100 U | 10.0 U | 10.0 U | 10.0 UJ | 10.0 U | 10.0 U |
| m-Monochlorobenzotrifluoride | | 10 | 30.0 U | 3.00 U | 3.00 U | 3.00 UJ | 3.00 U | 3.00 U |
| o-Monochlorobenzotrifluoride | | 10 | 30.0 U | 3.00 U | 3.00 U | 3.00 UJ | 3.00 U | 3.00 U |
| p-Monochlorobenzotrifluoride | | 10 | 30.0 U | 3.00 U | 3.00 U | 3.00 UJ | 3.00 U | 3.00 U |
| Tetrachloroethene | | 10 | 100 U | 10.0 U | 10.0 U | 10.0 UJ | 10.0 U | 10.0 U |
| Trichloroethene | | 10 | 100 U | 10.0 U | 10.0 U | 10.0 UJ | 10.0 U | 10.0 U |

Notes:
- Not available / not applicable.
J Associated value is estimated.
U Non-detect at associated value.

**TABLE 5.3**

**ANALYTICAL RESULTS SUMARY**
**MONTHLY EFFLUENT COMPOSITE SAMPLES - LEACHATE TREATMENT SYSTEM**
**FOURTH QUARTER - 2001**
**HYDE PARK RRT PROGRAM**

| *Parameter* | *Units* | *Treatment Level* | *October 2001* | *November 2001* | *December 2001* |
|---|---|---|---|---|---|
| 1,2,3,4-Tetrachlorobenzene | ug/L | 10 | - | - | - |
| 1,2,3-Trichlorobenzene | ug/L | 10 | 3.00 U | 3.00 U | 3.00 U |
| 1,2,4,5-Tetrachlorobenzene | ug/L | 10 | - | - | - |
| 1,2,4-Trichlorobenzene | ug/L | 10 | 3.00 U | 3.00 U | 3.00 U |
| 1,3,5-Trichlorobenzene | ug/L | 10 | 3.00 U | 3.00 U | 3.00 U |
| 2,4,5-Trichlorophenol | ug/L | 10 | - | - | - |
| Hexachlorobenzene | ug/L | 10 | - | - | - |
| Hexachlorobutadiene | ug/L | 10 | - | - | - |
| Hexachlorocyclopentadiene | ug/L | 10 | - | - | - |
| Octachlorocyclopentene | ug/L | | | | |
| ***Pesticides*** | | | | | |
| alpha-BHC | ug/L | 10 | - | - | - |
| beta-BHC | ug/L | 10 | - | - | - |
| delta-BHC | ug/L | 10 | - | - | - |
| gamma-BHC (Lindane) | ug/L | 10 | - | - | - |

Notes:
- \- Not available/not applicable.
- J Associated value is estimated.
- U Non-detect at associated value.

## TABLE 6.1

## MONTHLY NAPL ACCUMULATION
## HYDE PARK RRT PROGRAM

| | *NAPL Volume Per Decanter* | | | *Manually Recovered NAPL* | | *NAPL Removed* | | | | *Disposed Total Shipped* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Decanter* | | | *Total* | |
| | *1* | *2* | *3* | | | *1* | *2* | *3* | | |
| | | *(Gallons)* | | *(Gallons)* | | | *(Gallons)* | | | *(Gallons)* |
| Dec-00 | 2350 | 3508 | 3384 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Jan-01 | 2,444 | 3,760 | 3,384 | 30 | (1) | 0 | 0 | 0 | 0 | 0 |
| Feb-01 | 3,196 | 3,572 | 3,384 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Mar-01 | 3,384 | 3,760 | 3,384 | 0 | | 0 | 0 | 0 | 0 | 0 |
| 1st Quarter | 1,034 | 252 | 0 | 30 | | 0 | 0 | 0 | 0 | 0 |
| Apr-01 | 3,384 | 3,760 | 3,384 | 0 | | 0 | 0 | 0 | 0 | 0 |
| May-01 | 3,384 | 3,760 | 3,384 | 0 | | 504 | 504 | 504 | 1,512 | 1,512 |
| Jun-01 | 2,880 | 3,256 | 2,880 | 0 | | 0 | 0 | 0 | 0 | 0 |
| 2nd Quarter | 0 | 0 | 0 | 0 | | 504 | 504 | 504 | 1,512 | 1,512 |
| Jul-01 | 4,512 | 3,132 | 1,316 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Aug-01 | 3,760 | 3,132 | 1,316 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Sep-01 | 4,512 | 3,384 | 1,504 | 38 | (2) | 0 | 0 | 0 | 0 | 0 |
| 3rd Quarter | 1,632 | 128 | 0 | 38 | | 0 | 0 | 0 | 0 | 0 |
| Oct-01 | 2,162 | 3,290 | 1,252 | - | | - | - | - | - | - |
| Nov-01 | 0 | 1,628 | 1,252 | - | | 2,162 | 1,662 | - | 3,824 | - |
| Dec-01 | 0 | 1,628 | 1,252 | 1 | (3) | - | - | - | - | - |
| 4th Quarter | 0 | 0 | 0 | 1 | | 2,162 | 1,662 | 0 | 3,824 | 3,824 |
| | | | *Year to Date:* | 69 | | 2,666 | 2,166 | 504 | 5,336 | 5,336 |

Notes:
Manual Recoveries:
(1) January 25: CD1U 10.0 gals; and PMW-3U 20.0 gals.
(2) September 15: CD1U 8.0 gals; and PMW-3U 30.0 gals.
(3) December 06: CD1U 1.0 gals.

# APPENDIX A

# STATISTICAL TREND ANALYSIS OF GROUNDWATER MONITORING DATA, FOURTH QUARTER 2001 MONITORING

CONESTOGA-ROVERS & ASSOCIATES

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# MEMORANDUM

TO: Mike Mateyk; Jon Williams REF. NO.: 01069-20

FROM: Wesley Dyck; Naz Syed-Ritchie DATE: January 31, 2002

**RE: Statistical Trend Analysis of Groundwater Monitoring Data**
**Fourth Quarter 2001 Monitoring**
**Hyde Park Landfill**
**Niagara Falls, New York**

## 1.0 INTRODUCTION

Groundwater at the Hyde Park Landfill in Niagara Falls, New York (Site) is sampled quarterly and analyzed for indicator parameters including benzoic acid, chlorendic acid, phenolics, total chlorobenzoic acids, and total organic halides (TOX). As part of the evaluation of the quarterly monitoring data, a statistical analysis is performed to look for any evidence of increasing trends in indicator parameters at a given well over time.

This memorandum reports the findings of statistical evaluations of the Site groundwater monitoring data up to and including the fourth quarter 2001 samples.

## 2.0 STATISTICAL TREND ANALYSES

Helsel and Hirsch (1992) recommend a number of statistical trend analysis methods for application to environmental data sets. A typical pattern in groundwater constituent concentrations is a rapid decline in concentration immediately following a remedial action, which then slows and observed concentrations fluctuate up and down at a much lower level. This type of pattern has been observed at a number of Site monitoring wells, and may be observed in the concentration vs. time plots (Attachment A).

A recommended statistical procedure for trend assessment commonly applied to environmental monitoring data is the Mann-Kendall trend test. The Mann-Kendall test is a non-parametric (rank-based) method that evaluates a set of data for a monotonic (unidirectional) trend. The procedure makes no assumptions regarding the shape of the trend (e.g., linear, log-linear…), except that it is in a single direction (i.e., either consistently upward or downward). However, the Mann-Kendall procedure loses sensitivity if a large proportion of non-detected results is present.

For data sets with large proportions (> 50 percent) of censored data, logistic regression is recommended by Helsel and Hirsch. In this procedure, the numerical values of the monitoring data are not used, but instead the presence or absence of a detectable concentration of the analyte of interest is considered. Thus, the hypothesis tested as a measure of trend by logistic regression is that more detectable results are occurring later than earlier (increasing trend), or earlier than later (decreasing trend).

The Site groundwater monitoring data were assessed for trends on an individual well basis using either the Mann-Kendall trend test (if < 50 percent non-detects) or logistic regression (for 50-99 percent non-detects). Analytes that were not detected at a given well (i.e., 100 percent non-detects) during the time period of interest were not statistically evaluated.

## 3.0 SCOPE OF DATA

The approach most applicable to assessing current trends in groundwater quality at the Site is to apply a given test to analytical data representative of the current groundwater conditions at the Site. This is accomplished for the Site by treating calendar years as a unit (i.e. either keeping or removing the four quarters of monitoring data for a calendar year) and ensuring that a minimum of 8 data points and maximum of 11 data points are used for the statistical evaluation. In the case of the fourth quarter 2001 data analysis, the analytical data include eight sampling events from 2000 to present. As anticipated in a previous memo, since four quarters of monitoring were completed for 2001, the 1999 monitoring results were removed from the analysis. This data scope approach provides a moving two to three year comparison window.

For the concentration vs. time plots (Attachment A), all historical data are included (1993 to present).

## 4.0 RESULTS

The results of the trend analyses are presented in Table 1. Three statistically significant ($P<0.05$) increasing trends were identified. Of these increasing trends, one was observed for chlorendic acid at B1U and two were observed for total chlorobenzoic acid at J2M and J3L. Four statistically significant ($P<0.05$) decreasing trends were also identified. Of these decreasing trends, three were observed for TOX, at wells B1U, C1M, and F4U while the decreasing trend was observed for total phenolics at D2M.

Table 2 presents the comparison of the statistical trend analyses performed following the first, second, third, and fourth quarters of the year 2001. Only wells/analytes with a significant trend identified during at least one evaluation are presented.

In 20 cases, the trends changed from statistically significantly decreasing to not significant or vice versa between the four quarters. Five new statistically significant trends were identified for the fourth quarter evaluation. In three cases statistically significant decreasing trends were identified for the fourth quarter evaluation for TOX at B1U and C1M and total phenolics at D2M, which had not been identified as statistically significant trends in previous evaluations. Similarly for two cases, statistically significant increasing trends identified for chlorendic acid at B1U and total chlorobenzoic acid at J3L, had not been identified as statistically significant in previous evaluations.

In twelve cases, statistically significant decreasing trends observed in the first quarter evaluation were found to be not statistically significant during the fourth quarter evaluation. For two of these cases statistically significant decreasing trends, which were observed for TOX at CIL and H3L in the first three rounds of evaluation were not statistically significant during the fourth quarter evaluation. Similarly, for three cases, statistically significant decreasing trends observed for TOX at B1M and G1L and total phenolics at J2M in the first and second quarter evaluations were not significant during the third and fourth quarter evaluations. For seven cases, including benzoic acid at J2M; chlorendic acid at C1M; total chlorobenzoic acid at B1M, C1M, and C1L; and TOX at H2M and J2M, statistically significant decreasing trends were only identified for the first quarter evaluation but have not been observed to be statistically significant for subsequent evaluations.

For total phenolics at C1U, statistically significant decreasing trends identified during the second and third quarter evaluations were not statistically significant during the first or fourth quarter evaluations. For TOX at F1M, a statistically significant decreasing trend was only observed during the third quarter evaluation while statistically significant decreasing trends were identified for TOX at F4U for the third and fourth quarter evaluations. For total chlorobenzoic acid at J2M, a statistically significant decreasing trend was identified during the first quarter evaluation, while a statistically significant increasing trend was identified for the same well/analyte combination during the fourth quarter evaluation.

## 5.0 CONCLUSIONS

Statistical trend evaluations of Site groundwater monitoring data following the fourth quarter 2001 monitoring unit were carried out using either the Mann-Kendall trend test or logistic regression (depending on proportion of non-detect values present) to evaluate all data sets except those consisting entirely of non-detect results.

Three statistically significant increasing trends and four statistically significant decreasing trends were identified as noted in Section 4.0 and on Table 1.

## 6.0 REFERENCE

Helsel, D.R. & R.M. Hirsch, 1992. Statistical Methods in Water Resources. Amsterdam: Elsevier.

## TABLE 1



**RESULTS OF STATISTICAL TREND ANALYSES MONITORING EVALUATION**
**FOURTH QUARTER 2001**
**HYDE PARK LANDFILL**
**NIAGARA FALLS, NEW YORK**

| *Location* | *Analyte* | *Number of Observations* | *Percentage Non-Detect* | *Trend Test* | | | |
|---|---|---|---|---|---|---|---|
| | | | | *Method* | *Test Statistic* | *Probability* | *Conclusion* |
| B1U | Benzoic Acid | 8 | 88% | Logistic | -0.245 | 0.945 | NST |
| | Chlorendic Acid | 8 | 13% | Mann-Kendall | 18 | **0.035** | Increasing |
| | Phenolics | 8 | 25% | Mann-Kendall | -10 | 0.266 | NST |
| | Total Chlorobenzoic Acid | 8 | 13% | Mann-Kendall | 4 | 0.711 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -18 | **0.035** | Decreasing |
| B1M | Benzoic Acid | 8 | 75% | Logistic | 0.003 | 0.445 | NST |
| | Chlorendic Acid | 8 | 25% | Mann-Kendall | 4 | 0.711 | NST |
| | Phenolics | 8 | 63% | Logistic | 0.009 | 0.137 | NST |
| | Total Chlorobenzoic Acid | 8 | 13% | Mann-Kendall | 10 | 0.266 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | 8 | 0.386 | NST |
| B1L | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 25% | Mann-Kendall | -8 | 0.386 | NST |
| | Phenolics | 8 | 25% | Mann-Kendall | 6 | 0.536 | NST |
| | Total Chlorobenzoic Acid | 8 | 13% | Mann-Kendall | -14 | 0.108 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -14 | 0.108 | NST |
| C1U | Benzoic Acid | 8 | 88% | Logistic | -0.245 | 0.945 | NST |
| | Chlorendic Acid | 8 | 13% | Mann-Kendall | 2 | 0.902 | NST |
| | Phenolics | 8 | 38% | Mann-Kendall | -15 | 0.083 | NST |
| | Total Chlorobenzoic Acid | 8 | 25% | Mann-Kendall | -7 | 0.458 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -16 | 0.063 | NST |
| C1M | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 13% | Mann-Kendall | -4 | 0.711 | NST |
| | Phenolics | 8 | 75% | Logistic | 0.015 | 0.227 | NST |
| | Total Chlorobenzoic Acid | 8 | 75% | Logistic | -0.001 | 0.719 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -23 | **0.006** | Decreasing |
| C1L | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 25% | Mann-Kendall | 1 | 1.000 | NST |
| | Phenolics | 8 | 63% | Logistic | 0.009 | 0.137 | NST |
| | Total Chlorobenzoic Acid | 8 | 13% | Mann-Kendall | 8 | 0.386 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -12 | 0.174 | NST |
| D3U | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 0% | Mann-Kendall | 8 | 0.386 | NST |
| | Phenolics | 8 | 88% | Logistic | 0.260 | 0.945 | NST |
| | Total Chlorobenzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -4 | 0.711 | NST |
| D2M | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 25% | Mann-Kendall | 6 | 0.536 | NST |
| | Phenolics | 8 | 25% | Mann-Kendall | -20 | **0.019** | Decreasing |
| | Total Chlorobenzoic Acid | 8 | 13% | Mann-Kendall | -2 | 0.902 | NST |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -6 | 0.536 | NST |
| D1L | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 13% | Mann-Kendall | 3 | 0.805 | NST |
| | Total Chlorobenzoic Acid | 8 | 88% | Logistic | -0.004 | 0.520 | NST |
| | Total Organic Halides | 8 | 13% | Mann-Kendall | -8 | 0.386 | NST |

**TABLE 1**

**RESULTS OF STATISTICAL TREND ANALYSES MONITORING EVALUATION**
**FOURTH QUARTER 2001**
**HYDE PARK LANDFILL**
**NIAGARA FALLS, NEW YORK**

| *Location* | *Analyte* | *Number of Observations* | *Percentage Non-Detect* | *Trend Test* | | | |
|---|---|---|---|---|---|---|---|
| | | | | *Method* | *Test Statistic* | *Probability* | *Conclusion* |
| E3U | Benzoic Acid | 7 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 7 | 57% | Logistic | 0.010 | 0.153 | NST |
| | Phenolics | 8 | 75% | Logistic | 0.403 | 0.932 | NST |
| | Total Chlorobenzoic Acid | 7 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 25% | Mann-Kendall | 2 | 0.902 | NST |
| E3M | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 75% | Logistic | 0.007 | 0.236 | NST |
| | Total Chlorobenzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 50% | Logistic | 0.005 | 0.236 | NST |
| E2L | Benzoic Acid | -- | -- | -- | -- | -- | -- |
| | Chlorendic Acid | -- | -- | -- | -- | -- | -- |
| | Phenolics | -- | -- | -- | -- | -- | -- |
| | Total Chlorobenzoic Acid | -- | -- | -- | -- | -- | -- |
| | Total Organic Halides | -- | -- | -- | -- | -- | -- |
| F4U | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 75% | Logistic | 0.007 | 0.235 | NST |
| | Total Chlorobenzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 13% | Mann-Kendall | -18 | **0.035** | Decreasing |
| F1M | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 88% | Logistic | 0.290 | 0.940 | NST |
| | Total Chlorobenzoic Acid | 8 | 88% | Logistic | 0.009 | 0.370 | NST |
| | Total Organic Halides | 8 | 50% | Logistic | 0.002 | 0.523 | NST |
| F2L | Benzoic Acid | -- | -- | -- | -- | -- | -- |
| | Chlorendic Acid | -- | -- | -- | -- | -- | -- |
| | Phenolics | -- | -- | -- | -- | -- | -- |
| | Total Chlorobenzoic Acid | -- | -- | -- | -- | -- | -- |
| | Total Organic Halides | -- | -- | -- | -- | -- | -- |
| G4U | Benzoic Acid | 7 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 7 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 7 | 86% | Logistic | 0.297 | 0.949 | NST |
| | Total Chlorobenzoic Acid | 7 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 7 | 57% | Logistic | 0.009 | 0.169 | NST |
| G1M | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 50% | Logistic | 0.008 | 0.136 | NST |
| | Total Chlorobenzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 50% | Logistic | 0.007 | 0.161 | NST |
| G1L | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 25% | Mann-Kendall | 11 | 0.216 | NST |
| | Total Chlorobenzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | 10 | 0.266 | NST |

**TABLE 1**

**RESULTS OF STATISTICAL TREND ANALYSES MONITORING EVALUATION**
**FOURTH QUARTER 2001**
**HYDE PARK LANDFILL**
**NIAGARA FALLS, NEW YORK**

| *Location* | *Analyte* | *Number of Observations* | *Percentage Non-Detect* | *Trend Test* | | | |
|---|---|---|---|---|---|---|---|
| | | | | *Method* | *Test Statistic* | *Probability* | *Conclusion* |
| H1U | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 50% | Logistic | 0.013 | 0.124 | NST |
| | Phenolics | 8 | 88% | Logistic | 0.287 | 0.940 | NST |
| | Total Chlorobenzoic Acid | 8 | 63% | Logistic | 0.206 | 0.961 | NST |
| | Total Organic Halides | 8 | 13% | Mann-Kendall | -4 | 0.711 | NST |
| H2M | Benzoic Acid | 8 | 88% | Logistic | -0.001 | 0.778 | NST |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 63% | Logistic | 0.009 | 0.138 | NST |
| | Total Chlorobenzoic Acid | 8 | 0% | Mann-Kendall | 12 | 0.174 | NST |
| | Total Organic Halides | 8 | 13% | Mann-Kendall | 2 | 0.902 | NST |
| H3L | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 63% | Logistic | 0.009 | 0.137 | NST |
| | Total Chlorobenzoic Acid | 8 | 50% | Logistic | 0.002 | 0.491 | NST |
| | Total Organic Halides | 8 | 13% | Mann-Kendall | -8 | 0.386 | NST |
| J1U | Benzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 88% | Logistic | 0.260 | 0.945 | NST |
| | Total Chlorobenzoic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Total Organic Halides | 8 | 75% | Logistic | 0.004 | 0.426 | NST |
| J2M | Benzoic Acid | 8 | 63% | Logistic | 0.003 | 0.477 | NST |
| | Chlorendic Acid | 8 | 63% | Logistic | 0.192 | 0.963 | NST |
| | Phenolics | 8 | 13% | Mann-Kendall | 6 | 0.536 | NST |
| | Total Chlorobenzoic Acid | 8 | 0% | Mann-Kendall | 20 | **0.019** | Increasing |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | 12 | 0.174 | NST |
| J3L | Benzoic Acid | 8 | 13% | Mann-Kendall | 13 | 0.138 | NST |
| | Chlorendic Acid | 8 | 100% | Non-Detect | ND | ND | ND |
| | Phenolics | 8 | 13% | Mann-Kendall | -8 | 0.386 | NST |
| | Total Chlorobenzoic Acid | 8 | 13% | Mann-Kendall | 20 | **0.019** | Increasing |
| | Total Organic Halides | 8 | 0% | Mann-Kendall | -8 | 0.386 | NST |

**Notes:**

ND: Parameter not detected at this location. No trend analysis performed.
NST: No statistically significant ($P<0.05$) trend detected.
Increasing: Statistically significant ($P<0.05$) increasing trend detected.
Decreasing: Statistically significant ($P<0.05$) decreasing trend detected.
Logistic: Logistic regression used for trend test (>= 50%ND).
Mann-Kendall: Mann Kendall method used for trend test (<50%ND).
--: No data collected at wells E2L and F2L during the past 2 years.
Data used for the statistical tests include monitoring events from 1999 to present.

TABLE 2

COMPARSION OF STATISTICAL TREND ANALYSES FOR YEAR 2001
FIRST, SECOND, THIRD, AND FOURTH QUARTER EVALUATIONS
HYDE PARK LANDFILL
NIAGARA FALLS, NEW YORK

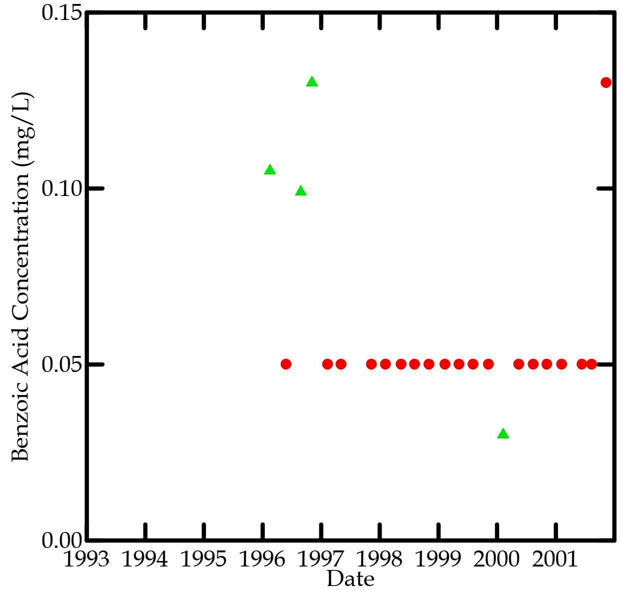
| *Location* | *Analyte* | *First Quarter 2001* | | *Second Quarter 2001* | | *Third Quarter 2001* | | *Fourth Quarter 2001* | |
|---|---|---|---|---|---|---|---|---|---|
| | | *Number of Samples* | *Conclusion* | *Number of Samples* | *Conclusion* | *Number of Samples* | *Conclusion* | *Number of Samples* | *Conclusion* |
| B1U | Chlorendic Acid | 9 | NST | 10 | NST | 11 | NST | 8 | Increasing |
| | Total Organic Halides | 9 | NST | 10 | NST | 11 | NST | 8 | Decreasing |
| B1M | Total Chlorobenzoic Acid | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| | Total Organic Halides | 9 | Decreasing | 10 | Decreasing | 11 | NST | 8 | NST |
| B1L | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| C1U | Phenolics | 9 | NST | 10 | Decreasing | 11 | Decreasing | 8 | NST |
| C1M | Chlorendic Acid | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| | Total Chlorobenzoic Acid | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| | Total Organic Halides | 9 | NST | 10 | NST | 11 | NST | 8 | Decreasing |
| C1L | Total Chlorobenzoic Acid | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| | Total Organic Halides | 9 | Decreasing | 10 | Decreasing | 11 | Decreasing | 8 | NST |
| D3U | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| D2M | Phenolics | 9 | NST | 10 | NST | 11 | NST | 8 | Decreasing |
| D1L | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| E3U | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| E3M | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| E2L | No Data | -- | -- | -- | -- | -- | -- | -- | -- |
| F4U | Total Organic Halides | 9 | NST | 10 | NST | 11 | Decreasing | 8 | Decreasing |
| F1M | Total Organic Halides | 9 | NST | 10 | NST | 11 | Decreasing | 8 | NST |
| F2L | No Data | -- | -- | -- | -- | -- | -- | -- | -- |
| G4U | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| G1M | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| G1L | Total Organic Halides | 9 | Decreasing | 10 | Decreasing | 11 | NST | 8 | NST |
| H1U | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| H2M | Total Organic Halides | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| H3L | Total Organic Halides | 9 | Decreasing | 10 | Decreasing | 11 | Decreasing | 8 | NST |
| J1U | No Trends | -- | -- | -- | -- | -- | -- | -- | -- |
| J2M | Benzoic Acid | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| | Phenolics | 9 | Decreasing | 10 | Decreasing | 11 | NST | 8 | NST |
| | Total Chlorobenzoic Acid | 9 | Decreasing | 10 | NST | 11 | NST | 8 | Increasing |
| | Total Organic Halides | 9 | Decreasing | 10 | NST | 11 | NST | 8 | NST |
| J3L | Total Chlorobenzoic Acid | 9 | NST | 10 | NST | 11 | NST | 8 | Increasing |

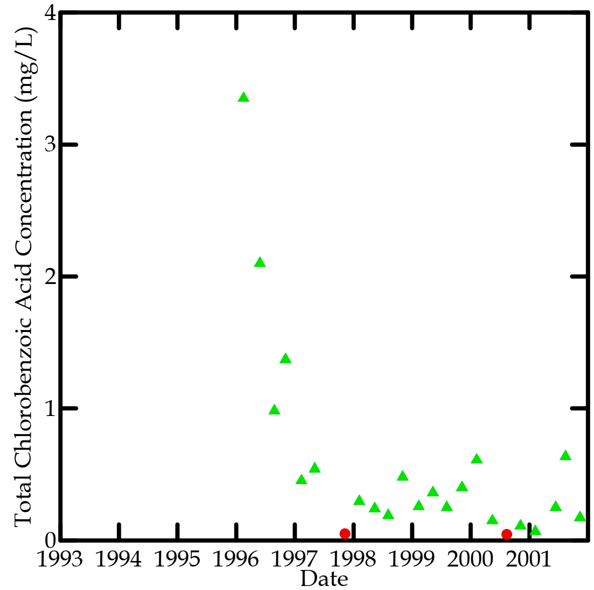
**Notes:**

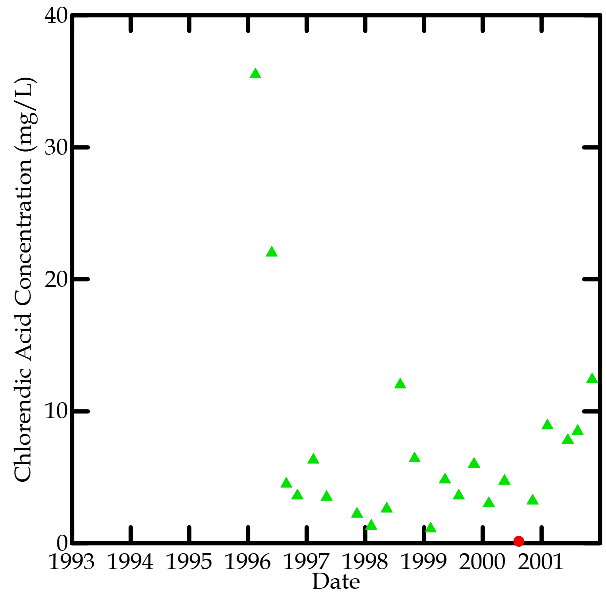
No Trends: No statistically significant trends identified to date for any of the analytes.
No Data: No data collected at this well for the year 2001 sampling rounds.
NST: No statistically significant ($P<0.05$) trend detected.
Increasing: Statistically significant ($P<0.05$) increasing trend detected.
Decreasing: Statistically significant ($P<0.05$) decreasing trend detected.

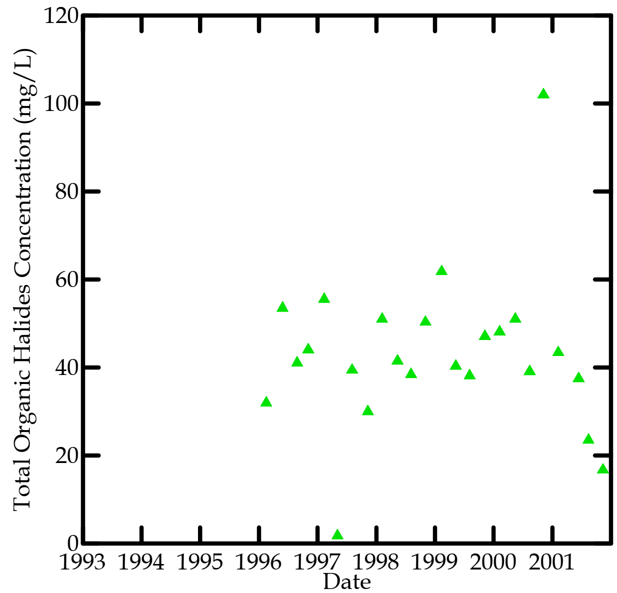
ATTACHMENT A

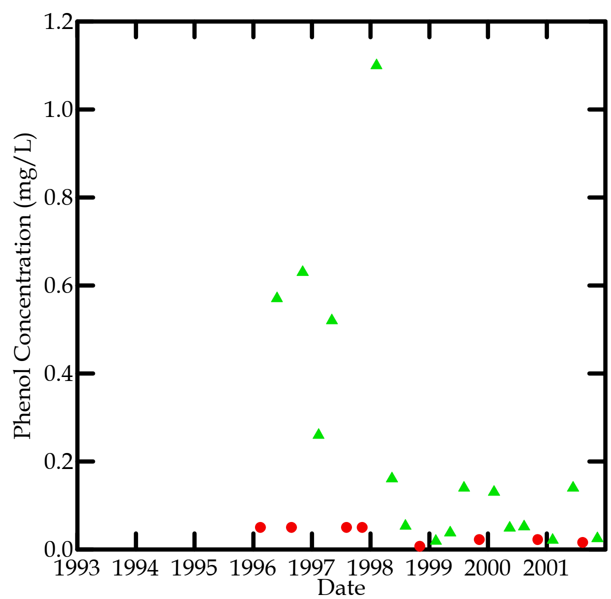
CONCENTRATION VS. TIME PLOTS




Notes:

● Non-detect result

▲ Detected result

figure 1

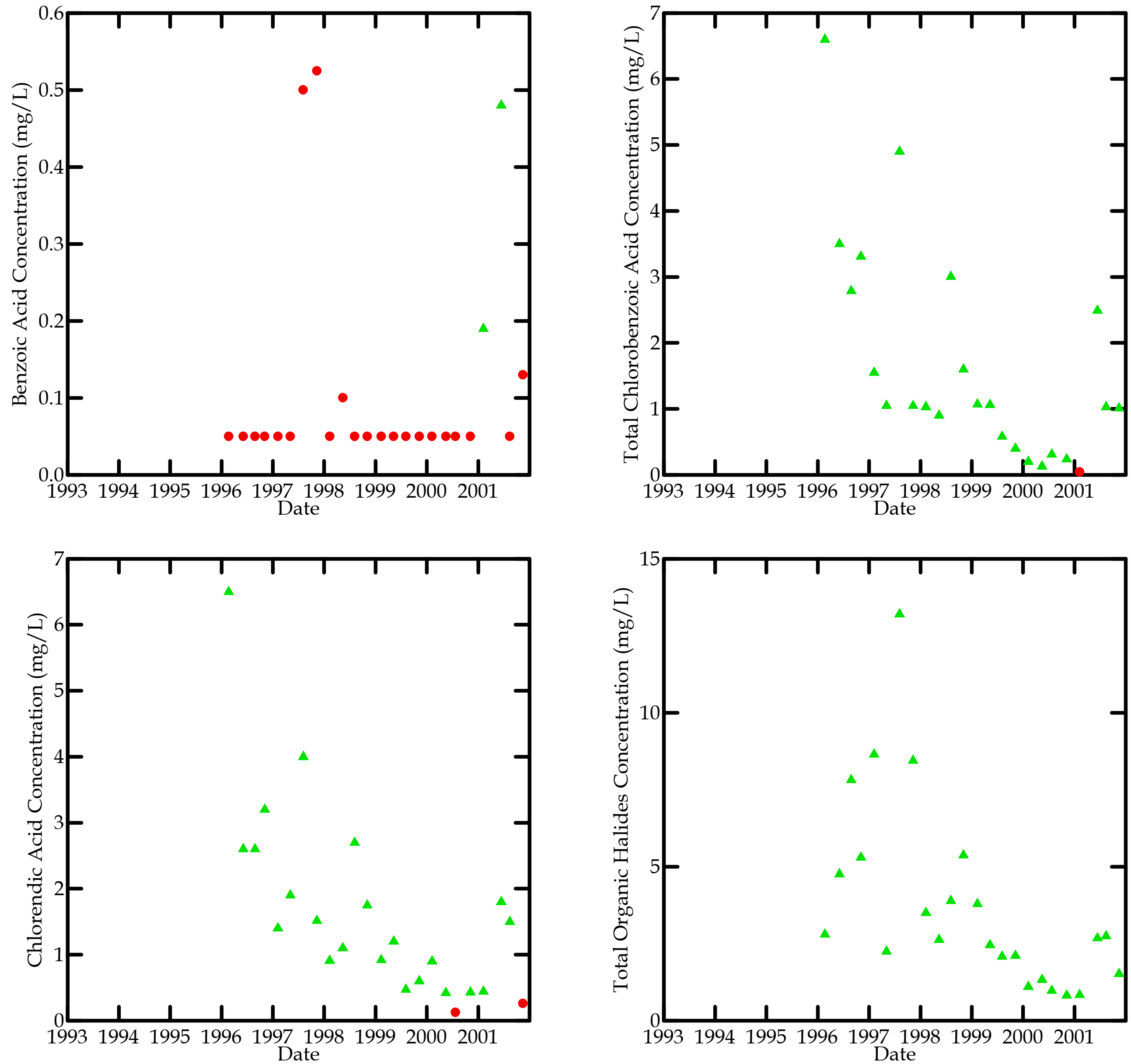
Well B1U

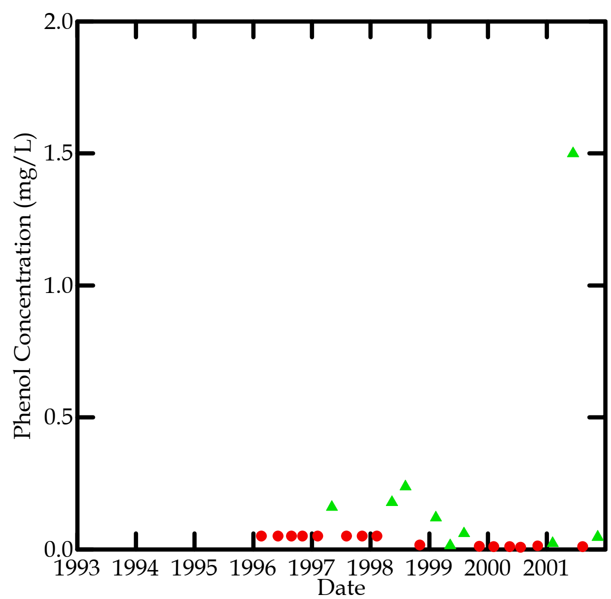
Analyte Concentration vs. Time

Fourth Quarter 2001

Hyde Park Landfill

*Niagara Falls, New York*



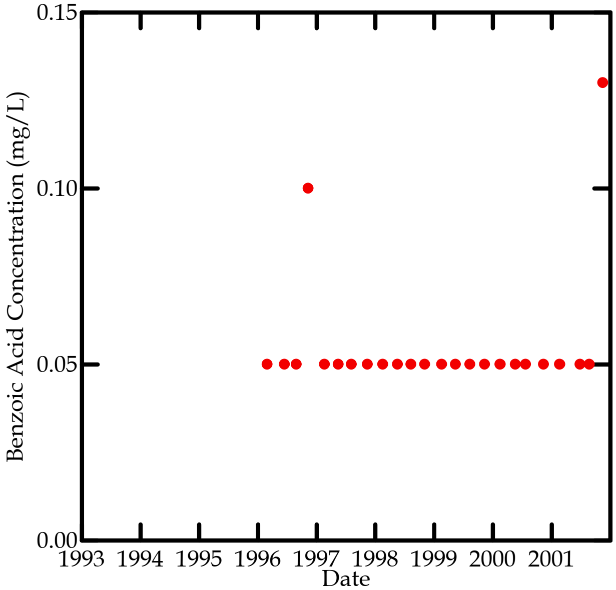

Notes:

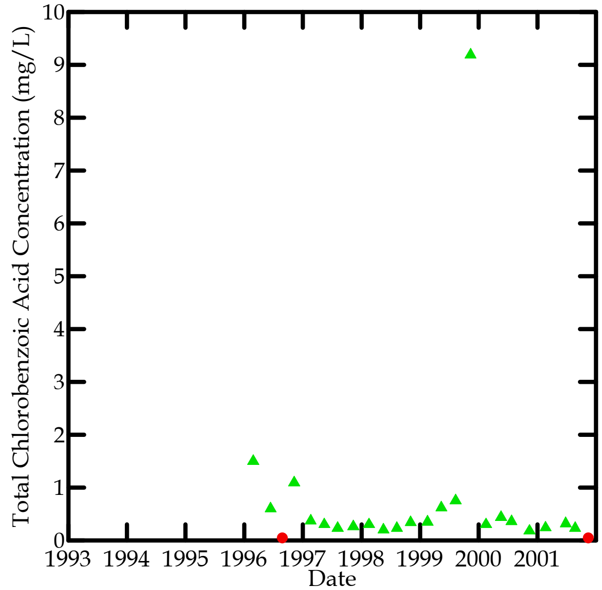
● Non-detect result

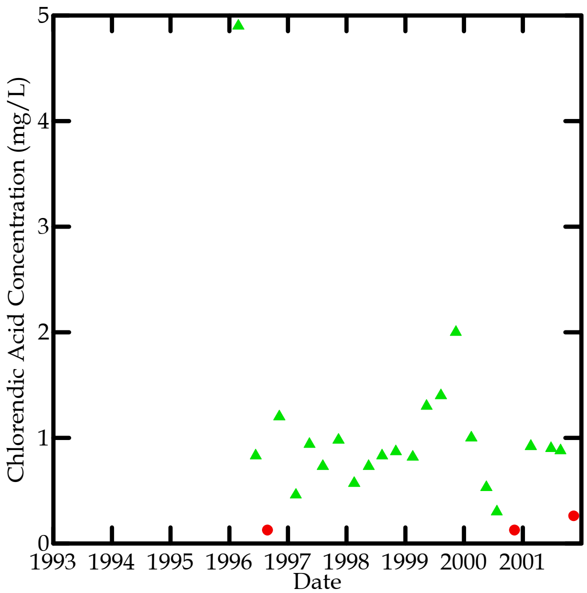
▲ Detected result

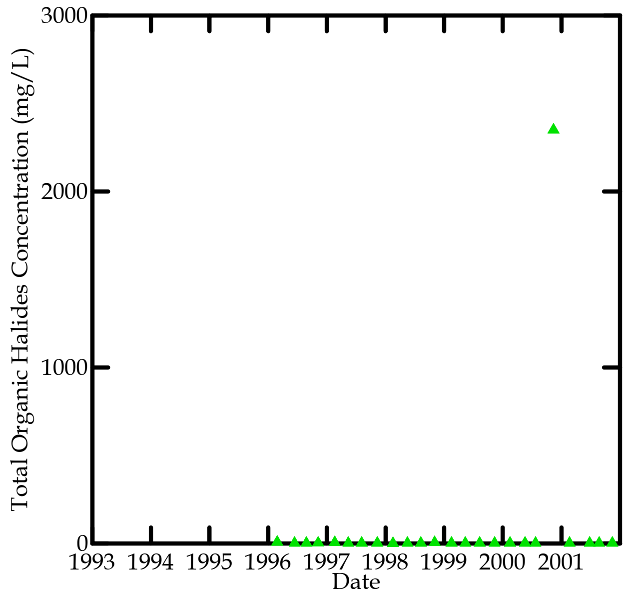
figure 2

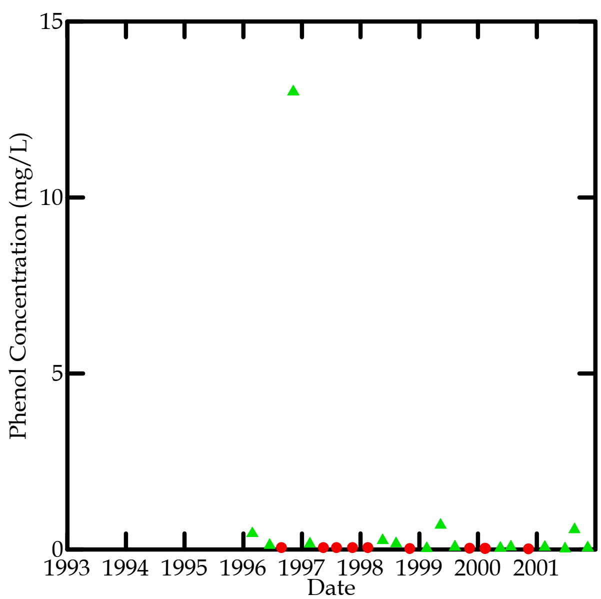
Well B1M
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 3

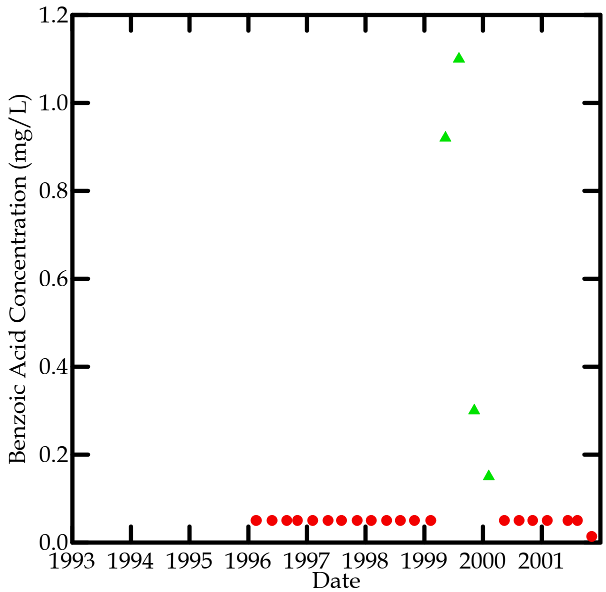
Well B1L

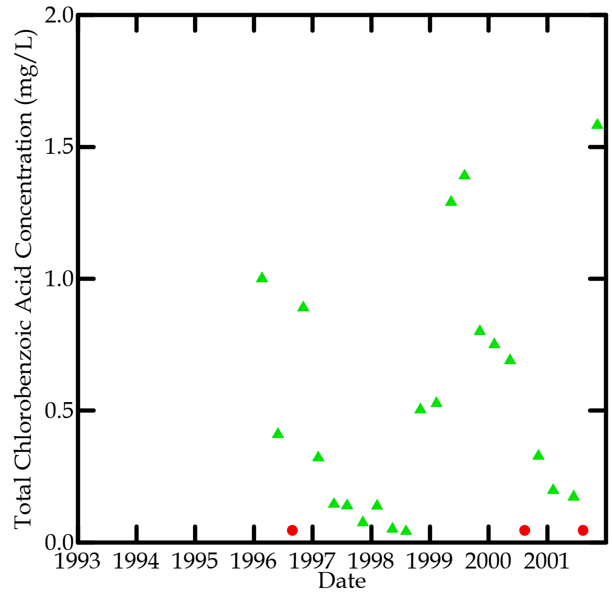
Analyte Concentration vs. Time

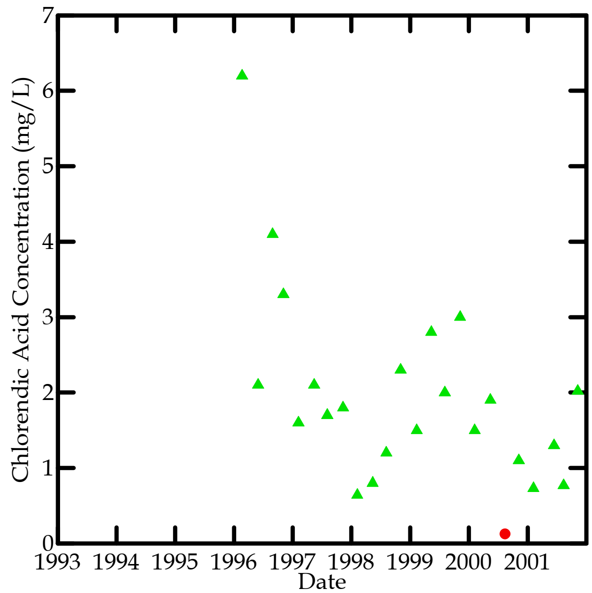
Fourth Quarter 2001

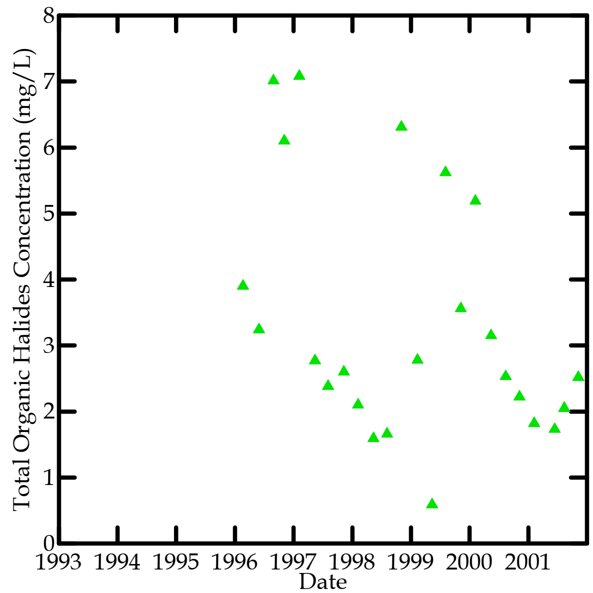
Hyde Park Landfill

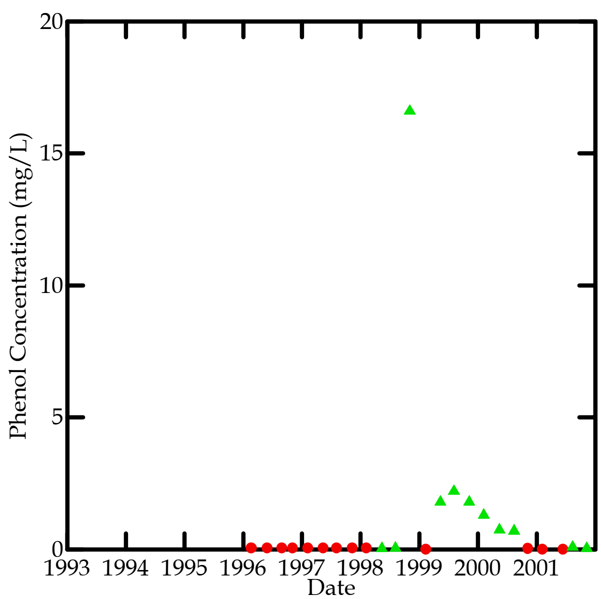
*Niagara Falls, New York*



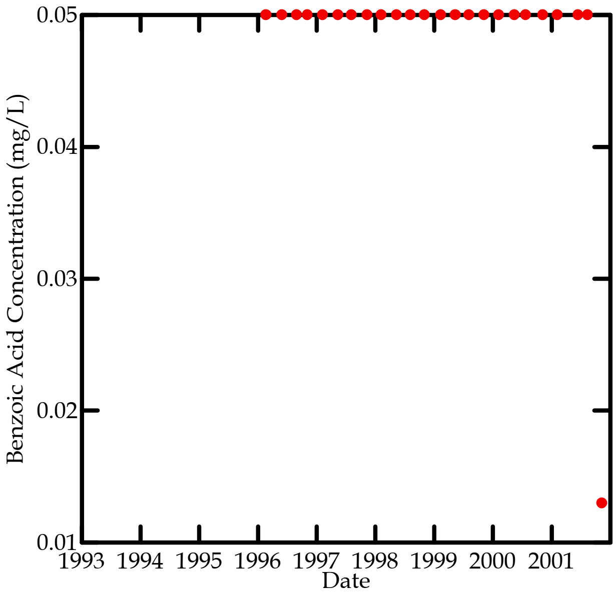



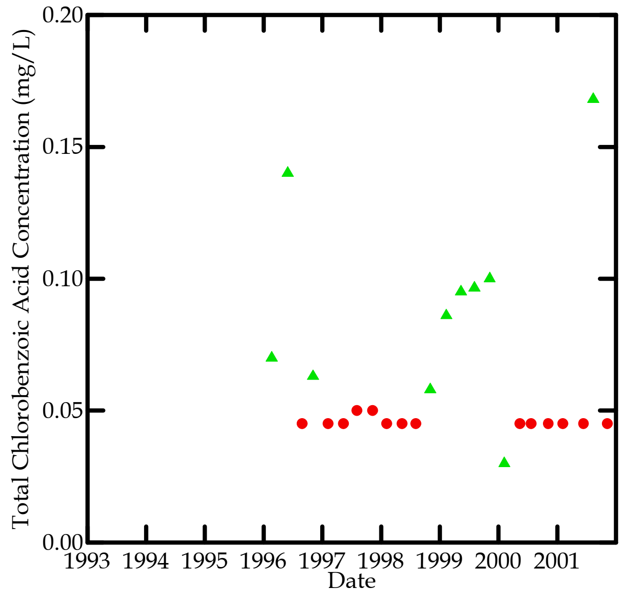



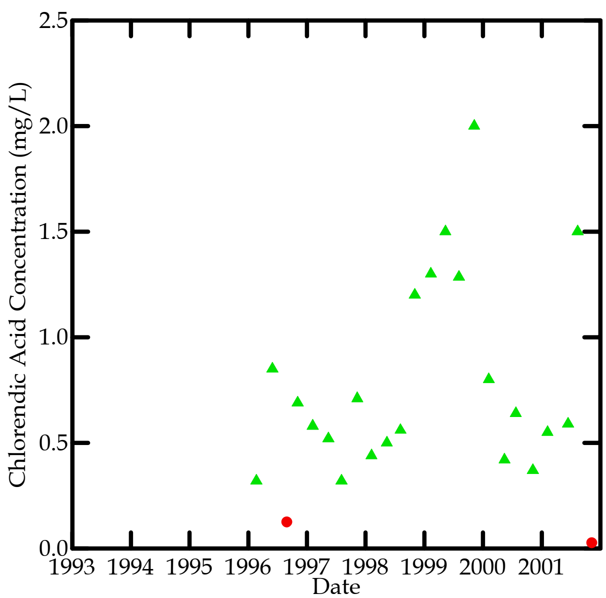

Notes:
● Non-detect result
▲ Detected result

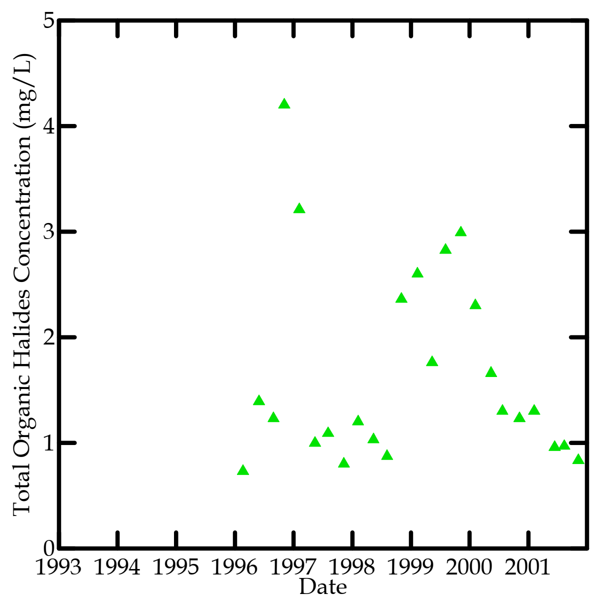
figure 4

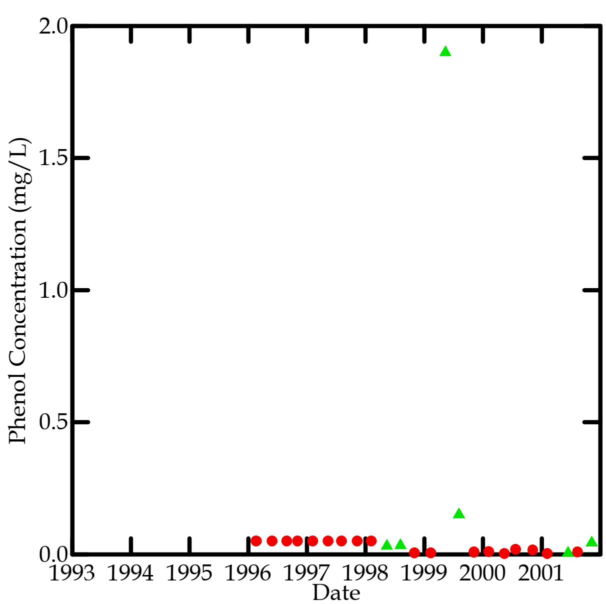
Well C1U
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*



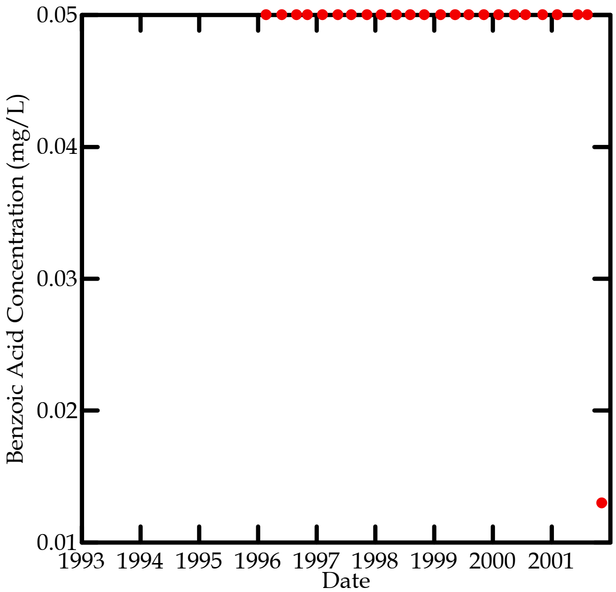

Notes:

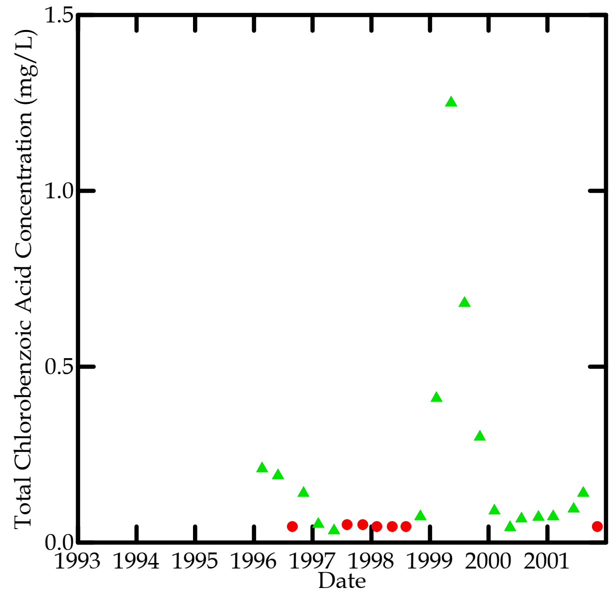
● Non-detect result

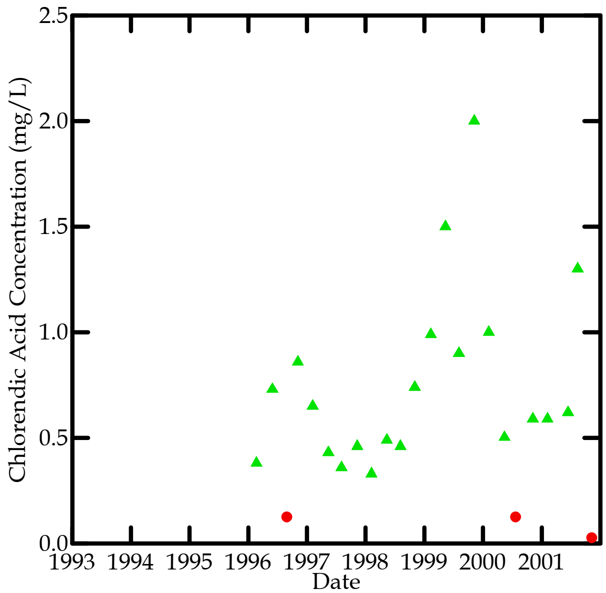
▲ Detected result

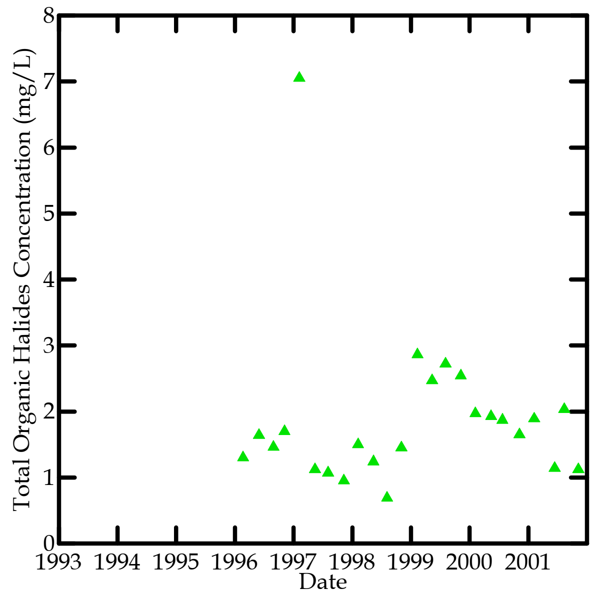
figure 5

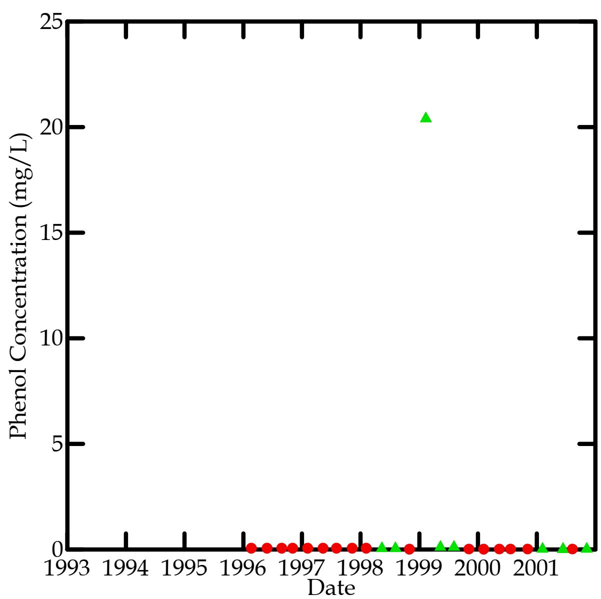
Well C1M
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 6

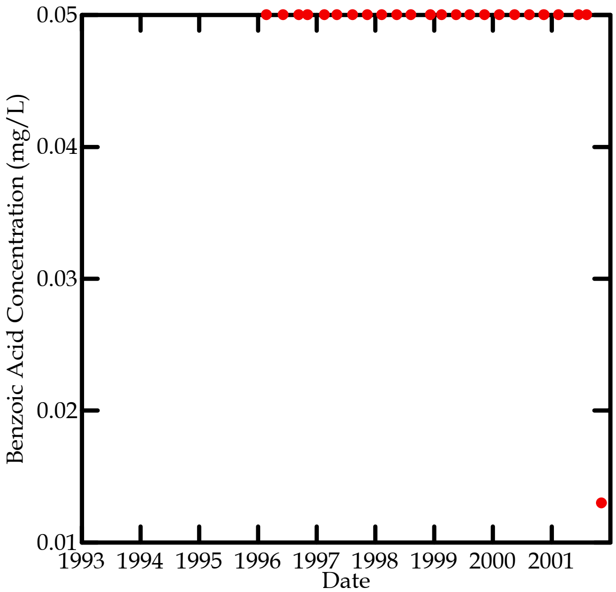
Well C1L

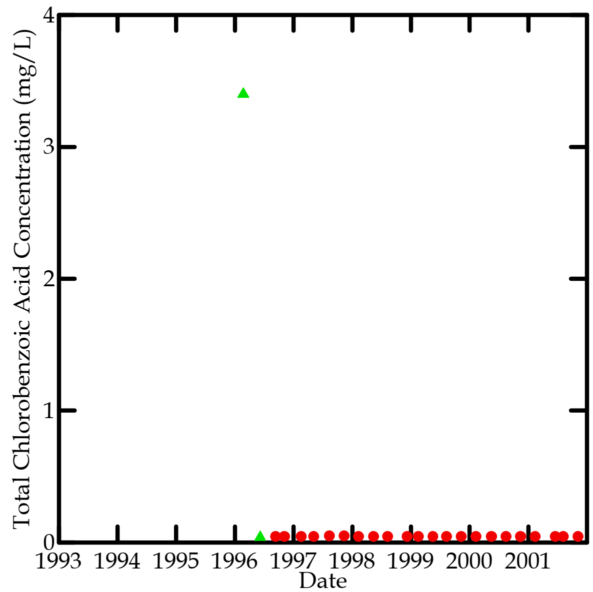
Analyte Concentration vs. Time

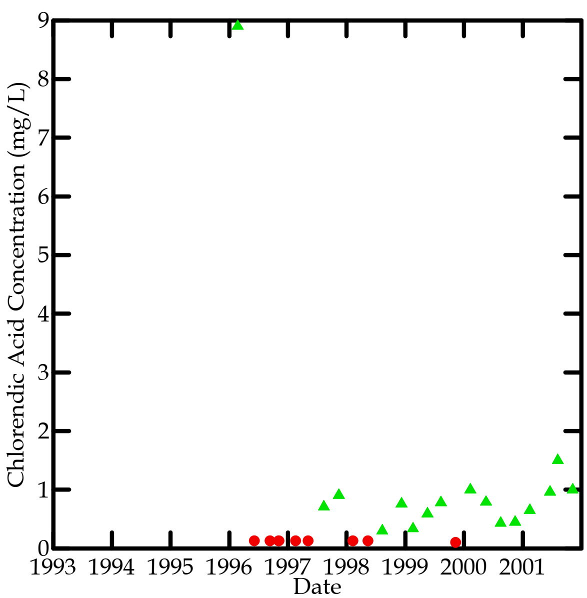
Fourth Quarter 2001

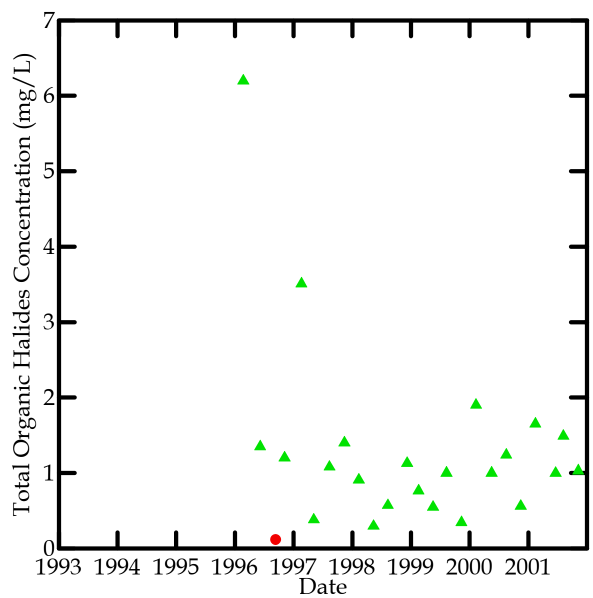
Hyde Park Landfill

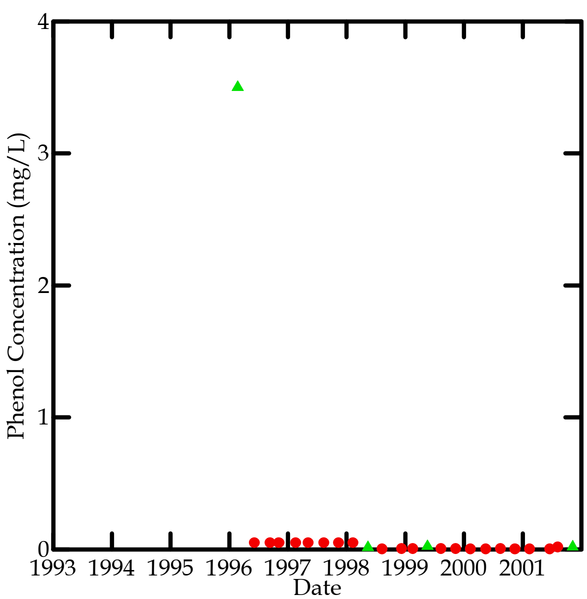
*Niagara Falls, New York*



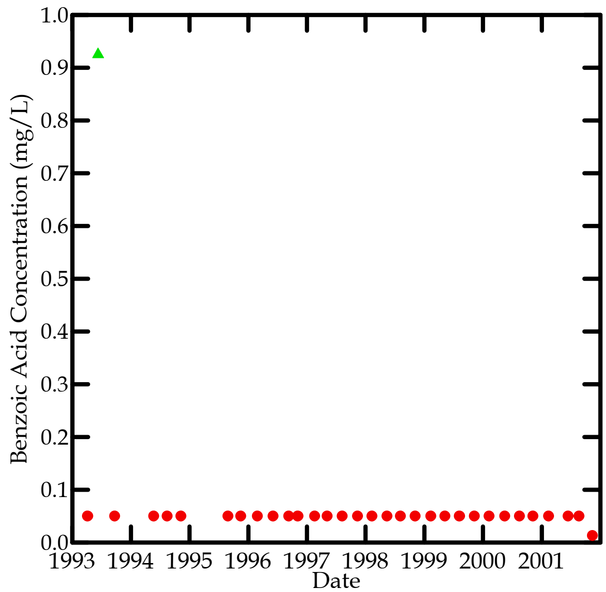



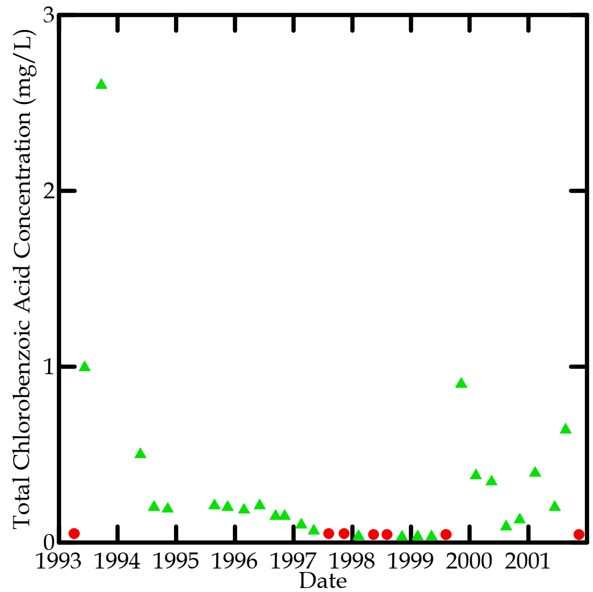



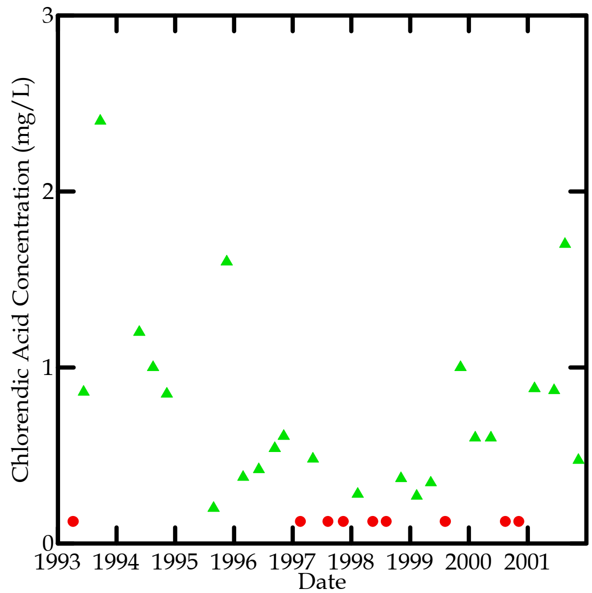

Notes:
● Non-detect result
▲ Detected result

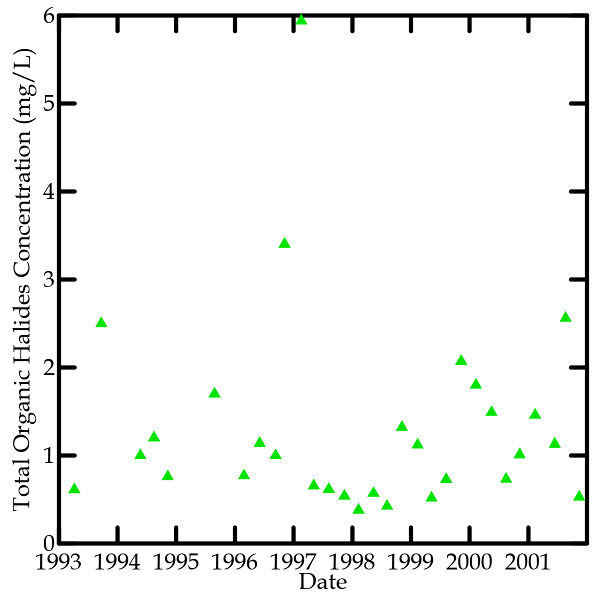
figure 7

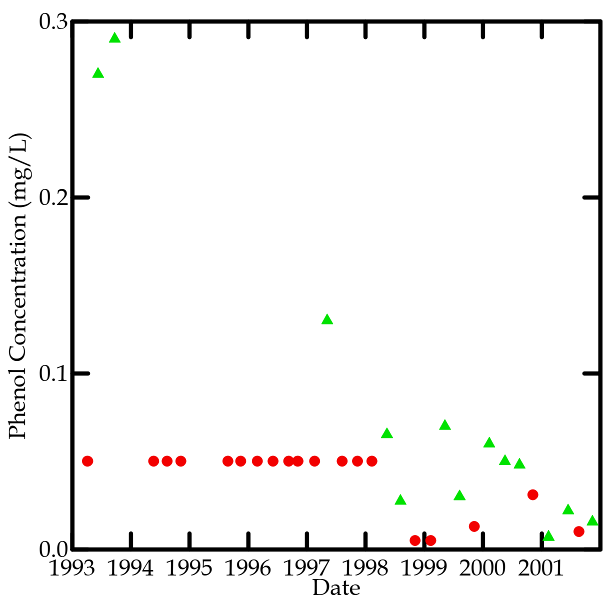
Well D3U
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 8

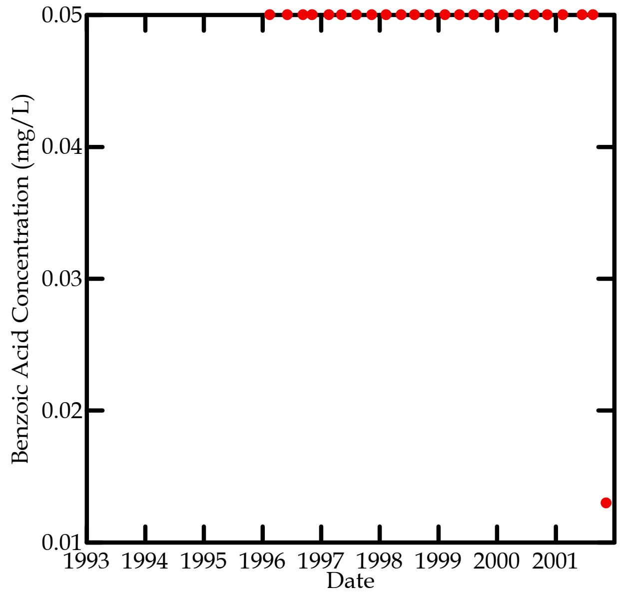
Well D2M

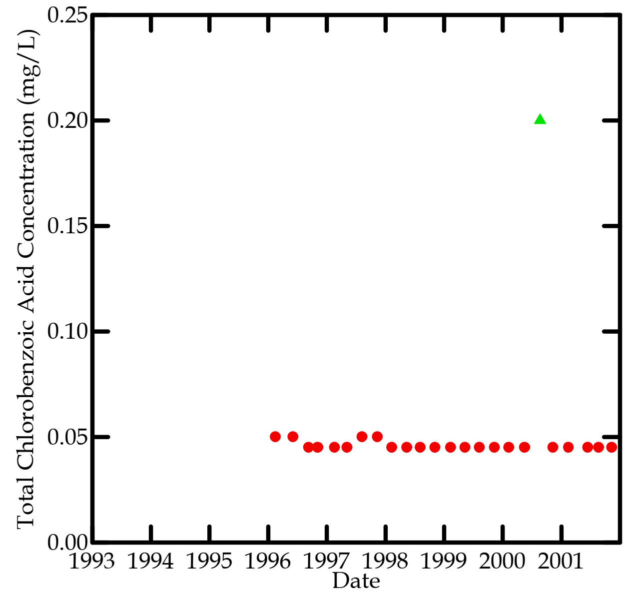
Analyte Concentration vs. Time

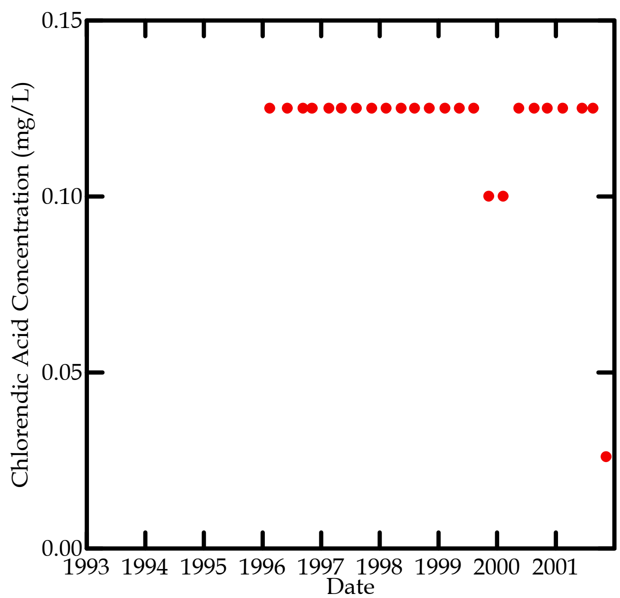
Fourth Quarter 2001

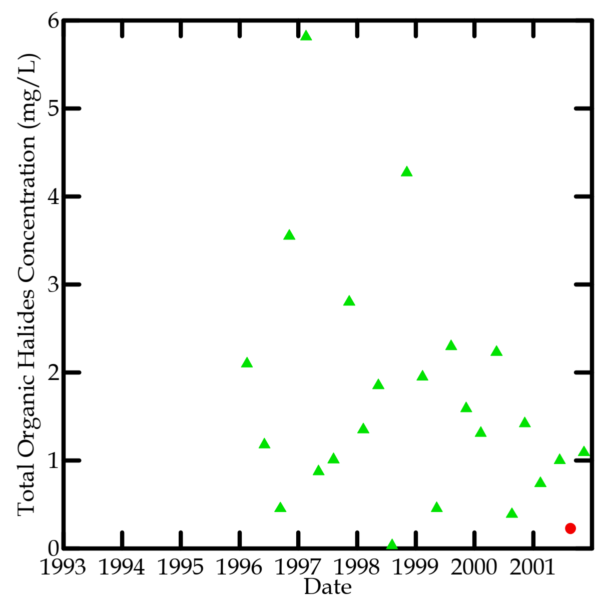
Hyde Park Landfill

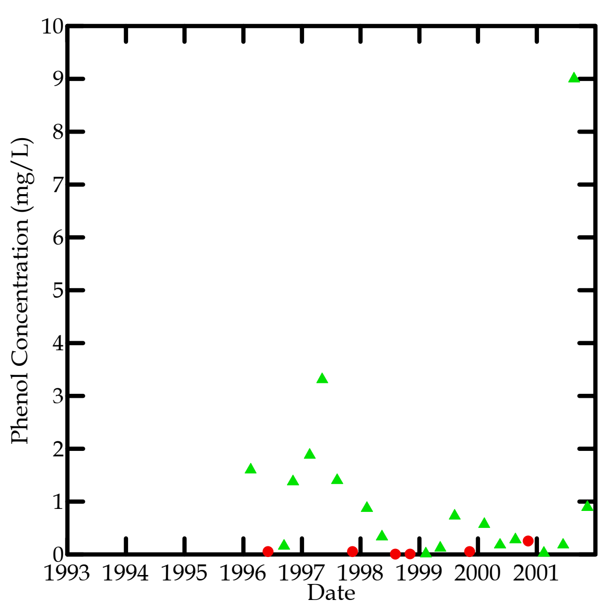
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 9

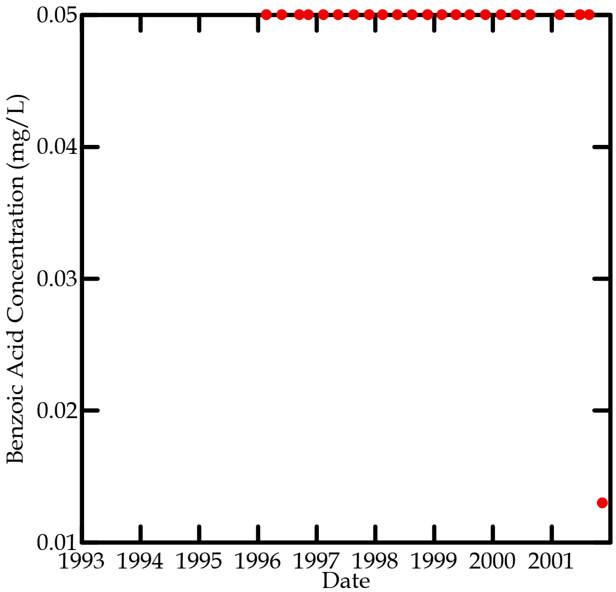
Well D1L

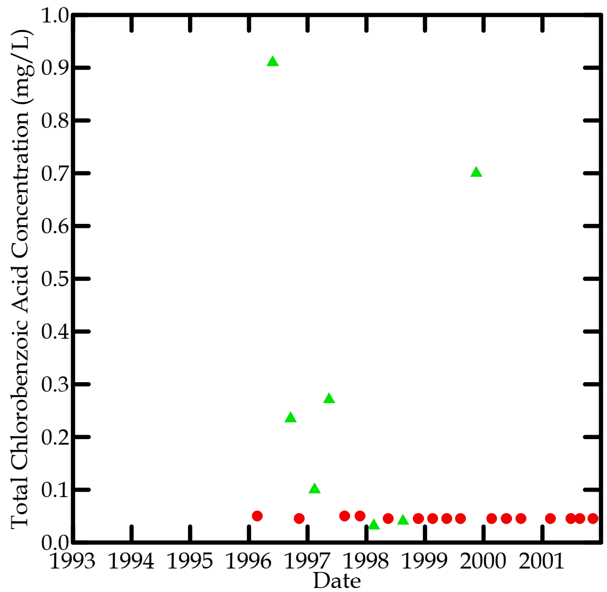
Analyte Concentration vs. Time

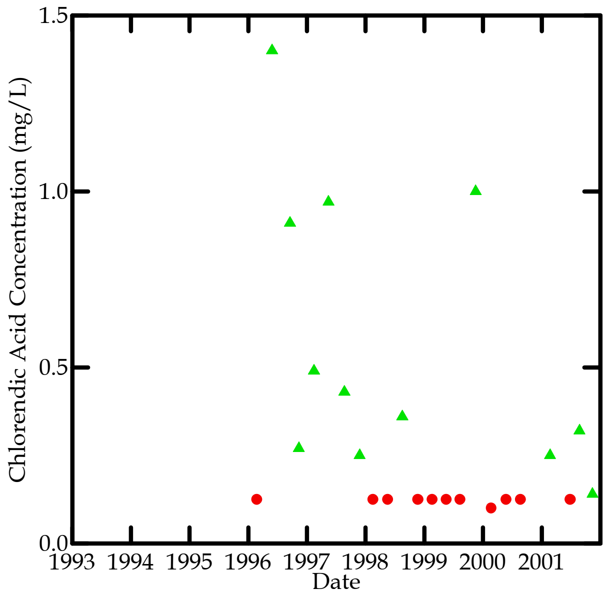
Fourth Quarter 2001

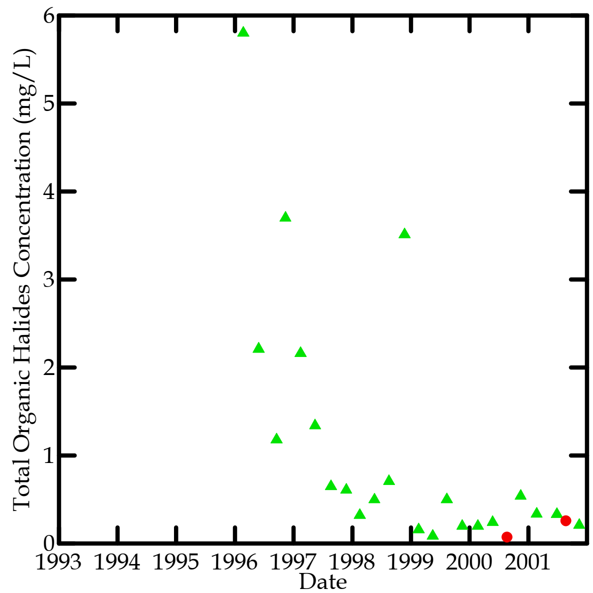
Hyde Park Landfill

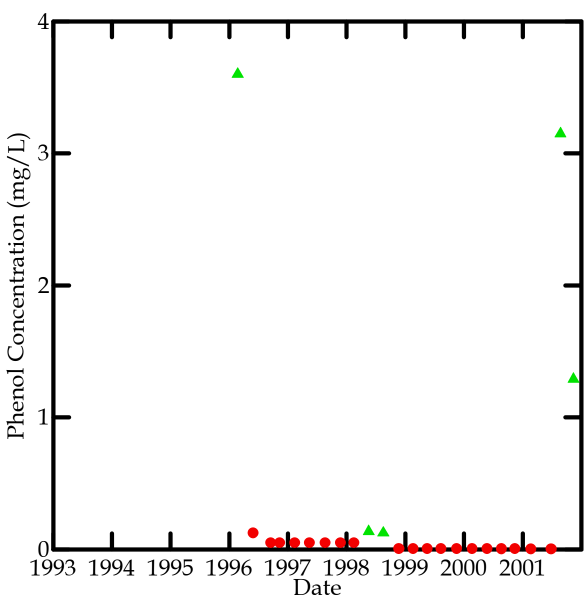
*Niagara Falls, New York*



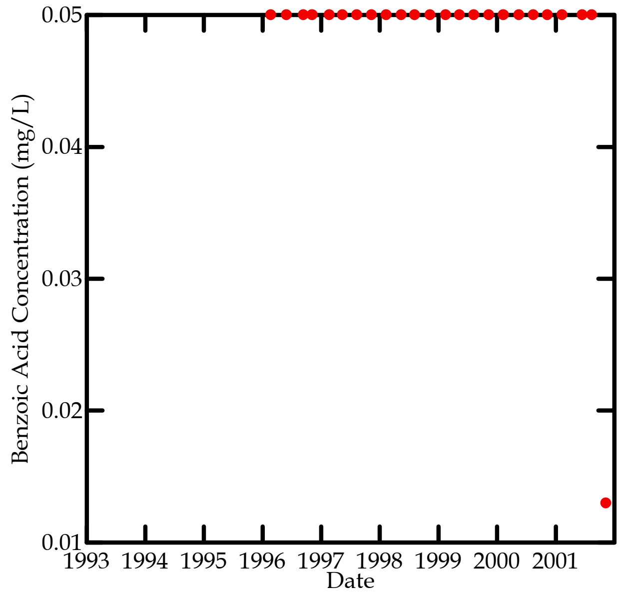



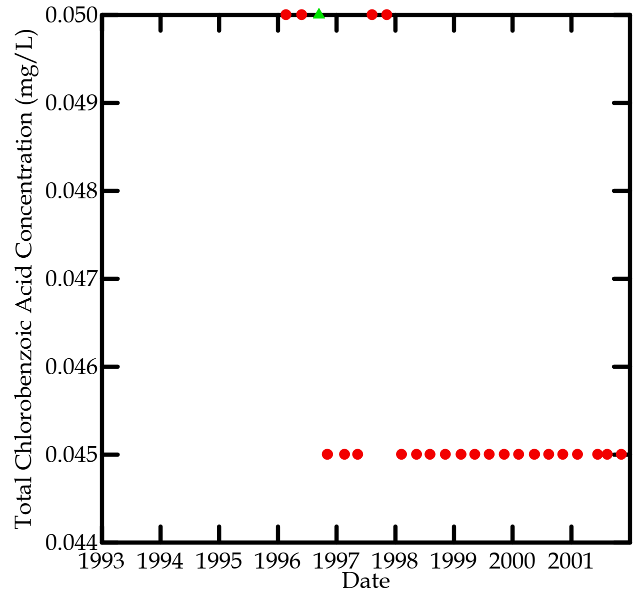



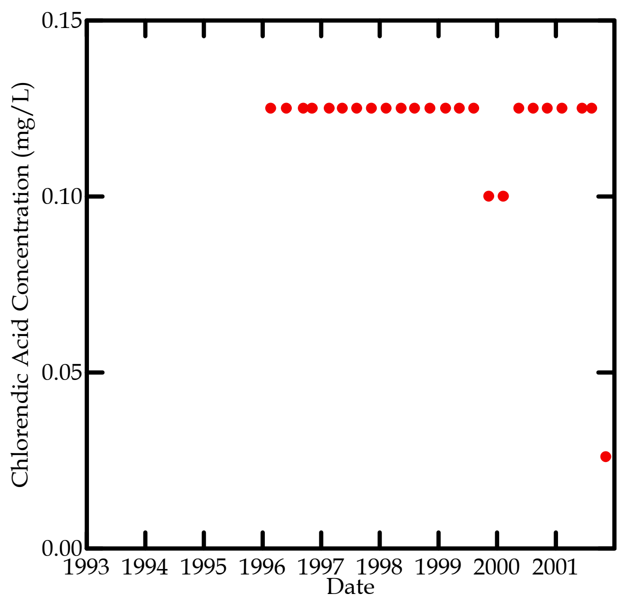

Notes:
● Non-detect result
▲ Detected result

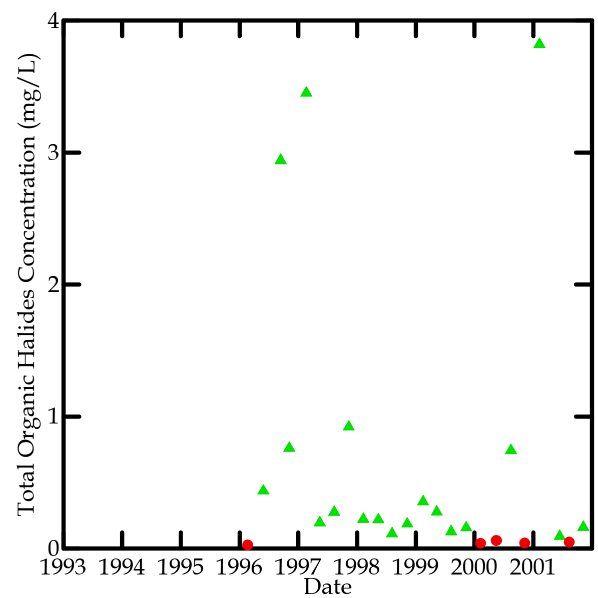
figure 10

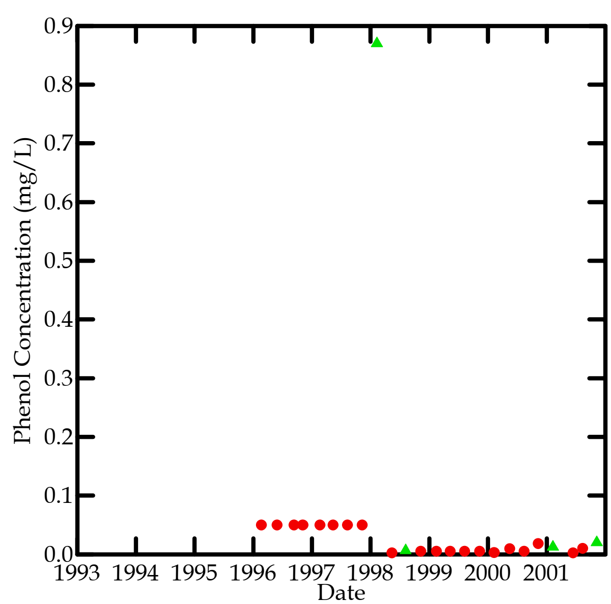
Well E3U
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 11

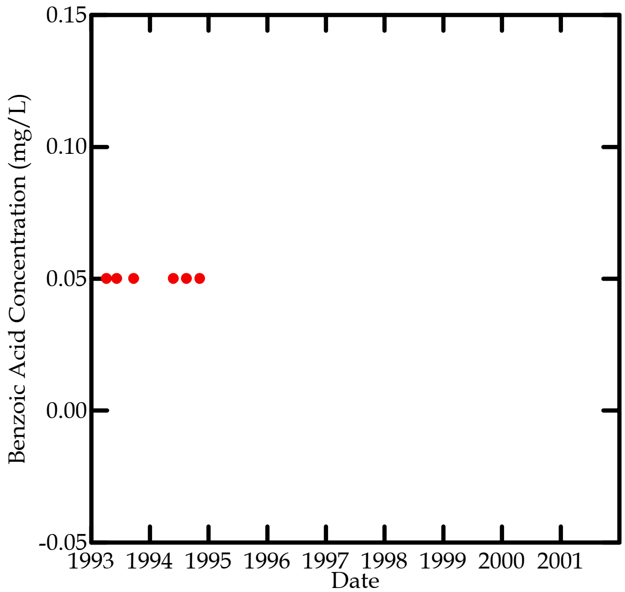
Well E3M

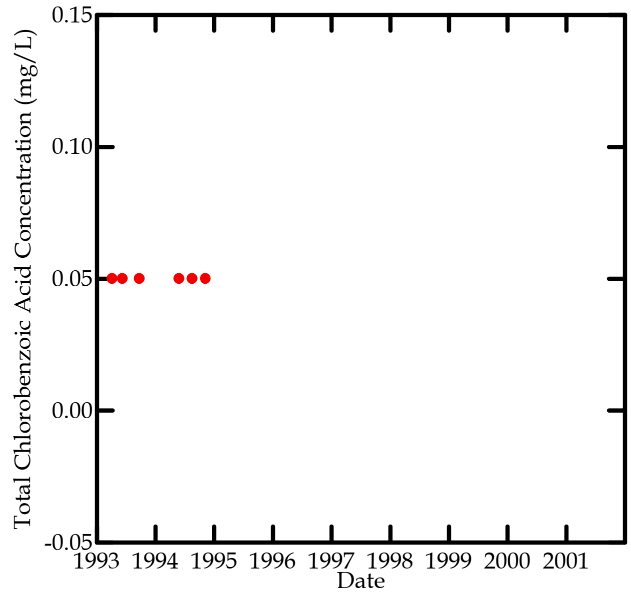
Analyte Concentration vs. Time

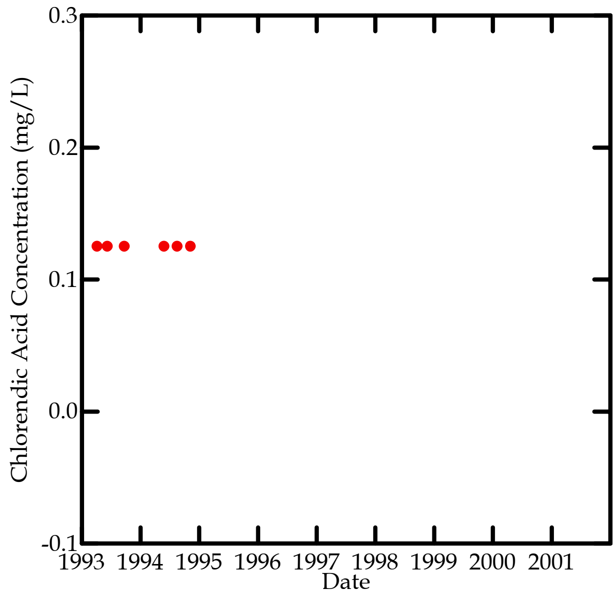
Fourth Quarter 2001

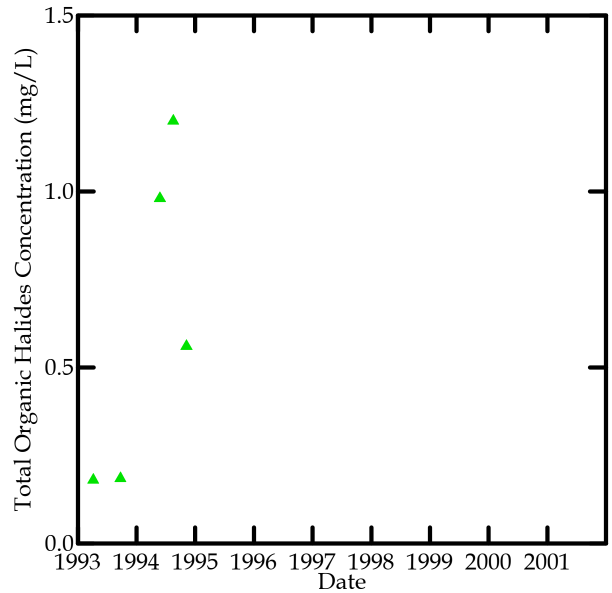
Hyde Park Landfill

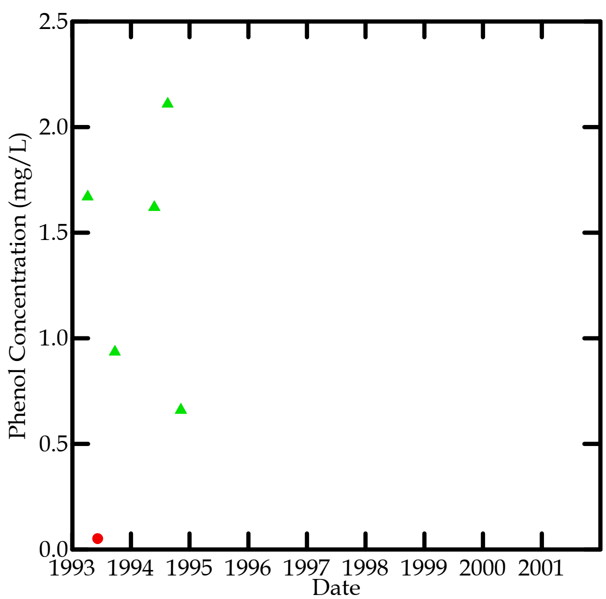
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 12

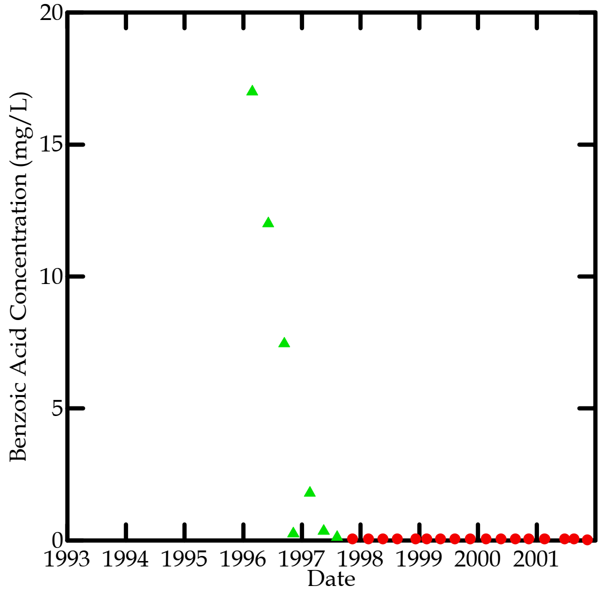
Well E2L

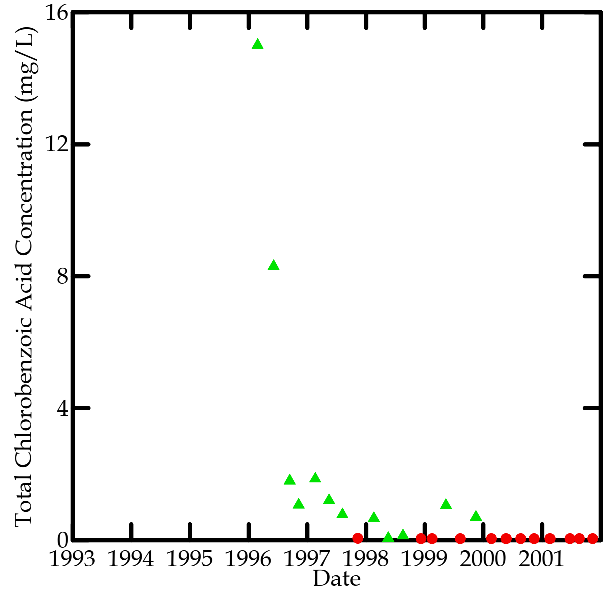
Analyte Concentration vs. Time

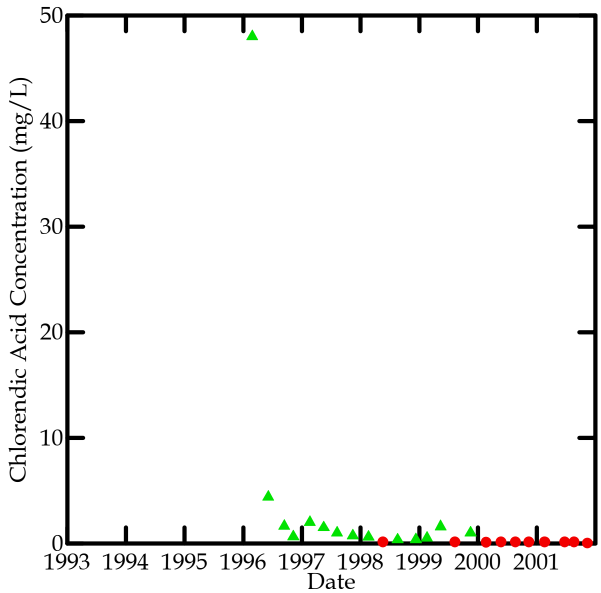
Fourth Quarter 2001

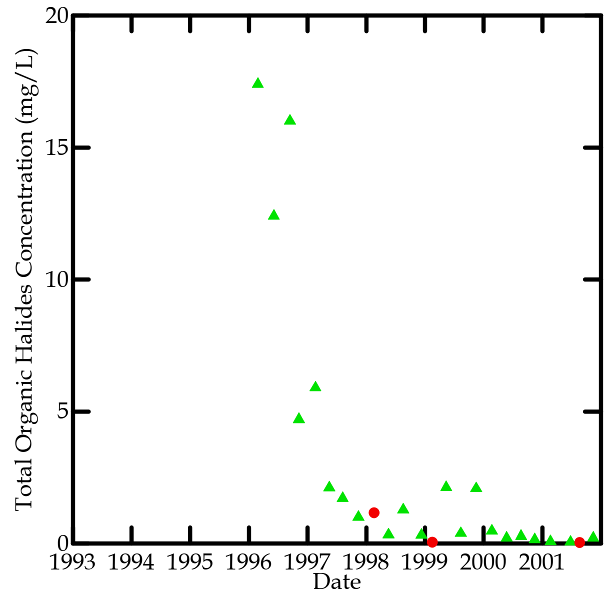
Hyde Park Landfill

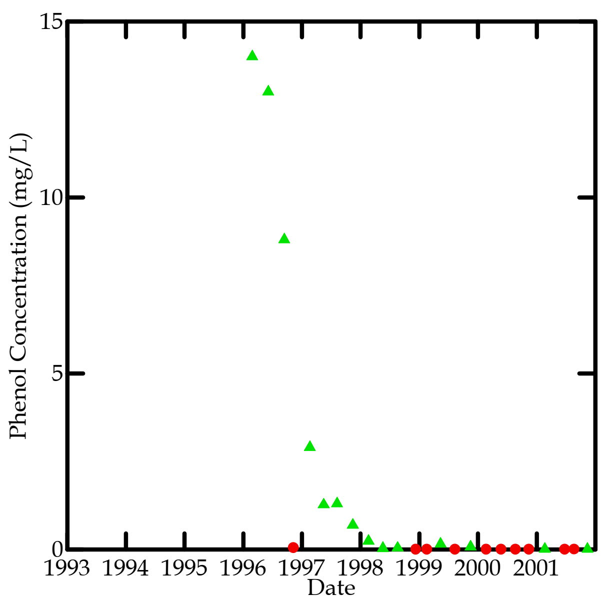
*Niagara Falls, New York*



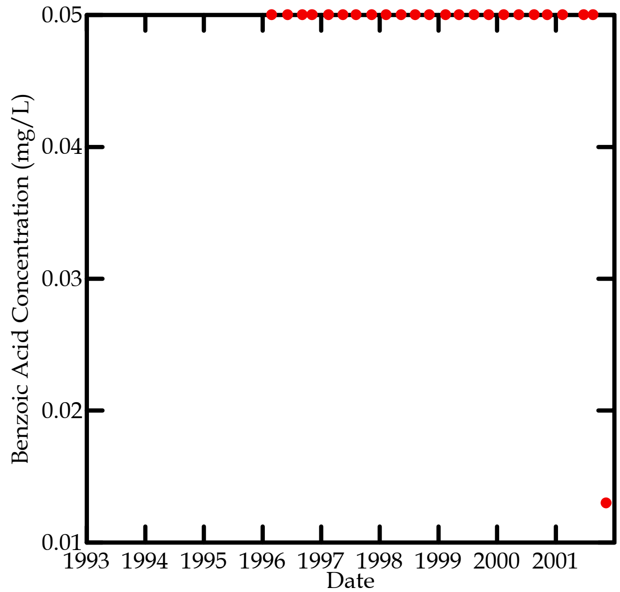



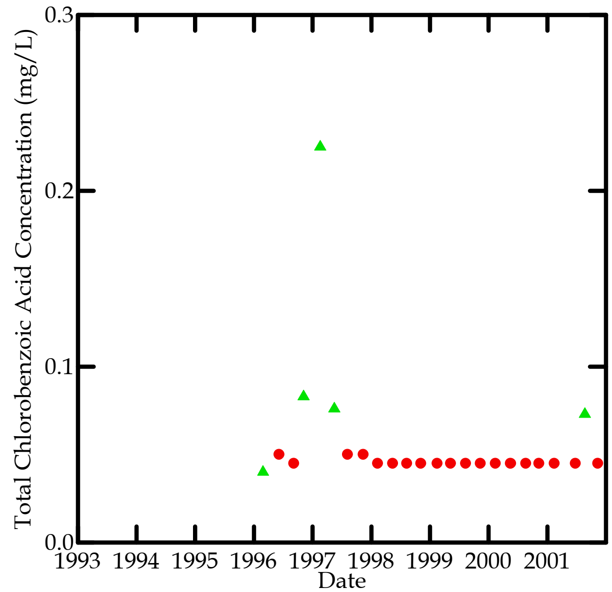



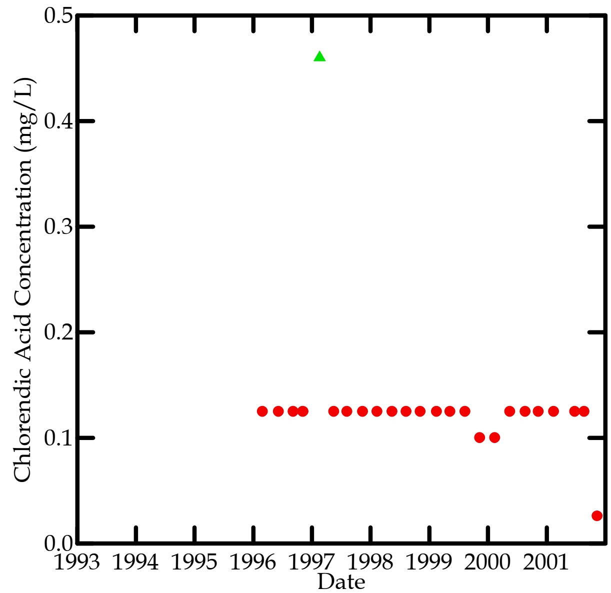

Notes:
● Non-detect result
▲ Detected result

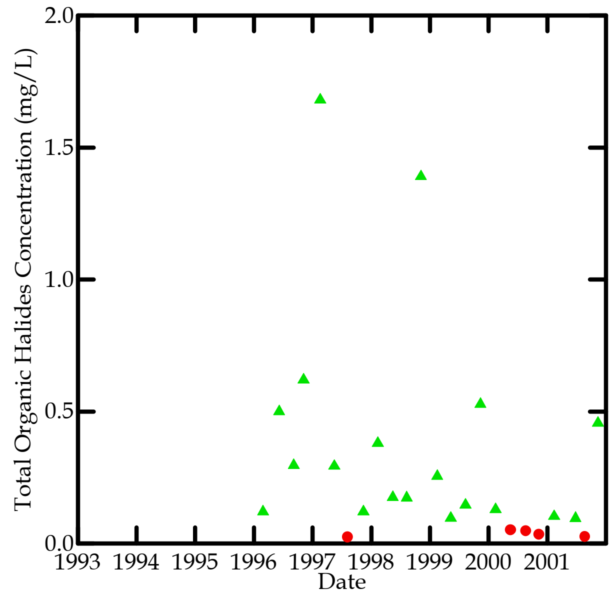
figure 13

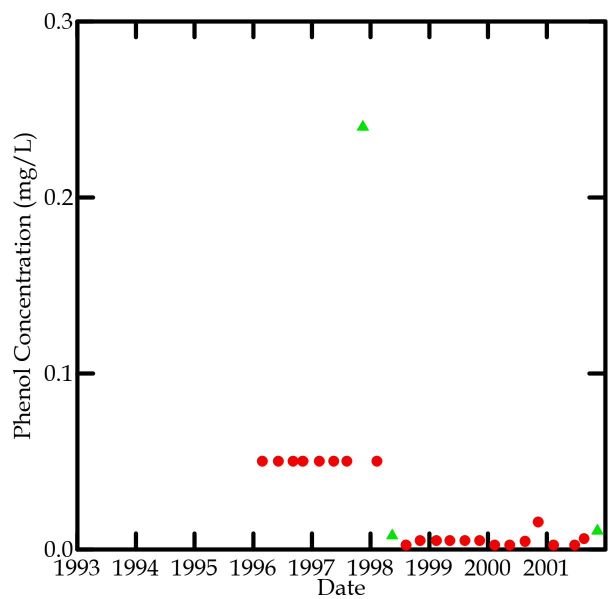
Well F4U
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 14

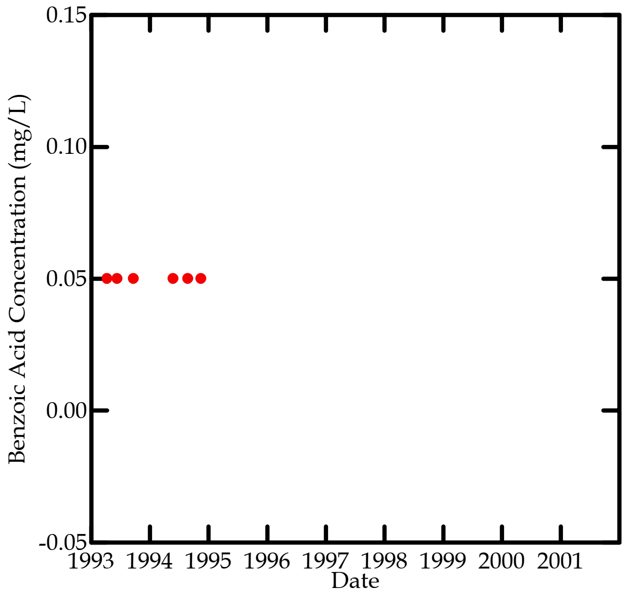
Well F1M

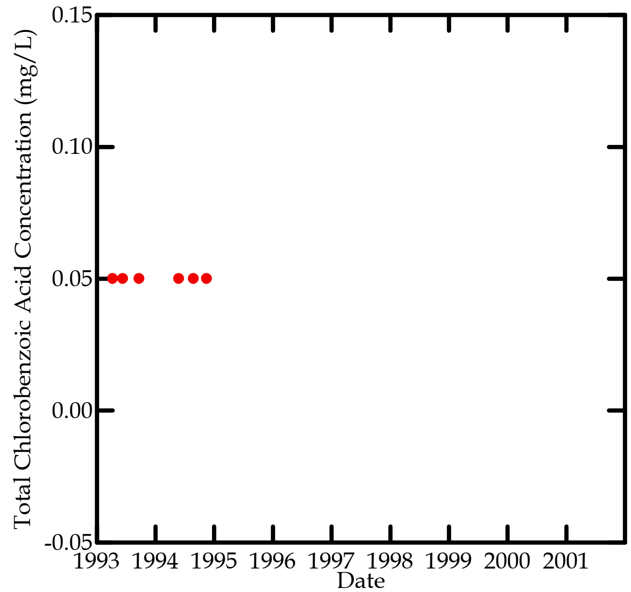
Analyte Concentration vs. Time

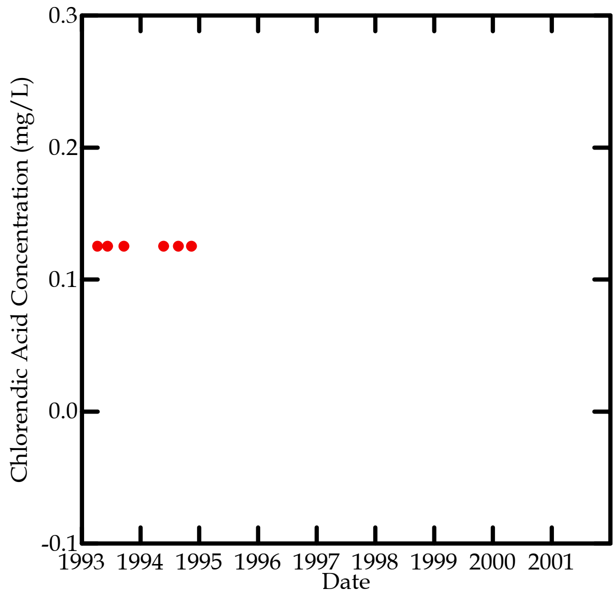
Fourth Quarter 2001

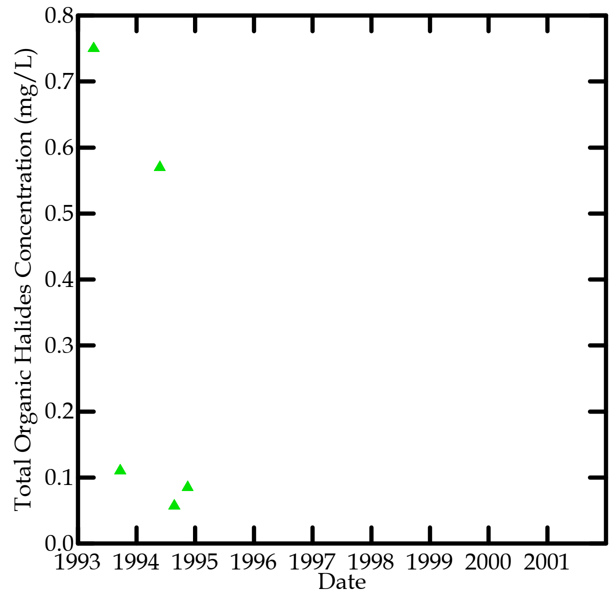
Hyde Park Landfill

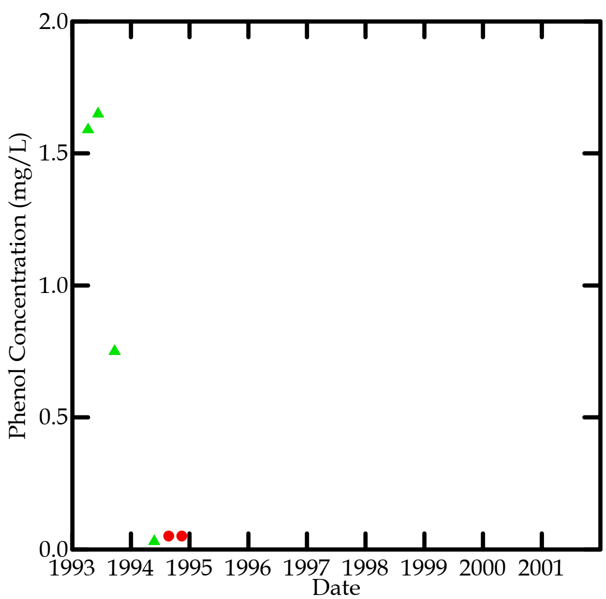
*Niagara Falls, New York*



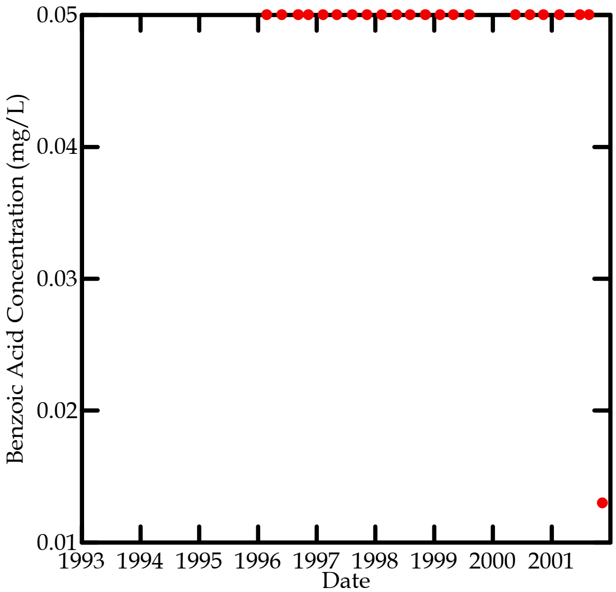

Notes:

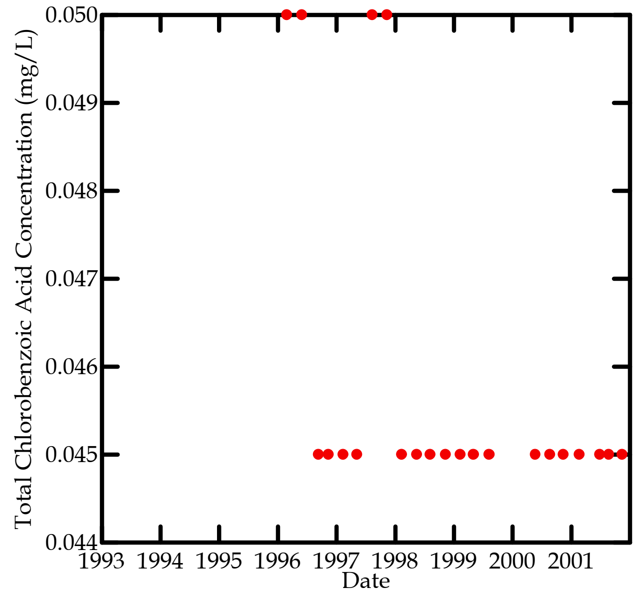
● Non-detect result

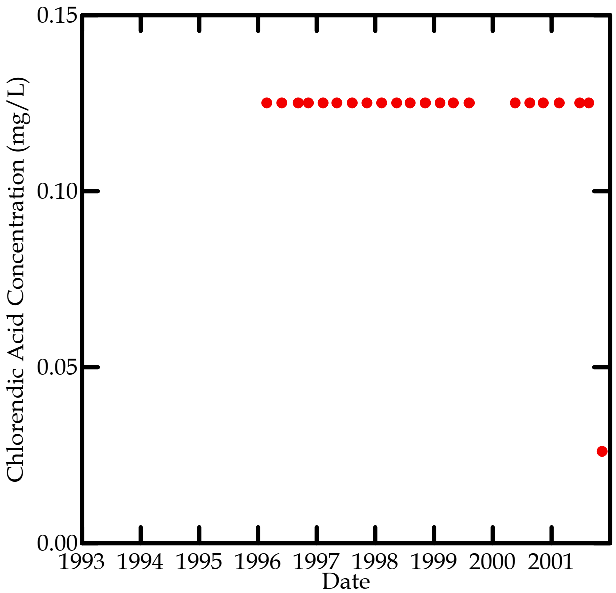
▲ Detected result

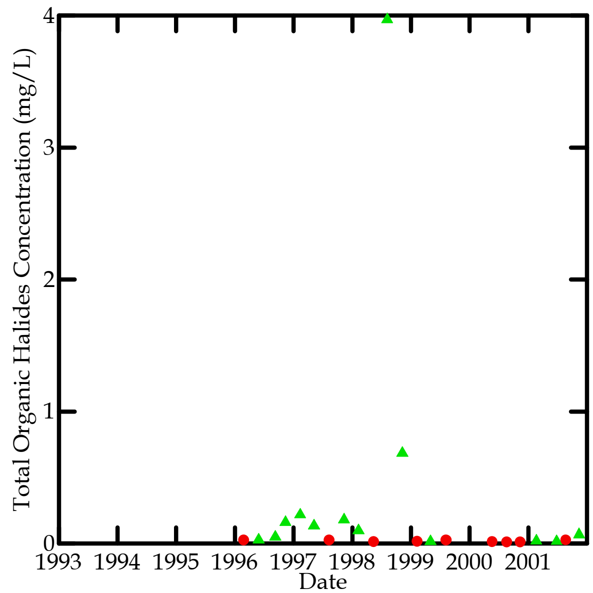
figure 15

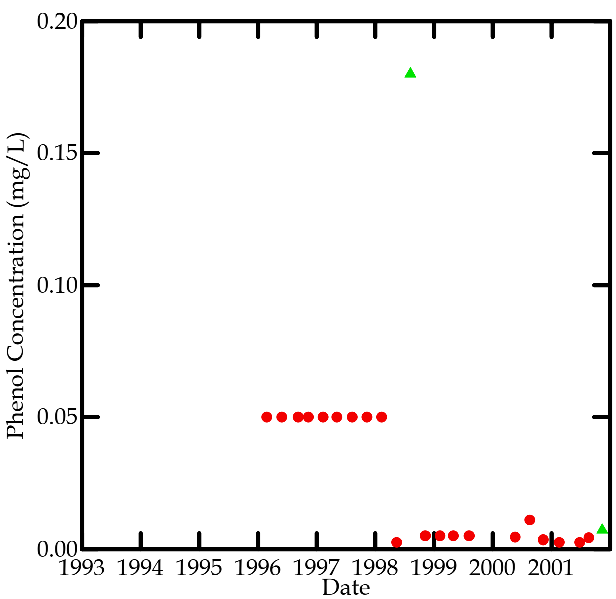
Well F2L
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 16

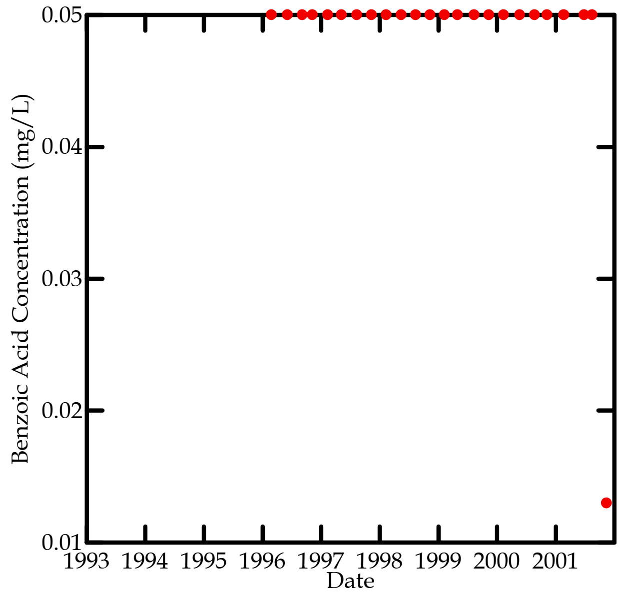
Well G4U

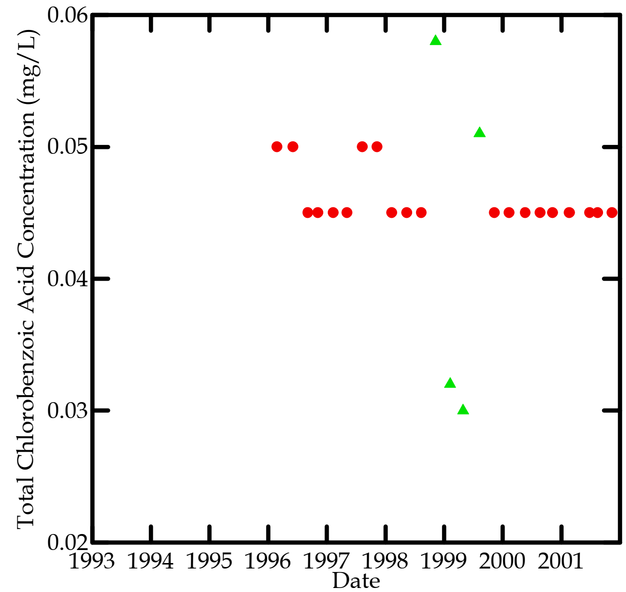
Analyte Concentration vs. Time

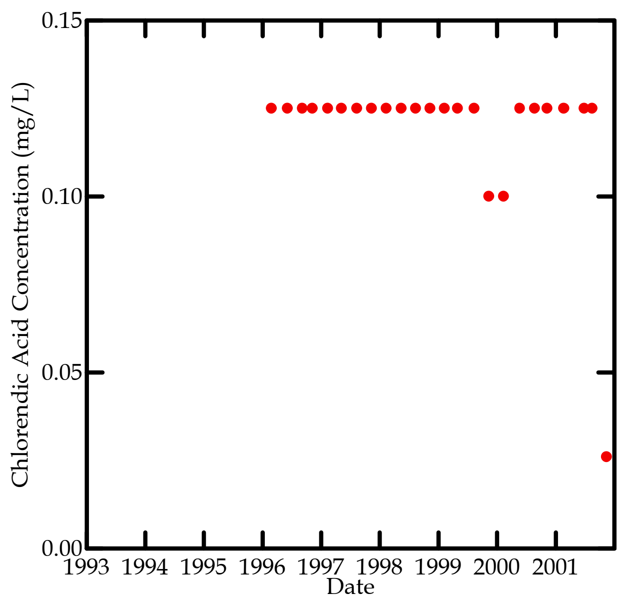
Fourth Quarter 2001

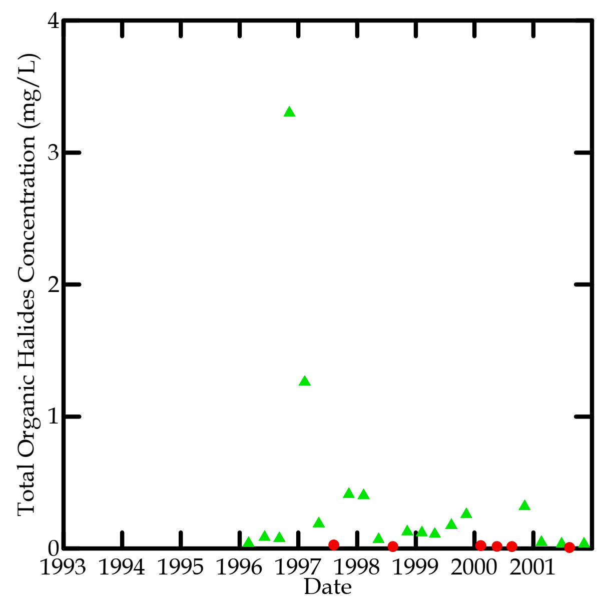
Hyde Park Landfill

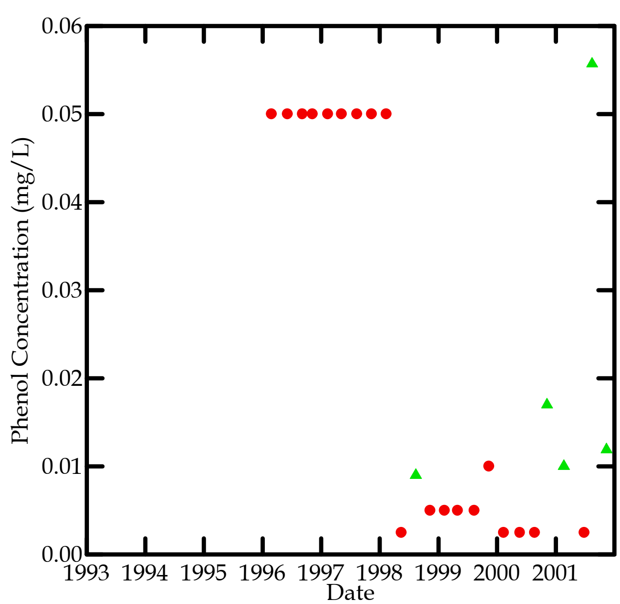
*Niagara Falls, New York*



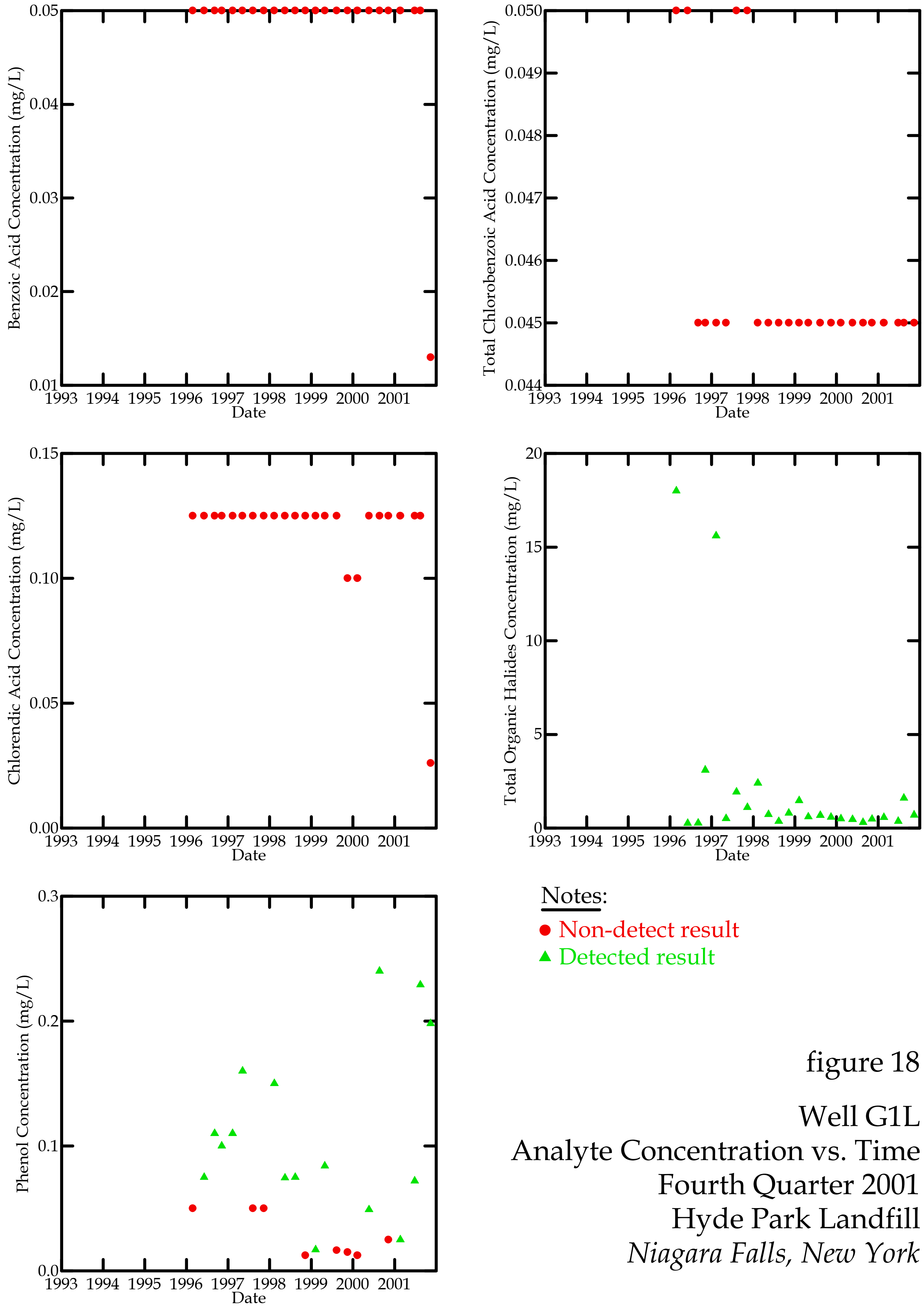




Notes:

- ● Non-detect result
- ▲ Detected result

figure 17

Well G1M
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

- ● Non-detect result
- ▲ Detected result

figure 18

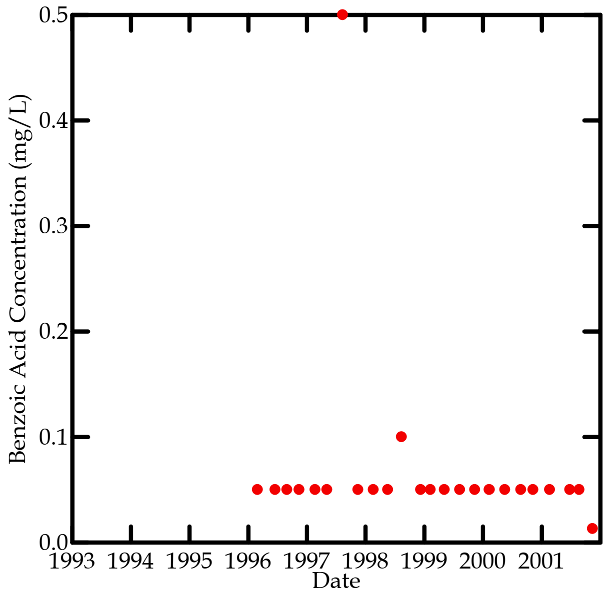
Well G1L

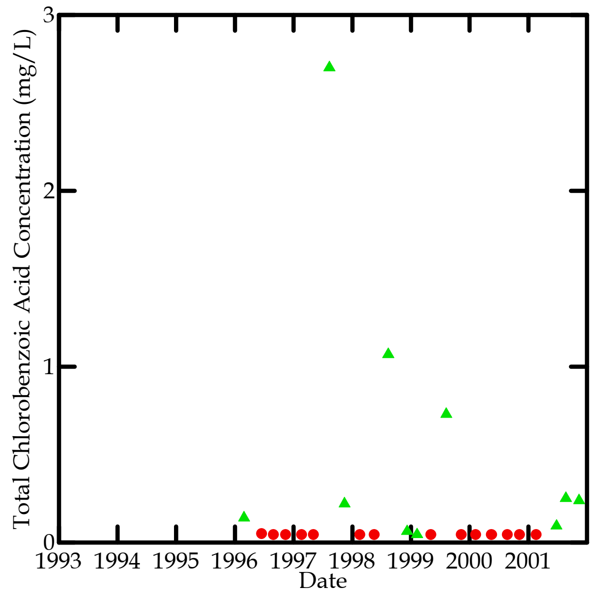
Analyte Concentration vs. Time

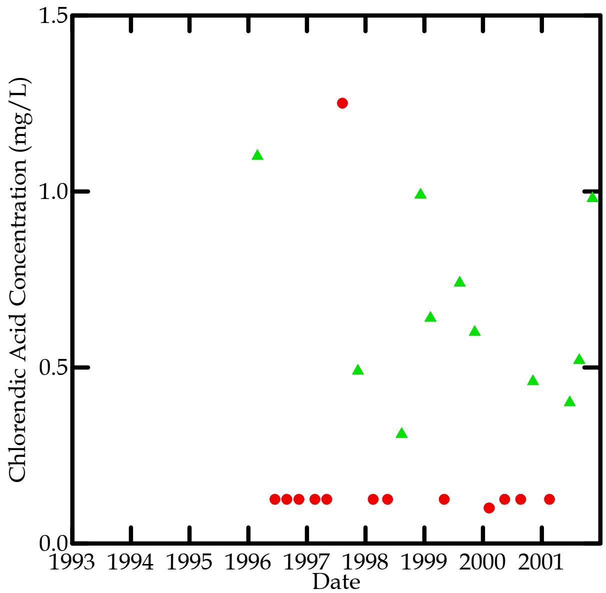
Fourth Quarter 2001

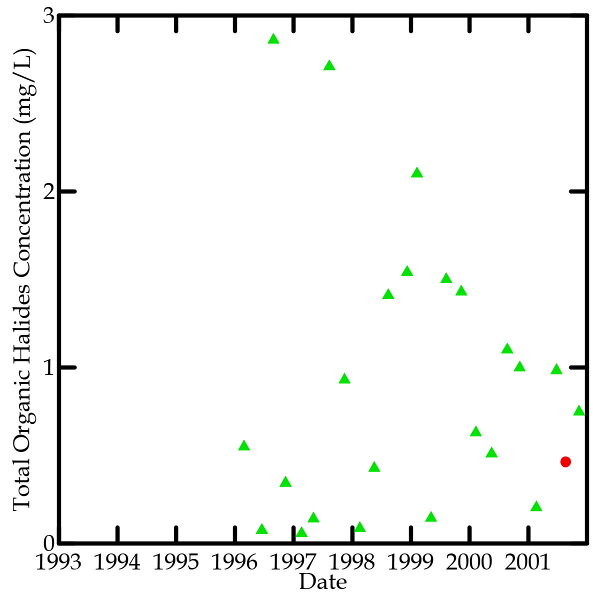
Hyde Park Landfill

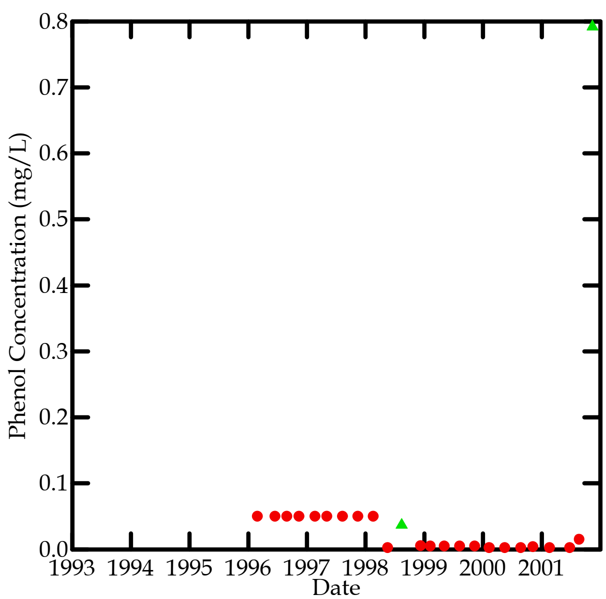
*Niagara Falls, New York*




Notes:

● Non-detect result

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figure 19

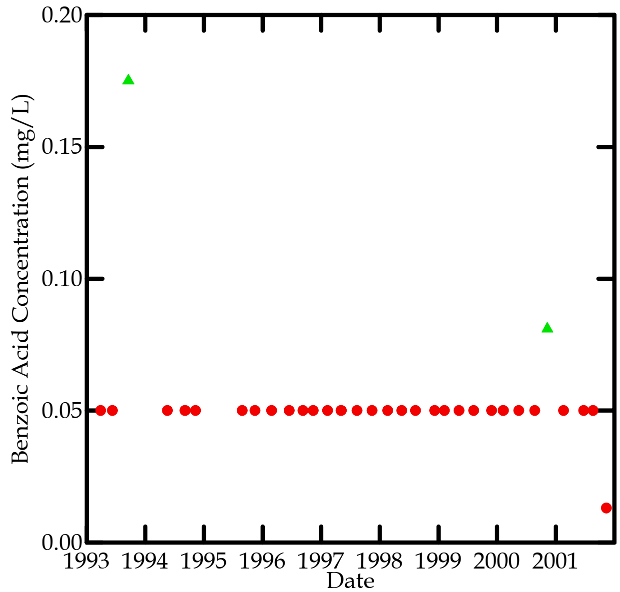
Well H1U

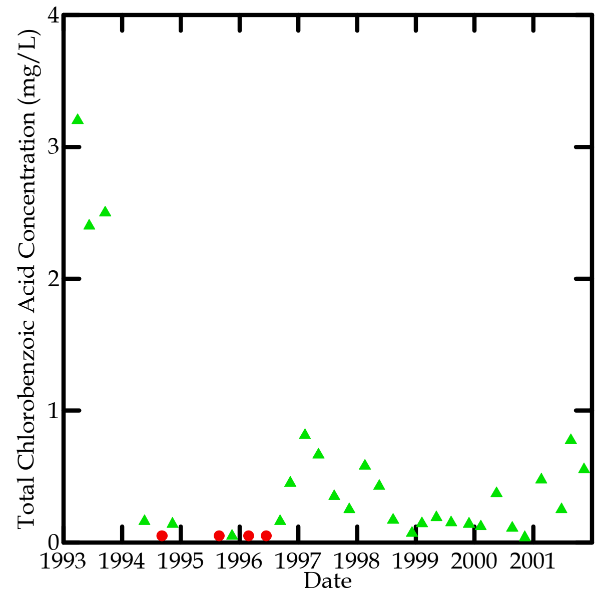
Analyte Concentration vs. Time

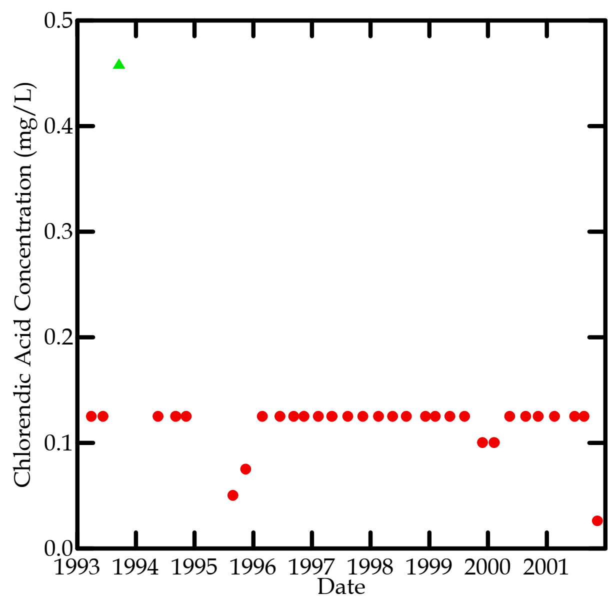
Fourth Quarter 2001

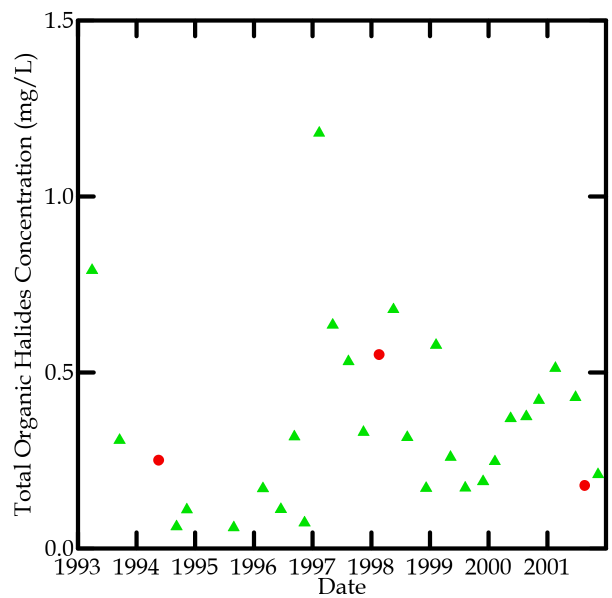
Hyde Park Landfill

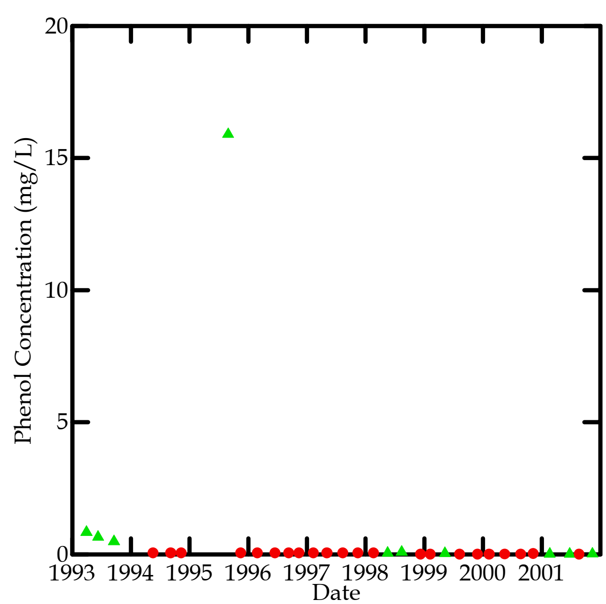
*Niagara Falls, New York*



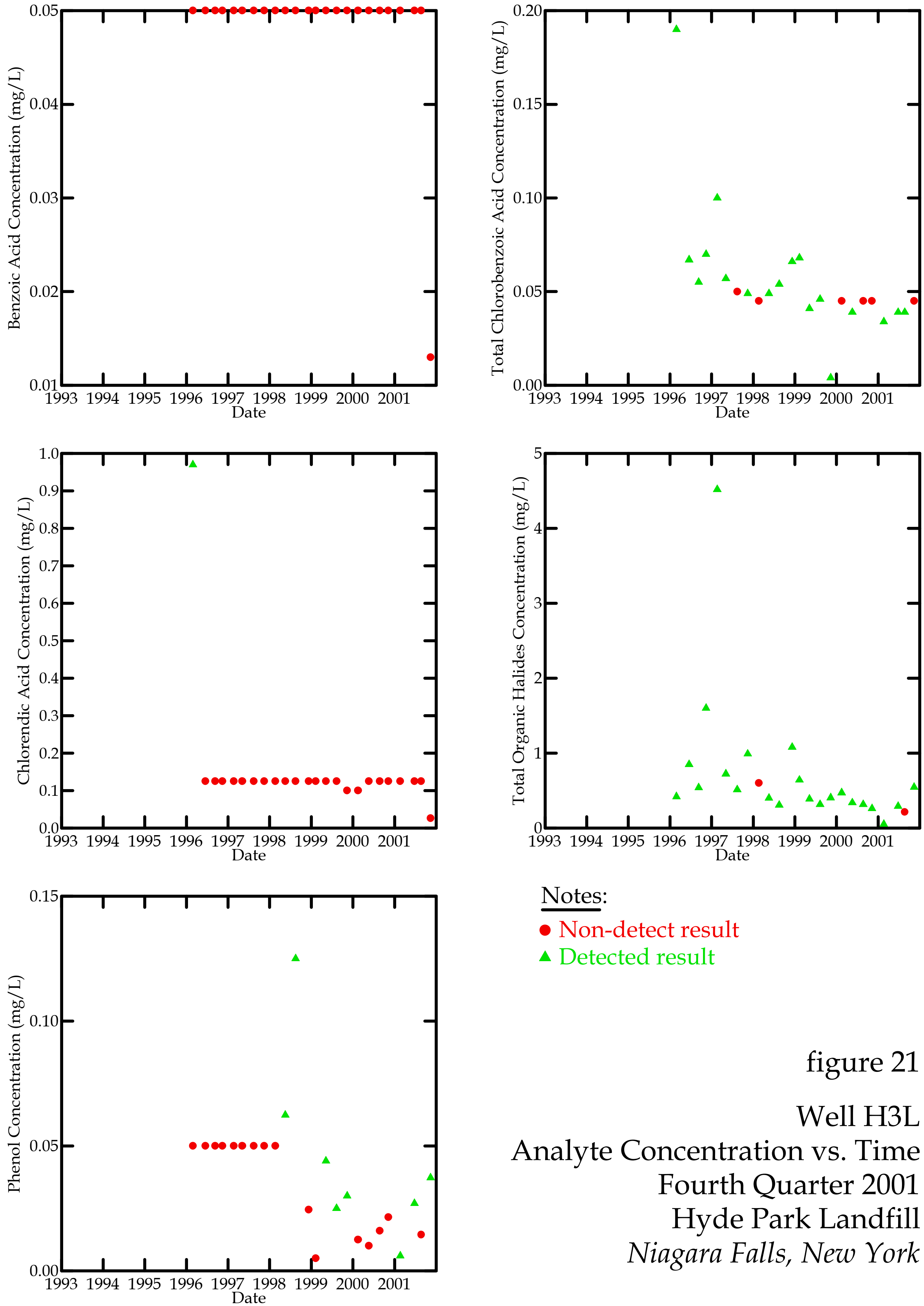




Notes:
- ● Non-detect result
- ▲ Detected result

figure 20

Well H2M
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:

● Non-detect result

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figure 21

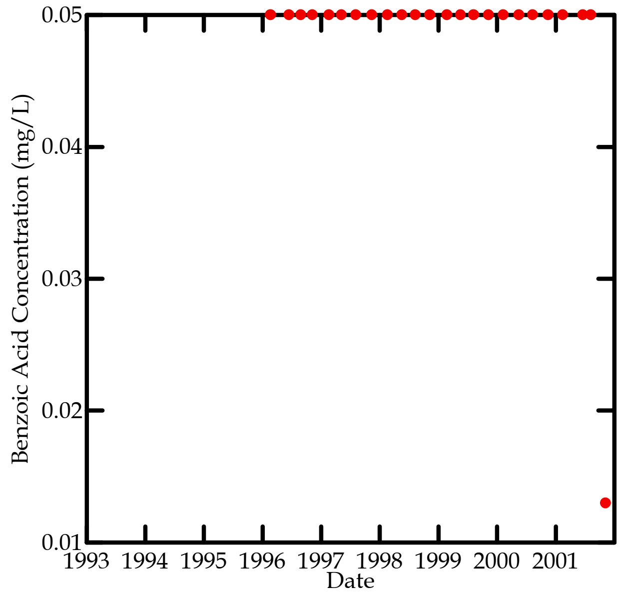
Well H3L

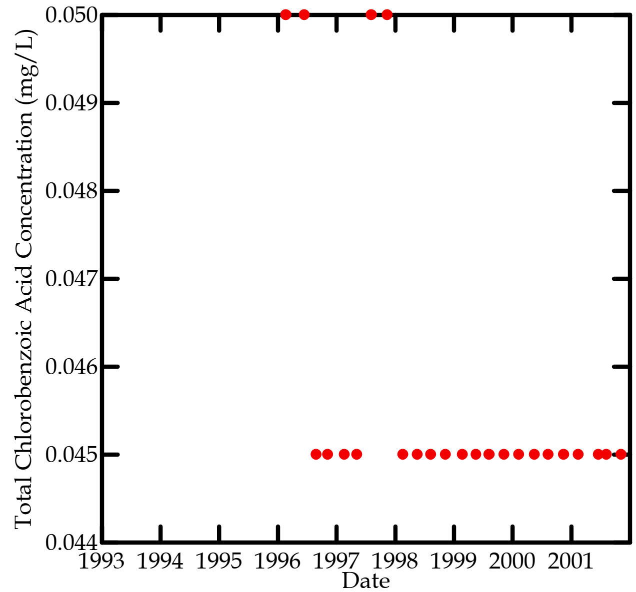
Analyte Concentration vs. Time

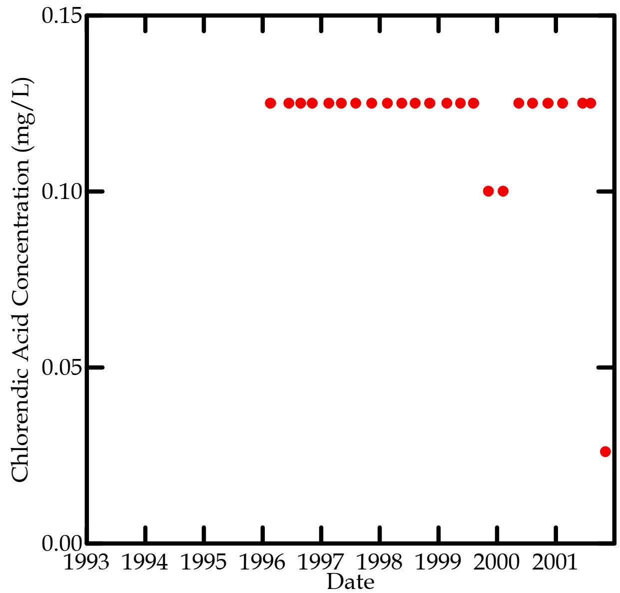
Fourth Quarter 2001

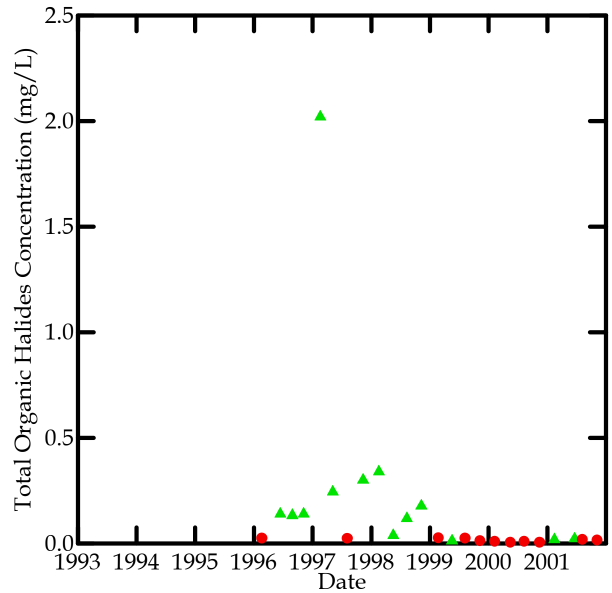
Hyde Park Landfill

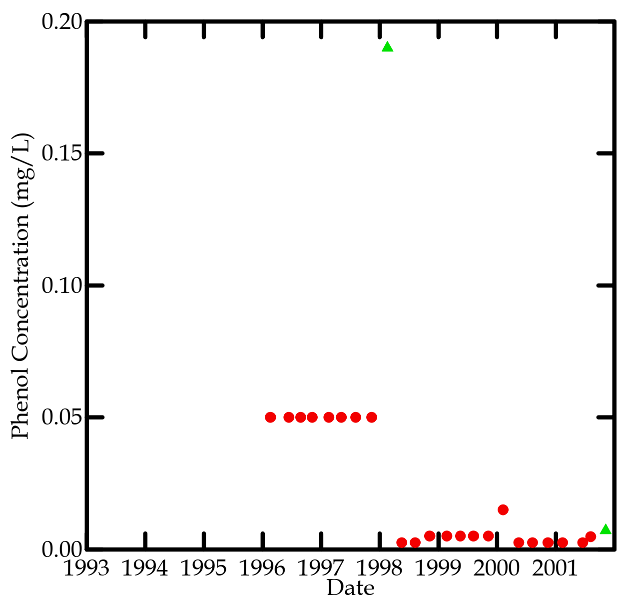
*Niagara Falls, New York*




Notes:

● Non-detect result

▲ Detected result

figure 22

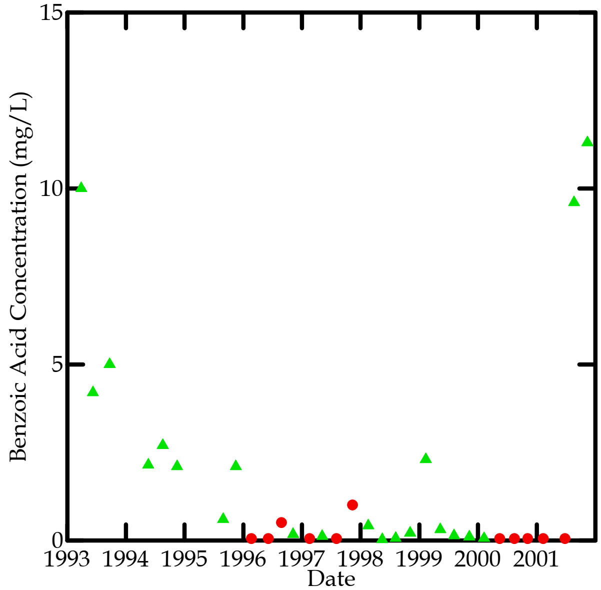
Well J1U

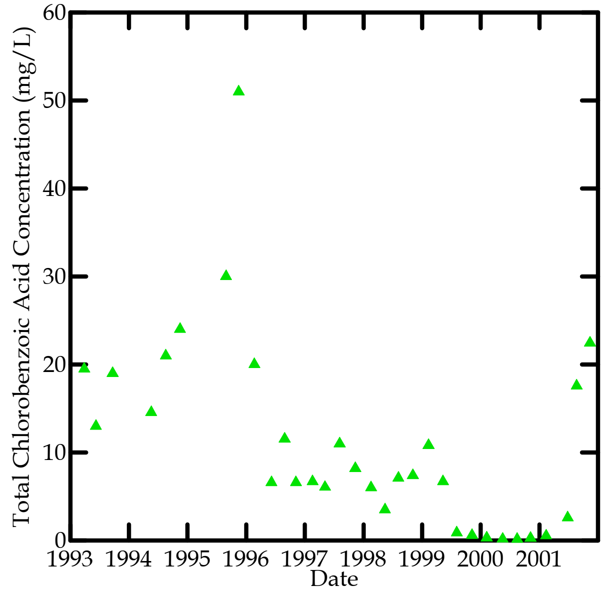
Analyte Concentration vs. Time

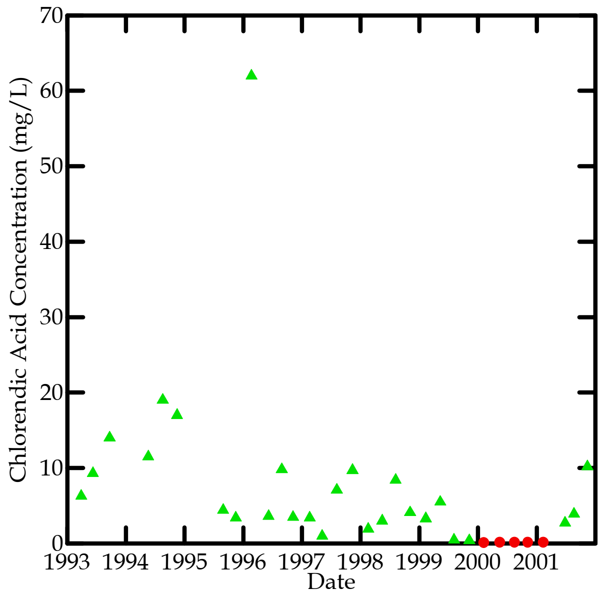
Fourth Quarter 2001

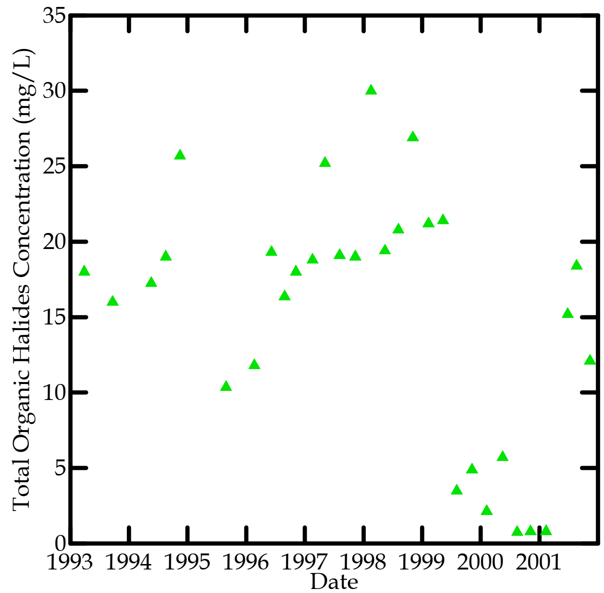
Hyde Park Landfill

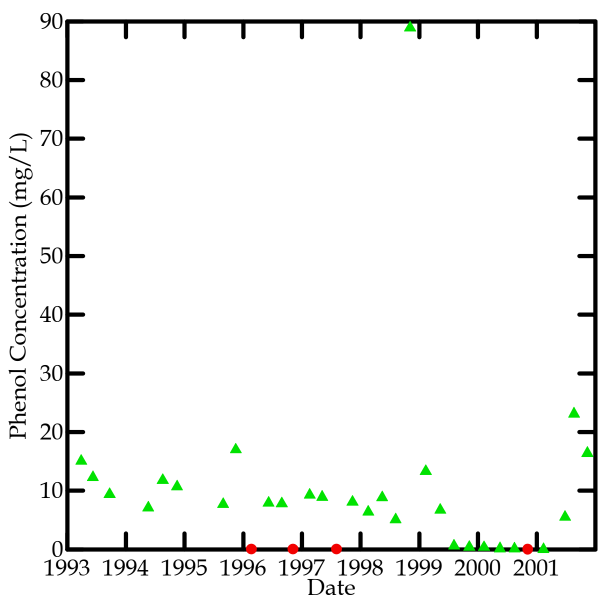
*Niagara Falls, New York*



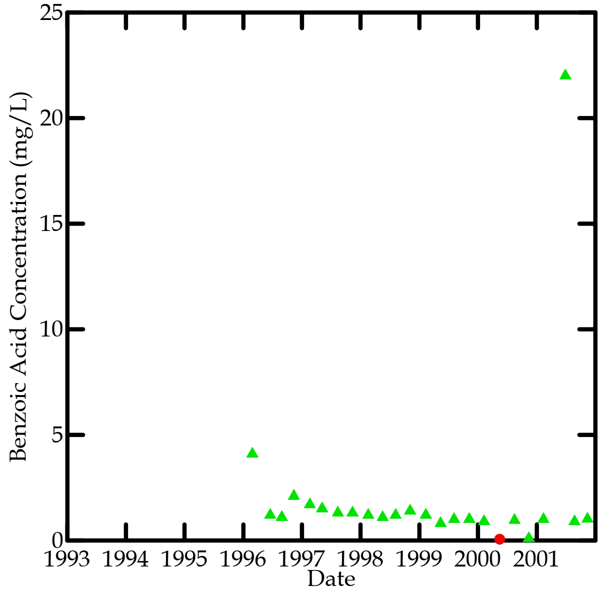



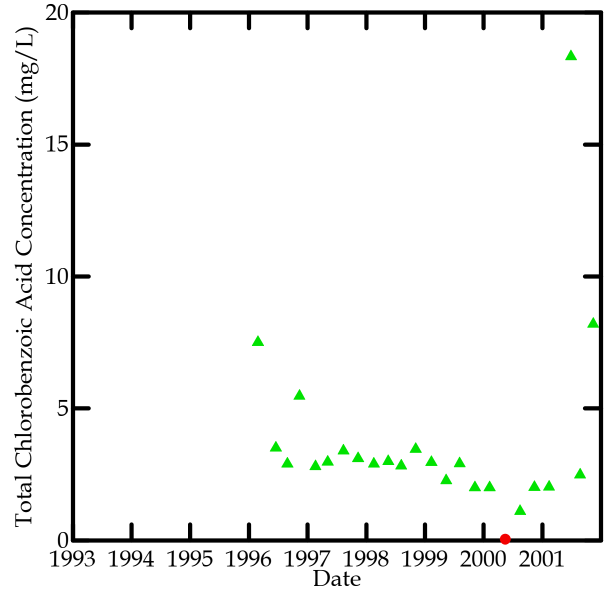

Notes:

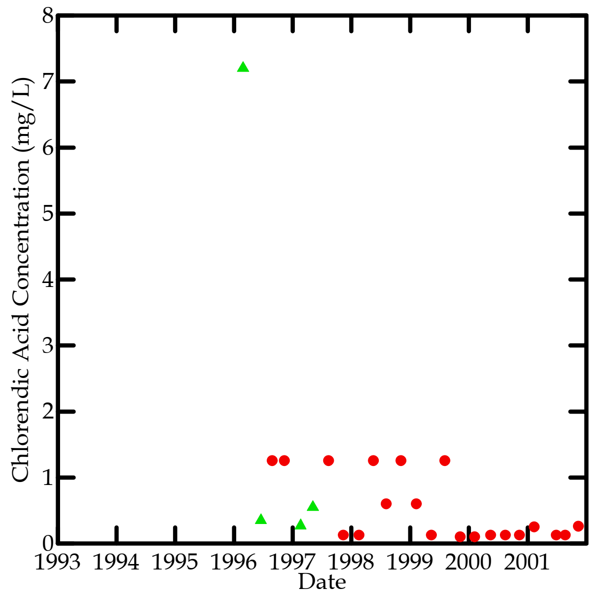
- ● Non-detect result
- ▲ Detected result

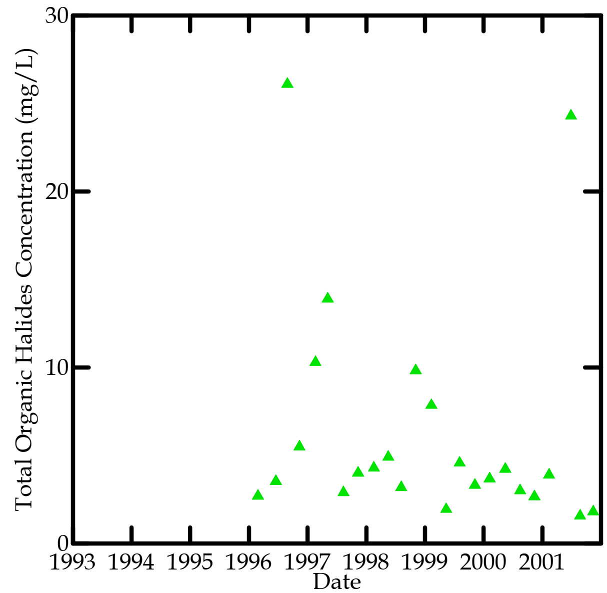
figure 23

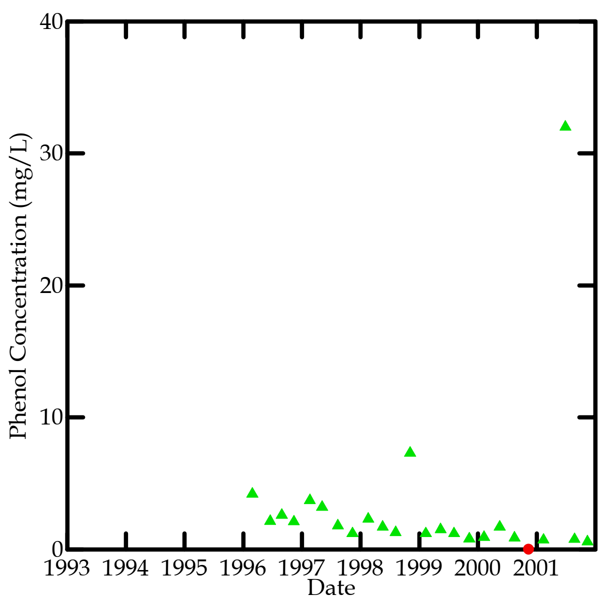
Well J2M
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*




Notes:
- ● Non-detect result
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figure 24

Well J3L
Analyte Concentration vs. Time
Fourth Quarter 2001
Hyde Park Landfill
*Niagara Falls, New York*

APPENDIX B

WORK PLAN FOR DATA COLLECTION DURING THE START OF OPERATION OF THE 2001 PURGE WELLS

# Hyde Park Landfill Site
# Niagara Falls, New York

# Work Plan for Data Collection During the Start of Operation of the 2001 Purge Wells

*Prepared For:*

**Miller Springs Remediation Management, Inc. and Glenn Springs Holdings, Inc.**

*Prepared By:*

**S.S. PAPADOPULOS & ASSOCIATES, INC.**
**Environmental & Water Resource Consultants**

**November 25, 2001**

**207 King Street South, Waterloo, Ontario N2J 1R1 (519) 579-2100**

# Table of Contents

**Page**

# Section 1
# Introduction

Four new bedrock purge wells have been installed at the Hyde Park Landfill Site in 2001, and one existing NAPL purge well has been retrofit for dissolved phase containment. The conceptual design of these wells is based on analyses with the groundwater model of the Site. The initial layout of the wells is described in a letter from G.W. Luxbacher to G.M. Sosa and C.D. Jackson, dated June 11, 2001.

The open intervals of the wells have been specified according to the current site conceptualization. The wells are listed below:

<u>Upper zone</u>

- PW-7U (this well is the retrofit of NAPL purge well PW-7U)
- PW-8U
- PW-9U
- PW-10U

<u>Middle zone</u>

- PW-8M

This Work Plan describes the procedures for starting operation of the new purge wells. Monitoring the start of pumping at each of the new wells offers important opportunities to improve the characterization of particular areas around the Site. The start-up procedures are developed with the specific objective of obtaining relevant hydrogeologic data during start-up. This start-up program will provide data that are critical for future assessments of well performance degradation, for the estimation of long-term pumping rates, and for the evaluation of subsurface properties.

# Section 2
# Start-up Procedures

The start-up procedures described below are designed to collect data on the efficiency of each purge well, and the influence on water levels at nearby observation wells.

Well efficiency is evaluated by performing step tests. A typical step test is conducted by pumping a well at a sequence of constant rates for fixed time intervals, and monitoring the water level in the pumping well. A typical step test is conducted with three or four steps, with progressively higher pumping rates. Due to the design of the pump controllers on the new purge wells, the start-up for each will proceed by pumping a well at a sequence of constant levels for fixed time intervals, and monitoring the water level and pumping rate.

Each well will be started according to the following procedures:

1. The Hyde Park Technical Team will be notified one week in advance that a new well is ready to begin pumping. The contact for the Team will be Rick Passmore. Each new purge well includes automated pump control based on the water level in the well, and will be connected to the Site water treatment plant.

   During the testing of the new Upper purge wells, the existing bedrock purge well network will continue to operate according to normal conditions.

   During the testing of the new Middle purge well PW-8M, wells PW-2M and PW-1L will be deactivated. All other purge wells will continue to operate according to normal conditions. Wells PW-2M and PW-1L will be deactivated four (4) days prior to the start-up of PW-8M, and will remain inactive for one day after the well has been tested. This will allow the determination of the maximum pumping rate at PW-8M.

2. Transducers will be installed in specified observation wells two (2) days before the start-up of each new well. The installation will include confirmation of the transducer reliability by lifting the transducers by 5.00 ft and observing the change in the change in level recorded by the dataloggers. The dataloggers should be scaled to ensure that the correct change is recorded. In addition, manual water level measurements will be collected in the instrumented wells twice per day.

3. During the both the start-up and the subsequent long-term operation, the new purge wells will be operated at specified pumping levels, not at specified rates. This is consistent with the operation of the existing purge wells.

   Each test will be conducted with three (3) fixed water level settings in the pumping well. The fixed levels will be determined prior to the start of pumping, based on the manual water levels measured one day before the test. The start-up will consist of setting the desired pumping level, followed by automatic adjustment of the pumping rate to achieve this level.

   Each step of the purge well start-up will correspond to a drawdown equal to one-third of the available drawdown in the pumping well, $s_{all}$. The pumping levels for each test will be determined by referring to the Figure 1. The required measurements and calculations are listed below.

   1) Measure the depth from the measuring point to the bottom of the well ($W_1$).

   2) Measure the depth from the measuring point to the static water level in the well ($W_2$).

   3) Calculate the allowable drawdown:

   $$s_{all} = W_1 - W_2 - \left(d_s + L_p + 2\right)$$

   where:

   $d$ : minimum depth of submergence of pump
   $L_p$ : length of the pump

   It is assumed in this calculation that the base of the pump is 2 ft above the bottom of the well. Figure 1 indicates a minimum depth of submergence of 5 ft. If a minimum submergence of less than 5 ft is feasible, then a larger allowable drawdown will be determined at the time of testing.

   4) Calculate the operating pump levels for each step ($X_1$, $X_2$ and $X_3$):

   $$X_1 = Z_1 - W_2 - \frac{s_{all}}{3}$$

   $$X_2 = X_1 - \frac{s_{all}}{3}$$

   $$X_3 = X_2 - \frac{s_{all}}{3}$$

   where $Z_1$ is the elevation of the measuring point.

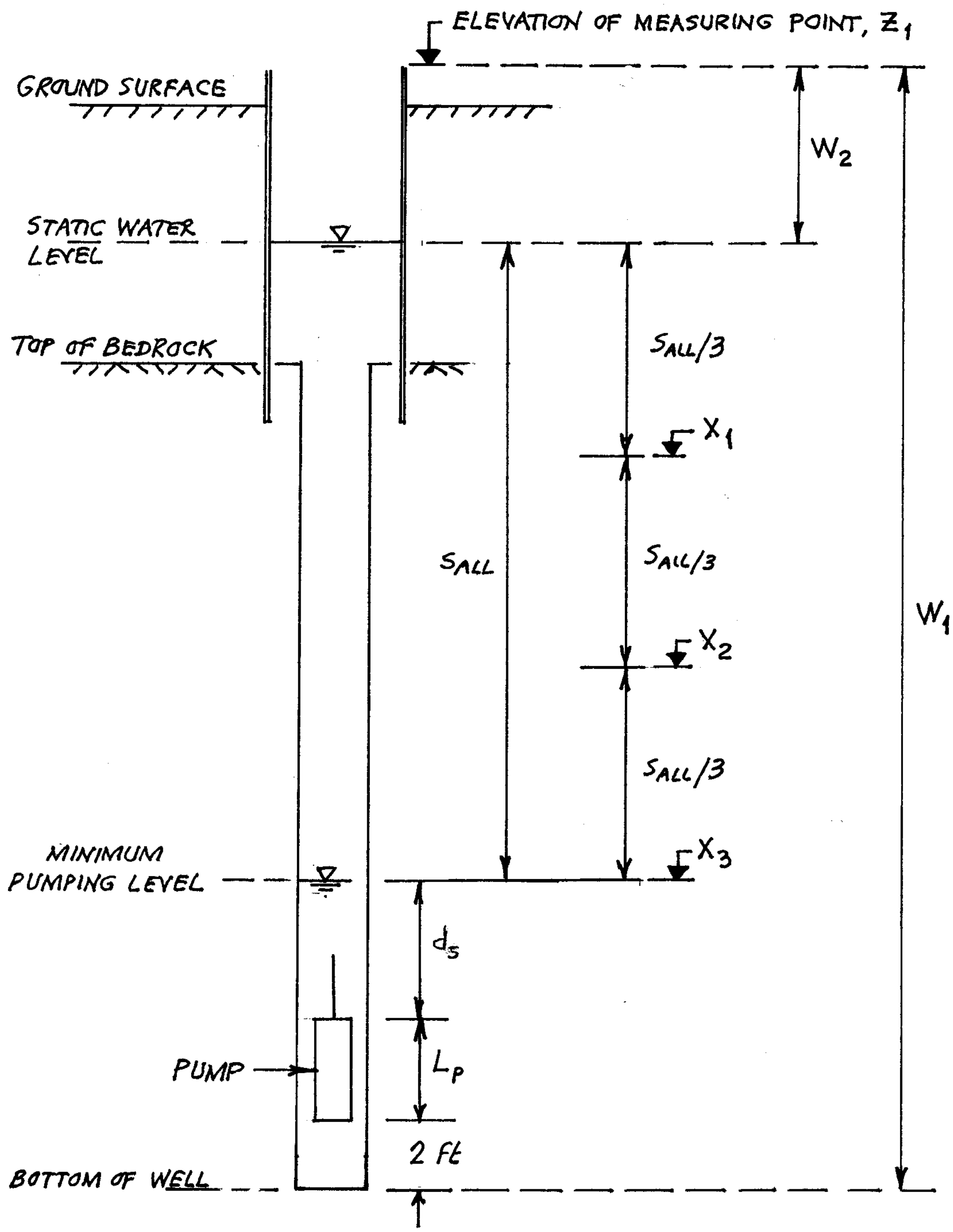


Figure 1. Schematic of well pumping levels

4. The first two steps of the start-up will each last two hours. The purge wells will be operated continuously at the level set during the third step of the start-up.

   Based on the results of analyses conducted with the existing Site groundwater model, our estimates of the long-term pumping rates are:

| **Purge Well** | **Anticipated long-term pumping rate (gpm)** |
|---|---|
| PW-7U | 6 |
| PW-8U | 4 |
| PW-9U | 3 |
| PW-10U | 1 |
| PW-8M | 8 |

# Section 3
# Data Collection During Start-Up

During the start-up of each well, water levels will be measured in the purge well and at selected observation wells. In addition, the barometric pressure and pumping rates of all purge wells will be monitored.

## 3.1 Measurements of water levels

Water levels will be measured automatically with transducers and manually with an electric tape.

- Water levels in the selected observation wells will be measured manually at least twice during the day before pumping, once one hour before pumping, every hour during pumping, and once one day after the start of the third step.
- Water levels in the purge well will be measured manually at least twice one day before pumping, one hour before pumping, every half hour during start-up, and once one day after the start of the third step of the start-up.
- The transducers in the observation wells will be set to begin measuring water levels two days before each start-up, and end one day following the start of the third step of each new purge well start-up. The dataloggers will be set to record levels at five-minute intervals.

The monitoring schedule for each start-up is shown schematically on Figure 2.

## 3.2 Measurement of barometric pressure

The barometric pressure will be measured continuously with a transducer throughout each test, including one day before and after pumping.

## 3.3 Measurement of pumping rates

The pumping rate of the purge well being activated will be recorded on five-minute intervals.

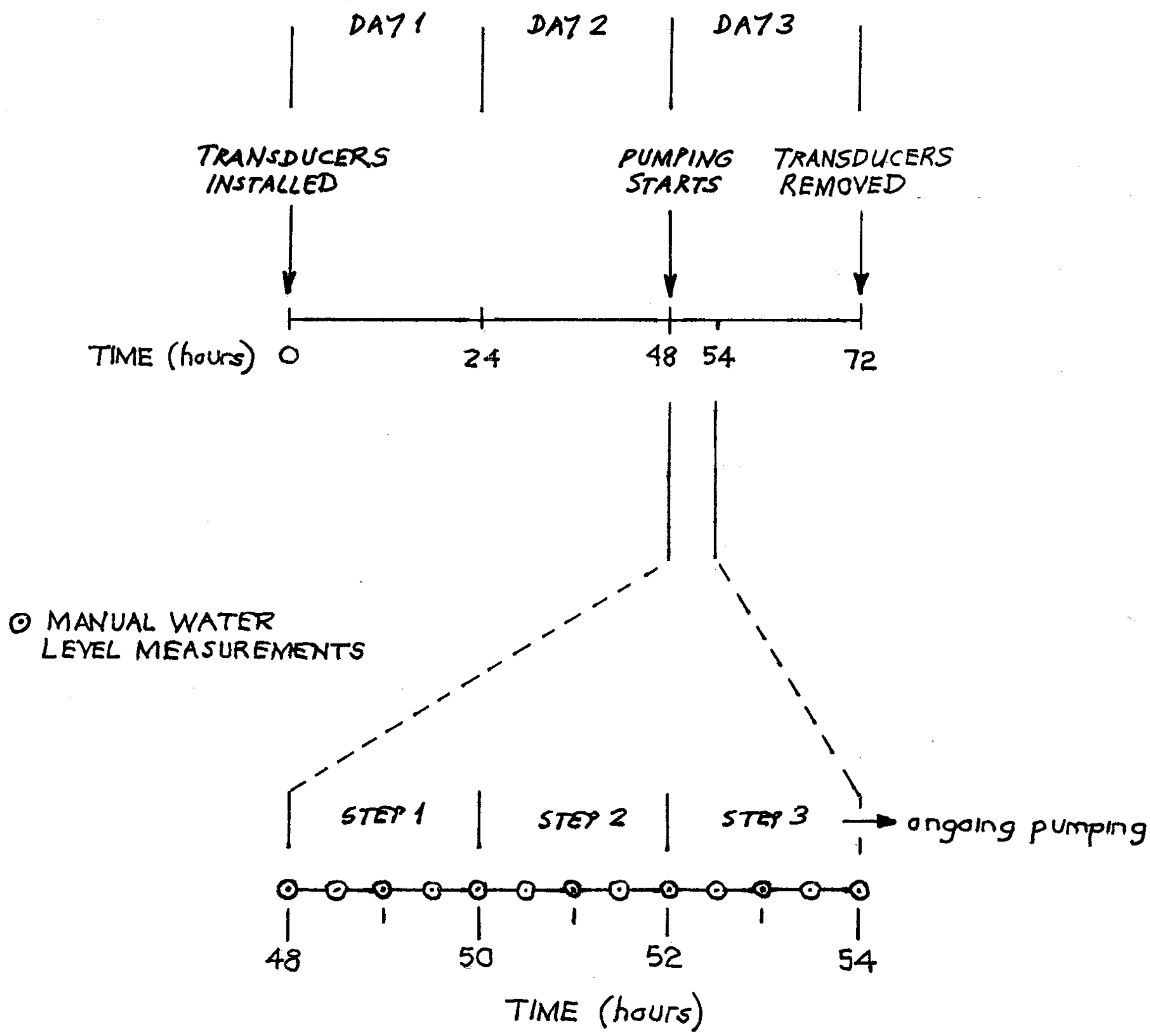


**Figure 2. Schematic of start-up monitoring schedule**

## 3.4 Monitoring wells for the start-up of the new Upper purge wells

The observations wells for each new Upper well test are listed below.

| Purge Well | Observation wells |
|---|---|
| PW-7U | CD5U, CD6U, CD3U, BC3U, CMW12OB, CMW12SH |
| PW-8U | MW5-2001, MW6-2001, B1U |
| PW-9U | MW3-2001, MW4-2001, AB1U |
| PW-10U | MW1-2001, MW2-2001, A2U |

## 3.5 Monitoring wells for the start-up of the new Middle well PW-8M

The start-up of PW-8M will be monitored more intensively than the Upper wells. The following wells will be equipped with transducers:

<u>Middle wells</u>

B1M
B2M
BC3M
C1M
C2M
CD1M
PMW-1M

<u>Lower wells</u>

B1L
B2L
BC3L
C1L
C2L
PMW-1L

# Section 4
# Field Procedures

## 4.1 Disposal of wastewater

Each well will start pumping only after it has been connected to the Hyde Park treatment plant by forcemains. Therefore, no wastewater will be generated at the wellheads.

## 4.2 Decontamination of Equipment

All downhole tools and cables will be decontaminated between uses in each well. In general, where dense non-aqueous phase liquid (DNAPL) is not encountered, decontamination will consist of scrubbing with soap and water followed by a water rinse. If DNAPL is encountered, decontamination will consist of scrubbing with "OCT" (available on-Site) to remove visible DNAPL, followed by scrubbing with soap and water followed by a water rinse.

## 4.3 Health and Safety

All work conducted at the Site will be performed in accordance with the document entitled "Site Health and Safety Plan, Hyde Park Landfill Site, Niagara Falls, New York" dated September 1995.

# Section 5
# Schedule

The commissioning of the Upper wells will begin with PW-7U. The starts of the remaining Upper wells can commence on a well-by-well basis. That is, the individual wells may be tested as they are connected to the treatment plant, and their order is not important. Furthermore, all of the existing wells can continue operating during the tests.

PW-8M, will be started after the Upper wells have commenced continuous operation. The Technical Team will be notified one week before the anticipated completion of the well. Wells PW-2M and PW-1L will be stopped four days prior to the start of testing, and will remain inactive during the testing of PW-8M. The temporary stoppages of pumping at PW-2M and PW-1L will maximize the available drawdown at PW-8M, and thereby allow determination of its maximum possible capacity.

# Section 6
# Data Collection and Reporting

Professional staff of Conestoga-Rovers & Associates (CRA) will be responsible for data collection and compilation. S.S. Papadopulos & Associates, Inc. will direct the data interpretation, with input and review from CRA and Sayko Environmental Data Analysis (SEDA).

The purge wells will remain in continuous operation after the end of the third step of the start-up phase, with the levels set to achieve maximum drawdowns. The pumping data for each purge well will be evaluated after the first complete month of joint operation. The performance of the augmented purge well system will then be simulated with the existing groundwater flow model, using the average pumping rates over the period. The results and evaluation of the well start-up program will be documented in a report that will be submitted to the U.S. EPA and New York State DEC for their review.

# Appendices

A1. Agency comments on the new purge well start-up work plan

A2. Responses to agency comments on the new purge well start-up work plan

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

November 20, 2001

Mr. George Luxbacher
Hyde Park Coordinator
Glenn Springs Holdings, Inc.
2480 Fortune Drive, Suite 300
Lexington, Kentucky 40509

Re: Hyde Park Remedial Program, EPA/State Comments on the *Work Plan for Data Collection During the Start of Operation of the 2001 Purge Wells*,, Hyde Park Landfill, Niagara Falls, New York

Dear Mr. Luxbacher:

The governments have reviewed the *Work Plan for Data Collection During the Start of Operation of the 2001 Purge Wells*, dated November 1,, 2001, prepared by S.S. Papadopoulis AND Associates, Inc., under the direction of Miller Springs Remediation Management, Inc. (MSRM), and provide the following comments:

## SPECIFIC COMMENTS

S-1. Section 1. Introduction. Page 1. Third paragraph,. Please include the overall objective of the start-up program (i.e., inward hydraulic gradient, hydraulic containment, etc.) in this section.

S-2. Section 2. Start -up Procedures. Page 2. Item Number 1. second paragraph. This paragraph needs to be clarified to clearly state that the existing purge wells will continue to operate during the upper zone step tests as noted in Section 5. Then separate out into another bullet or item number the test at PW-8M.

S-3. Section 2. Start-up Procedures. Page 2. Item Number 3. It is understood that the long term operation of the will be operated at specified pumping levels, not at specified rates. However, the model has predicted that pumping rates, and the cone of influence of each new pumping well (see Figure 16 of the Groundwater Modeling Study: Conceptual Evaluation of NAPL Plume Containment, dated March 15, 2001). Therefore, the checking/monitoring of pumping rates are critical to the overall evaluation of the hydraulic containment system.

S-4. Section 2. Start-up Procedures. Page 3. Item Number 3. In the equation, the subscript (s) is missing from the (d) in $(d + L_p + 2)$.

S-5. **Section 2. Start-up Procedures. Page 3. Item Number 4.** Should ($Z_1$) be referenced to static water level instead of top of casing? Also note the ($Z_1$) on the schematic of Figure 1.

S-6. **Section 2. Start-up Procedures. Page 4. Figure 1.** Vertical lines 1 and 2 shown on Figure 1 should be labeled as $W_1$ and $W_2$.

S-7. **Section 2. Start-up Procedures. Page 5. Item Number 4.** The first two steps have been designated to run for two hours each. How was this time arrived at? Is there flexibility in the duration of time for the first two steps - can they run longer or for less time? Also, please state very clearly, the duration of the third step. Will the third step run for 24 hours, and then end or will the pump remain running indefinitely while you go on to the next well for testing?

S-8. **Section 2. Start-up Procedures. Page 5. Table.** Several of the pumping rates stated in this table are different than those stated in the Groundwater Modeling Study: Conceptual Evaluation of NAPL Plume Containment, dated March 15, 2001. For example the Work Plan states that pumping well PW-10U will be pumped at only 1 gpm. Whereas the Conceptual Evaluation Model indicated that this well will be pumped at 5.2 gpm. Was the decrease in flow rate based on the results of the pumping tests performed at PW-10U after the well was installed? If so, then the Work Plan should provide the rationale for the change in the pumping rates.

S-9. **Section 3.1. Data Collection. Page 7. First paragraph.** Will all the wells being monitored have transducers?

S-10. **Section 3.1. Data Collection. Page 8. Figure 2.** The schematic on page 8 needs to be labeled along its lower section to indicate the hours monitored. Label it as Hours and then indicate hour 1, 2, 3, ........... Also, indicate the duration of the third pump step.

S-11. **Section 3.4. Monitoring Wells for the start-up of the New Upper Purge Wells. Page 9. Table.** As stated in comment no. 9, will all the wells listed in the table have transducers? Section 3.5 states that all the middle zone wells will have transducers installed. Does this mean that some of the upper zone wells will not have transducers installed?

S-12. **Section 5. Schedule. Page 11. Second paragraph.** In order to determine if a downward gradient exists, between the upper and the middle zone, it may be more appropriate to start with the middle zone well first. The new upper zone wells should then be turned on, after the middle zone has been tested. Additionally, several upper zone wells should be monitored during the middle zone pumping test.

The governments look forward to the startup of the 2001 purge wells and analyzing the data collected. Should you have any questions concerning this submission, please contact Gary E. Kline, P.E., at (518) 457-5636 or Gloria M. Sosa at (212) 637-4283.

Sincerely,

Gloria M. Sosa
United States Environmental
Protection Agency
Hyde Park-Bloody Run Area
Program Coordinator

Craig Jackson, P.E.
New York State Department of
Environmental Conservation
State Hyde Park-Bloody Run Area
Alternate Program Coordinator

cc: M. Basile, EPA

# GLENN SPRINGS HOLDINGS, INC.

**2480 Fortune Dr. - Suite 300 - Lexington, KY 40509**

*George W. Luxbacher* *Telephone (859) 543-2159*
*Director - Operations* *Facsimile (859) 543-2171*


November 26, 2001

Ms. Gloria M. Sosa
Site Investigation & Compliance Branch
U.S. EPA, Region II
290 Broadway, 20th Floor
New York, New York 10007-1866

Mr. Craig D. Jackson, P.E.
Technical Support Section
Bureau of Western Remedial Action
Dept. of Environmental Conservation
50 Wolf Road, Room 222
Albany, New York 12233-7010

Re: Hyde Park Remedial Program
Work Plan for Data Collection During the Start of Operation of the 2001 Purge Wells

Dear Ms. Sosa and Mr. Jackson:

Attached are responses to agency comments on the Work Plan for Data Collection During the Start of Operation of the 2001 Purge Wells. The revised version of the work plan incorporates the changes indicated in these responses, as well as a copy of the agency comments and our responses.

If you have any questions please feel free to contact me.

Sincerely,

*for* George W. Luxbacher, P.E., Ph.D.
Director, Operations

**S-1.** **<u>Section 1. Introduction. Page 1. Third paragraph.</u>**
**Please include the overall objective of the start-up program (i.e., inward hydraulic gradient, hydraulic containment, etc.) in this section.**

The objectives of the start-up and the accompanying monitoring program for each new purge well are described in the last paragraph of Section 1. "The start-up procedures are developed with the specific objective of obtaining relevant hydrogeologic data during start-up. This start-up program will provide data that are critical for future assessments of well performance degradation, for the estimation of long-term pumping rates, and for the evaluation of subsurface properties." Evaluation of containment or gradients is not part of the well startup program.

**S-2.** **<u>Section 2. Start -up Procedures. Page 2, Item Number 1, second paragraph.</u>**
**This paragraph needs to be clarified to clearly state that the existing purge wells will continue to operate during the upper zone step tests as noted in Section 5. Then separate out into another bullet or item number the test at PW-8M.**

The text of the work plan will be modified as follows:

*During the testing of the new Upper purge wells, the existing bedrock purge well network will continue to operate according to normal conditions.*

*During the testing of the new Middle purge well PW-8M, wells PW-2M and PW-1L will be deactivated. All other purge wells will continue to operate according to normal conditions. Wells PW-2M and PW-1L will be deactivated four (4) days prior to the start-up of PW-8M, and will remain inactive for one day after the well has been tested. This will allow the determination of the maximum pumping rate at PW-8M.*

**S-3.** **Section 2. Start-up Procedures. Page 2. Item Number 3.**
**It is understood that the long term operation of the will be operated at specified pumping levels, not at specified rates. However, the model has predicted that pumping rates, and the cone of influence of each new pumping well (see Figure 16 of the Groundwater Modeling Study: Conceptual Evaluation of NAPL Plume Containment, dated March 15, 2001). Therefore, the checking/monitoring of pumping rates are critical to the overall evaluation of the hydraulic containment system.**

In the long term operation of the purge wells, the computer control system will maintain the pumping water levels at fixed elevations, and will record the pumping rate of each purge wells every 20 minutes. This is how the system has always operated. Furthermore, the current RRT defines hydraulic gradient monitoring as the measurement of performance, not pumping rates. It is the objective of MSRM to meet the requirements of the RRT if possible, and the intent of the RRT if hydraulic gradient monitoring proves to be infeasible.

**S-4. Section 2. Start-up Procedures. Page 3, Item Number 3.**
**In the equation, the subscript (s) is missing from the (d) in $(d + L_p + 2)$.**

Noted. The equation will be corrected in the final text.

**S-5. <u>Section 2. Start-up Procedures. Page 3, Item Number 4.</u>**
**Should $(Z_1)$ be referenced to static water level instead of top of casing? Also note the $(Z_1)$ on the schematic of Figure 1.**

Noted. If we define $Z_1$ as the survey elevation of the measuring point on the well casing, the definition of the first operating pump level $X_1$ is incorrect. The correct relation should be:

$$X_1 = Z_1 - W_2 - \frac{s_{all}}{3}$$

The inclusion of the term $W_2$ (the depth from the measuring point to the static water level) effectively references the pumping level to the static water level instead of the top of casing.

Figure 1 will be modified to indicate the quantity $Z_1$.

**S-6. <u>Section 2. Start-up Procedures. Page 4. Figure 1.</u>**
**Vertical lines 1 and 2 shown on Figure 1 should be labeled as $W_1$ and $W_2$.**

Noted. Figure 1 will be modified to indicate correctly the quantities $W_1$, and $W_2$.

**S-7. Section 2. Start-up Procedures. Page 5. Item Number 4.**
**The first two steps have been designated to run for two hours each. How was this time arrived at? Is there flexibility in the duration of time for the first two steps - can they run longer or for less time? Also, please state very clearly, the duration of the third step. Will the third step run for 24 hours, and then end or will the pump remain running indefinitely while you go on to the next well for testing?**

The two-hour duration of the first two steps has been selected based on our estimation of the time required for steady pumping conditions to be established. All aspects of the tests will be under the control of professional staff and there is flexibility in the duration of these steps. The tests may be modified based on the results of on-site reviews of drawdown data, as they are collected.

The third pumping step will also last for two hours. However, once the third step is completed, each new purge well will remain pumping at the level set for the third step. In other words, the pump will remain running while we go on to the next well for testing. Water levels in the pumped well will be measured frequently with a water level tape only during the first two hours of the third step. Water levels in the purge well and the designated observation wells will be monitored with transducers during the first 24 hours of pumping.

**S-8. Section 2. Start-up Procedures. Page 5. Table.**
**Several of the pumping rates stated in this table are different than those stated in the Groundwater Modeling Study: Conceptual Evaluation of NAPL Plume Containment, dated March 15, 2001. For example the Work Plan states that pumping well PW-10U will be pumped at only 1 gpm. Whereas the Conceptual Evaluation Model indicated that this well will be pumped at 5.2 gpm. Was the decrease in flow rate based on the results of the pumping tests performed at PW-10U after the well was installed? If so, then the Work Plan should provide the rationale for the change in the pumping rates.**

The analyses presented in the report *Groundwater Modeling Study: Conceptual Evaluation of NAPL Plume Containment*, dated March 15, 2001, do not represent the final conceptual design basis for the new purge wells. Additional analyses were conducted following the meeting with the agencies on June 6, 2001. The results of the final conceptual design were submitted in a letter to the agencies on June 11, 2001. The pumping rates assumed in this analysis are tabulated below. The new purge wells are indicated with an asterisk. The rates indicated in the table are consistent with the information presented in the work plan.

| Well | Pumping rate (gpm) |
|---|---|
| PW-1U | 0.3 |
| PW-2UR | 1.5 |
| PW-4U | 0.7 |
| PW-5UR | 5.7 |
| PW-6UR | 0.0 |
| PW-7U* | 5.9 |
| PW-8U* | 4.4 |
| PW-9U* | 3.4 |
| PW-10U* | 1.1 |
| PW-2M | 20.5 |
| PW-3M | 0.0 |
| PW-4M | 0.0 |
| PW-6MR | 0.0 |
| PW-8M* | 7.8 |
| PW-1L | 20.0 |
| PW-2L | 3.0 |
| PW-3L | 6.6 |
| **Total** | **80.9** |

* indicates a new purge well

It is important to note that the pumping rates presented here are estimates to be used only for planning purposes. The actual yield of the well at the specified drawdowns will determine the actual pumping rate for each step.

The 'success' of each new purge well installation will not be assessed in terms of the pumping rate that is achieved. Rather, a purge well will be judged to be a success if it assists in accomplishing the goal of containment of the NAPL plume. The preliminary performance of each well will be evaluated in terms of the influence the well has on water levels in nearby observation wells.

**S-9. Section 3.1. Data Collection. Page 7. First paragraph.**
**Will all the wells being monitored have transducers?**

All of the monitoring wells identified in Section 3.4 (new Upper purge wells), and Section 3.5 (PW-8M) will be equipped with transducers. For the Upper purge wells, this will require between three and six transducers in observation wells per test. Thirteen (13) transducers will be required for the observation wells during the start-up of PW-8M.

**S-10. Section 3.1. Data Collection. Page 8. Figure 2.**
**The schematic on page 8 needs to be labeled along its lower section to indicate the hours monitored. Label it as Hours and then indicate hour 1, 2, 3, ........... Also, indicate the duration of the third pump step.**

Noted. Figure 2 will be modified to indicate the hours.

As indicated in the description of Step 4 of the Start-up Procedures, and in the response to comment S-7, each new purge well will be operated continuously at the level set at the beginning of the third step. The current plan calls for the well to be left operating at the level set at the start of the third step once the first two hours of pumping at the third level have elapsed. Water levels will monitored continuously for another 18 hours after the start of the third step (that is, 24 hours from the beginning of the first step).

**S-11. Section 3.4. Monitoring Wells for the start-up of the New Upper Purge Wells. Page 9. Table.**
**As stated in comment no. 9, will all the wells listed in the table have transducers? Section 3.5 states that all the middle zone wells will have transducers installed. Does this mean that some of the upper zone wells will not have transducers installed?**

As indicated in the response to comment S-9, all of the monitoring wells identified in Section 3.4 (new Upper purge wells), and Section 3.5 (PW-8M) will be equipped with transducers.

**S-12. <u>Section 5. Schedule. Page 11. Second paragraph.</u>**
**In order to determine if a downward gradient exists, between the upper and the middle zone, it may be more appropriate to start with the middle zone well first. The new upper zone wells should then be turned on, after the middle zone has been tested. Additionally, several upper zone wells should be monitored during the middle zone pumping test.**

There is no question as to the presence of a downward gradient between the Upper and Middle bedrock, it is present across the Site. As discussed in the response to S-1, the step tests are intended to assess well efficiency, estimate long term pumping rates, and to estimate local hydraulic properties. They are <u>not</u> designed or intended to provide an evaluation of horizontal or vertical hydraulic gradients. As discussed in previous meetings, MSRM and its consultants are currently studying monitoring procedures for hydraulic gradients. The step tests are not part of that evaluation.

We doubt that the alternate pumping sequence described in the work plan will provide us with different results than observed during the shutdown. We believe however, that activating the new Upper purge wells first will accelerate the execution of the tracer tests. The design of the tracer test requires that purge well PW-7U be operating regularly prior to the release of tracer.

Water levels in selected Upper wells will be monitored with an electric tape during the start-up of PW-8M, to ensure that no data are missed. In particular, we will measure water levels in wells in the clusters indicated in Section 3.5 (B1U, B2U, C1U, C2U).