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June 19, 2009

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Dear Ms. Sosa:

**NECCO PARK 2008 ANNUAL REPORT**

Enclosed are four copies of the *Remedial Action Post-Construction Monitoring 2008 Annual Report* for the DuPont Necco Park Hydraulic Controls System (HCS), Groundwater Treatment Facility (GWTF), and landfill cap.

This fourth annual report for the Necco Park Remedy has been prepared pursuant to Administrative Order (AO) Index No. II CERCLA-98-0215 dated September 28, 1998, issued by United States Environmental Protection Agency (USEPA). This report describes hydraulic and chemistry monitoring conducted in 2008 as required by the *Long-Term Groundwater Monitoring Plan*, dated April 2005 for the DuPont Necco Park Site located in Niagara Falls, New York.

Construction and start-up of the HCS and GWTF was substantially complete on April 5, 2005. Thereafter, the systems have been operated in accordance with the Operations and Maintenance Plan (O&M Plan). System operation uptime for 2008 was 84.0 %. Most of the downtime occurred in August and September and is attributed primarily to hydraulic testing of newly installed recovery well RW-11. Improved hydraulic control in the upper bedrock in the western portion of the site began in 4Q08 when new B/C-Zone pumping well RW-11 was put into operation. Well RW-11 was installed to replace recovery well RW-10 that exhibited diminished hydraulic efficiency soon after startup in 2005.

Approximately 512 gallons of DNAPL was recovered in 2008. This Annual Report provides a detailed evaluation of system operation with respect to the Performance Standards presented in the Necco Park Statement of Work (SOW).

Please call me at (716) 278-5496 if you have any questions or comments regarding this submittal.

Sincerely,

CORPORATE REMEDIATION GROUP

Paul F. Mazierski
Project Director

PFM/mac
Enc.
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cc: J. Kaczor/Earth Tech, M. Hinton/NYSDEC

# REMEDIAL ACTION POST-CONSTRUCTION MONITORING
# 2008 ANNUAL REPORT
# DUPONT NECCO PARK
# NIAGARA FALLS, NY

| | | |
|---|---|---|
| Date: June 19, 2009 | Project No.: | 507537<br>18985651.09002 |

CORPORATE REMEDIATION GROUP
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*DuPont and URS Diamond*

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# EXECUTIVE SUMMARY

This fourth Annual Report for the Necco Park Remedial Action has been prepared pursuant to Administrative Order (AO) Index No. II Comprehensive Environmental Response, Compensation and Liability Act (Superfund) (CERCLA)-98-0215 dated September 28, 1998, and issued by United States Environmental Protection Agency (USEPA). This report describes hydraulic and chemistry monitoring conducted in 2008 as required by the *Long-Term Groundwater Monitoring Plan*, dated April 2005 for the DuPont Necco Park Site located in Niagara Falls, New York.

The Necco Park Remedial Action consists of an upgraded cap over the landfill and a groundwater hydraulic control system (HCS). The HCS includes a network of five groundwater pumping wells and a groundwater treatment facility (GWTF). Construction and startup of the HCS and GWTF was substantially complete on April 5, 2005. Thereafter, the systems have been operated in accordance with the Operations and Maintenance Plan (O&M Plan). System operation uptime for 2008 was 84%. Discounting scheduled maintenance shutdowns, system uptime for 2008 was 85.4%. Summaries of system operations and hydraulic head data have been provided to the USEPA and the New York State Department of Environmental Conservation (NYSDEC) previously in the 2008 Quarterly Data Packages. This Annual Report provides a detailed evaluation of system effectiveness with respect to the Performance Standards presented in the Necco Park Statement of Work (SOW).

Hydraulic monitoring data from 2008 show that overall the HCS has maintained hydraulic control of the source area. Improved hydraulic control in the upper bedrock in the western portion of the site began in 4Q08 when new B/C-Zone pumping well RW-11 was put into operation. Well RW-11 was installed to replace recovery well RW-10 which had exhibited diminished hydraulic efficiency soon after startup in 2005. Well RW-11 includes a 170 ft section of blast fractured bedrock trench (BFBT) in the B-Zone and a bedrock open hole in the C-Zone.

In accordance with the Long-Term Groundwater Monitoring Plan (LGMP), annual groundwater sampling began in 2008 after three years of biannual sampling. Groundwater sampling results from 2008 continue to show an overall decrease in concentrations of total volatile organic compounds (TVOCs) for all flow zones compared to historical results. The 2008 results indicate:

- ☐ With the exception of two source area limit wells, TVOC concentrations for the A-Zone were below 10 μg/l
- ☐ TVOC concentrations at key source area limit wells, such as 150B and 172B, continue to decline
- ☐ Similar decreasing or stable TVOC concentrations are apparent in the deeper bedrock zones and at key source area limit wells such as 146E

The 2008 results were compared to the zone-specific source area limits provided in the 100% design submittal for overburden and bedrock hydraulic controls. Compared to the first year of long term monitoring in 2005, the 2008 results for the respective groundwater flow zones indicate a general reduction in the number of wells where solubility criteria (1% of pure-phase and effective) are met. Groundwater chemistry results compiled since the HCS has been operational indicate declining TVOC trends at many of the monitoring locations and support modifications to chemical monitoring program starting in 2010.

Hydraulic monitoring completed in 4Q08 indicates operation of new recovery well RW-11 has greatly enhanced the hydraulic control of the A-Zone and C-Zone in the west portion of the site. Results from continued monitoring are expected to show enhanced control of the B-Zone. Continued efforts will be made in 2009 to improve the hydraulic efficiency of recovery well RW-5 including evaluations to improve the long-term groundwater recovery at this location.

Results of the 2008 monitored natural attenuation (MNA) evaluation are consistent with the long term monitoring and previous findings indicating natural attenuation of site constituents is occurring under anaerobic degradation processes. Concentrations of site constituents have decreased in the majority of downgradient wells monitoring the B- through F-Zones. The presence of biochemical reaction products and microbial populations capable of degrading site constituents confirms MNA is providing beneficial groundwater remediation. Sampling for natural attenuation parameters (groundwater geochemistry and COC's) will be continued at the frequency described in the LGMP with the last year of assessment in 2009. Results of the MNA evaluation support discontinuing monitoring of some downgradient and sidegradient wells where contamination is not present or just marginally above detection limits.

Approximately 512 gallons of dense nonaqueous-phase liquid (DNAPL) was recovered in 2008. All of the DNAPL was recovered from B/C-Zone Recovery Well RW-5. Routine monitoring completed in 2008 show that DNAPL was only observed at well RW-5. A total of 8,335 gallons of DNAPL has been removed since initiation of the recovery program in 1989.

# 1.0 PROJECT DESCRIPTION

## 1.1 Site Background

The DuPont Necco Park site is located approximately 1.5 miles north of the Niagara River in a predominantly industrial area of Niagara Falls, New York (see Figure 1-1). Necco Park is a 24-acre inactive industrial waste disposal site. Detailed site background including operational history, regulatory background, and site geology and hydrogeology are provided in numerous site documents including the previous Annual Reports.

## 1.2 Source Area Remedial Action Documentation and Reporting

The approved remedy includes construction of the Overburden and Bedrock Source Area Hydraulic Controls and the Landfill Cap Upgrade. Completion of the remedy and compliance with the Performance Standards described in the SOW are documented in the Remedial Action Report (RAR). This 2008 Annual Report presents hydraulic and chemical monitoring results from the third complete year of operation of the hydraulic controls. In addition, the Annual Report includes historical groundwater chemistry results for assessment of trends in groundwater quality.

The following documents are applicable to the Necco Park long-term monitoring program and this report:

- ☐ Long-Term Groundwater Monitoring Plan (LGMP)
- ☐ Cap Maintenance and Monitoring Plan (CMMP)
- ☐ Sampling, Analysis, and Monitoring Plan (SAMP)
- ☐ Quality Assurance Project Plan (QAPP)
- ☐ DNAPL Monitoring and Recovery Plan
- ☐ Necco Park Source Area Report

With the exception of the Necco Park Source Area Report, these documents are included in the Necco Park Operations & Maintenance (O&M) Plan [DuPont Corporate Remediation Group (CRG), 2005]. The draft O&M Plan was submitted to USEPA in April 2005. A revised plan, which addresses Agency comments on the April 2005 submittal, was sent to USEPA and NYSDEC in November 2005. DuPont responded to additional EPA comments on the O&M Plan in September 2006. USEPA approved the O&M Plan on September 19, 2007. The Necco Park Source Area Report was submitted to the USEPA and NYSDEC in April 2001.

# 2.0 HCS OPERATIONS SUMMARY

The O&M Manual for the hydraulic control system (HCS) is provided as Appendix C in the O&M Plan. The O&M Manual has been prepared in accordance with DuPont Process Safety Management (PSM) guidelines and includes a technology description and standard operating procedures for the groundwater recovery and treatment system. The groundwater O&M Manual, in conjunction with vendor O&M Manuals, describes normal operation and shutdown procedures, emergency shutdown procedures, alarm conditions, and trouble-shooting and preventative maintenance procedures for the treatment system and hydraulic controls.

## 2.1 Operational Summary

Operational information for the HCS is provided in the 2008 Quarterly Data Packages (DuPont CRG 2009, 2008, 2008a, 2008b). A summary of system operations for 2008 follows:

| | HCS Uptime (%) | HCS Uptime [excluding scheduled maintenance downtime] (%) | Groundwater Treated (Gallons) | DNAPL Removed (Gallons) |
|---|---|---|---|---|
| 1Q08 | 92.6 | 93.5 | 2,761674 | 65 |
| 2Q08 | 95.9 | 95.9 | 2,902,261 | 279 |
| 3Q08 | 77.2 | 80.0 | 3,112,202 | 124 |
| 4QQ8 | 70.3 | 72.2 | 3,468,710 | 44 |
| **2008 Total** | **84.0** | **85.4** | **12,244,847** | **512** |

A summary of monthly groundwater quantities and uptime for each recovery well is provided in Table 2-1.

The HCS remained fully operational throughout 2008, averaging 84% total system uptime through December 31, 2008. The groundwater treatment facility (GWTF) downtime has been minimized by continuously monitoring operating conditions and implementing mechanical and procedural changes to the process equipment and the Honeywell Experion$^{TM}$ PKS operating system. Excluding downtime incurred due to planned maintenance, total system uptime for 2008 was 85.4%.

HCS downtime was a result of unexpected mechanical and process-related malfunctions, scheduled maintenance, power failures, and hydraulic testing of new B/C-Zone recovery well RW-11. The following table summarizes HCS downtime in 2008:

| Reason | Contributing Downtime % | Comments |
|---|---|---|
| Process Component Malfunction | 14% | Unexpected process-related downtime as a result of mechanical component failure. |
| Scheduled Maintenance shutdowns and system upgrades/inspections | 1.4% | Routine inspections, interlock verification, preventative maintenance, pump test, and mechanical upgrades to process-related infrastructure. |
| Power service disruption | 0.6% | Primarily due to inclement weather |

Scheduled maintenance shutdowns are based on operating conditions and the necessity to take corrective or preventative action to mitigate the need for future, larger scale maintenance. These shutdowns occur routinely to inspect, repair, and/or upgrade process-related components to ensure long-term operational success. Efforts to minimize downtime during planned maintenance shutdowns are employed. Influent tank capacity is utilized while maintenance occurs to minimize recovery well downtime. System enhancements and inspections to the GWTF contributing to operational downtime were primarily associated with the scheduled annual maintenance shutdown. The shutdown, completed from December 17th to December 19th, included cleaning of effluent lines, process-related lines, air strippers, and tanks. In addition to these measures, all pumps and process-related infrastructure were inspected and maintained as necessary.

Downtime associated with 3Q08 was attributed primarily to the hydraulic testing of the newly installed recovery well RW-11. Downtime during 4Q08 occurred mostly in December and was attributed to equipment malfunctions and failures associated with RW-5 in addition to the scheduled maintenance shut down. Additionally, the entire system was not operational from December 28th through December 30th due to a failure of the process control system module.

## 2.2 GWTF Process Sampling

In accordance with the SAMP, quarterly process sampling is conducted to assess the effectiveness of the treatment system in removing volatile organic compounds (VOCs) from groundwater. Two influent samples (one from the B/C-Zone influent tank and one from the D/E/F-Zone influent tank) are collected. One effluent sample is collected from the combined effluent tank. The samples are analyzed for VOCs, semi-volatile organic compounds (SVOCs), total barium, dissolved barium, and sulfate. A summary of results for the process sampling conducted in 2008 is provided in Table 2-2.

In addition to the quarterly process sampling, groundwater samples were collected from four of the five recovery wells in August 2008. The results were originally submitted in the 3Q08 Quarterly Data Package and are also included in Appendix A of this report. Well RW-10 was not operating at the time of the recovery well sampling event therefore a sample was not completed at this location. Groundwater samples were collected from new replacement well RW-11 during the pumping tests. Results for those samples are provided in Appendix B.

## 2.3 Process Sampling Summary

A Significant Industrial User (SIU) permit with the Niagara Falls publicly-owned treatment works (POTW) regulates the treated groundwater effluent discharged from the site. Quarterly sampling conducted at the permitted discharge point (MS#1) demonstrates that the GWTF is operating as designed. The Wastewater Discharge Permit (Permit No. 64) is due to expire on May 1, 2009. A required application and applicable documentation will be submitted to Niagara Falls POTW by April 3, 2009.

Throughout 2008, the GWTF remained in compliance and is in good standing with the Niagara Falls POTW regarding the Wastewater Discharge Permit (SIU #64), with the exception of a daily maximum exceedance for hexachlorobutadiene and an annual average exceedance of hexachloroethane in 3Q08. Calculated loading for hexachlorobutadiene and hexachloroethane exceeded the daily maximum and annual average limits, respectively, for the 3Q08 sample collected on June 10, 2008. In accordance with our discharge permit, two additional samples were collected (September 4th and 5th) and reported in the 4Q08 report. The additional sampling results for hexachlorobutadiene indicate that the current daily maximum limit for this compound is adequate. However, an increase in the annual average maximum limit for hexachloroethane from the current 0.015 lb/day up to 0.025 lb/day was requested.

Subsequent correspondence with the Niagara Falls POTW indicated that the anomalous sample for hexachloroethane (3Q08) be removed from the calculated annual average versus raising the annual average limit for that compound.

## 2.4 Recovery Well RW-5 Rehabilitation

Recovery well RW-5 was not operational from March 18th to March 21st and November 1st to November 7th due to scheduled well rehabilitation. The bottom of the open-hole well was cleaned of sediment via air lifting methods. Using a drill rig and length of drill rod fitted with ½-inch diameter steel cable secured perpendicular to the drill rod, the open rock hole portion of the well was then scrubbed by rotating the drill string. Scrubbing of the rock hole was concentrated on the depth of the water-bearing fractures. After the well scrubbing, solids were removed from the well using air lift methods. Additionally, 32% HCL was added to the well as part of the cleaning process. After a period of short-term well yield increase for both cleaning events, well yield returned to pre-cleaning levels. Subsequent well fouling has continued and further analysis to alleviate the problem will be completed in 2009. Following the March well cleaning, modifications were made to the overhead electrical service at well RW-5 so that future well cleaning can be completed without extended periods of electrical outage.

## 2.5 Recovery Well RW-10 Replacement

As discussed in the previous Annual Reports, hydraulic control efficiency of recovery well RW-10 has decreased since startup thereby reducing the overall effectiveness of the HCS in the B/C-Zone in the western portion of the site. Conventional rehabilitation methods to improve well efficiency had limited success. A new B/C-Zone recovery well

(RW-11) was installed in 2008 to replace well RW-10. A summary of the well installation is provided in Appendix B.

# 3.0 HCS PERFORMANCE

## 3.1 Hydraulic Head Monitoring

Groundwater hydraulic head measurements are the basis for determining control of groundwater flow in the overburden and bedrock groundwater flow zones by the HCS at Necco Park. Depth-to-water measurements and measuring point elevation data are used to calculate the elevation of groundwater and to generate hydrographs which show groundwater elevation trends in individual monitoring wells. These measurements are also used to generate potentiometric surface-contour maps, which depict groundwater elevation distribution for assessing flow directions and hydraulic gradients. Together, these data presentations are used to determine the extent and effectiveness of hydraulic control effect by the HCS at Necco Park. Potentiometric surface contour maps for the A-Zone through F-Zone include the zone-specific source area limits.

Quarterly groundwater level measurements collected during 2008 were presented in the Quarterly Data Packages (DuPont CRG 2009, 2008, 2008a, 2008b). Potentiometric surface-contour maps for the AT-Zone (top-of-clay), A-Zone (overburden), and bedrock zones B, C, D, E and F were also presented in the 2008 Quarterly Data Packages and are used in this report to assess effectiveness of hydraulic control of the HCS. Monitoring and recovery well locations are shown in Figure 3-1. A list of groundwater monitoring locations is provided in Table 3-1.

Long-term hydrographs for select wells and piezometers within each water-bearing zone are presented in Figures 3-2 through Figure 3-8. The hydrographs depict long-term groundwater hydraulic responses to startup and operation of the HCS.

Potentiometric surface-contour maps included in this report were selected from maps prepared and presented in the 2008 Quarterly Data Packages. Golden Software's SURFER™ program was used to interpolate water level data, develop potentiometric surface contours, and plot groundwater flow directions. A Kriging algorithm with a linear semi-variogram model and a slope of 1 was used as the standard method to interpolate groundwater elevations between wells, unless otherwise noted.

## 3.2 Hydraulic Control Assessment

As described in Section 2.5, measures were taken in 2008 to improve B/C-Zone hydraulic control in the western portion of the site by installing a recovery well in a blast fractured bedrock trench (BFBT). The new recovery well, RW-11, replaces existing well RW-10. Short-term assessment results indicate improved hydraulic control through the operation of recovery well RW-11. A detailed discussion of the hydraulic influence of well RW-11 is provided in Appendix B.

### 3.2.1 AT-Zone and A-Zone

The overburden materials comprising the A-Zone are generally characterized by high clay content and low hydraulic conductivity. Groundwater flow in the A-Zone is primarily downward to the more transmissive fractured bedrock. The AT-Zone (also known as the top-of-clay zone) is a thin presumably perched zone of saturation above the A-Zone. It is not a continuous zone and is absent in the western portion of the site where the overburden thickness diminishes and within portions of the Necco property footprint where excavation/landfilling activities have eliminated any AT/A-Zone distinction.

Figures 3-9 and 3-10 present typical AT-Zone and A-Zone potentiometric surface contours (November 13, 2008) resulting from continuous operation of the HCS.

### Long-Term Response to HCS Operation

Long-term AT and A-Zone baseline (non-pumping) hydraulic conditions were established on April 5, 2005, after the shutdown of the former pumping well network and Interim Treatment System on April 1, 2005 and prior to the startup of the HCS. Calculated AT-Zone and A-Zone long-term drawdowns (expressed as positive numbers) are presented in Tables 3-2 and 3-3, respectively. The tables indicate that the HCS has maintained drawdowns in 2008 in both the AT-Zone and A-Zone.

As can be seen in Table 3-2, AT-Zone long-term 2008 drawdowns for selected piezometers ranged between 0.99 and 6.55 feet. All of the calculated responses are consistently positive (i.e. true drawdown) with an average of 4.48 ft of drawdown for the year. This indicates substantial dewatering of the AT-Zone has been maintained by the continued operation of the HCS. All of the selected AT-Zone piezometers remained below their pre-startup elevations for all of 2008. A plot of November 13, 2008, AT-Zone drawdowns is presented in Figure 3-11.

As can be seen in Table 3-3, A-Zone long term drawdowns for selected wells during 2008 ranged between 0.03 and 9.24 feet. All drawdowns are consistently positive. This indicates that substantial dewatering of the A-Zone has been maintained by the continued operation of the HCS. Drawdowns for the selected A-Zone piezometers remained below their pre-startup elevations in 2008 with an average of 3.29 ft of drawdown for the monitored locations. A plot of May 15, 2008, A-Zone drawdowns is presented in Figure 3-12.

### AT and A-Zone Hydraulic Control

In both the AT-Zone and A-Zone, rapid responses to the short-term changes in groundwater levels in the HCS recovery wells were observed and presented in the 2005 Annual Report. The magnitude of observed drawdowns and the rapidity of responses provide additional evidence that the AT and A-Zones are vertically dominated flow regimes.

Vertical gradients are generally downward (negative) between both the AT/A-Zones and A/B-Zones as presented in Tables 3-4 and 3-5 (2008 average gradients) and shown in Figures 3-13 and 3-14 (November 13, 2008 gradients). In Table 3-4, the upward gradients at the 184AT/A and 185AT/A well pairs are likely the result of slightly overlapping well screens or a result of the absence of any appreciable A-Zone thickness below the clay layer. Also, the average upward and flat gradients at the 119AT/A and 129AT/A well pairs are likely due to structural effects within the landfill. The upward gradients indicated in Figure 3-13 are attributed to the temporary shut-down prior to the start-up of recovery well RW-11.

### 3.2.2 B and C Bedrock Water-Bearing Zones

Groundwater flow directions in the B-Zone were generally consistent throughout the 2008 period of HCS operation with the exception of the March 17, 2008 event, which exhibited a loss of control due to the reduced efficiency of RW-5 prior to rehabilitation (see Table 3-6 and Figures 3-15 and 3-16). Hydraulic control in the B-Zone was generally maintained even with the reduced efficiency of RW-5 and occasional shut downs of RW-10.

Hydraulic heads in the C-Zone were generally higher throughout the 2008 period of HCS operation with the exception of the November 13, 2008, event, which exhibited a response to the two rehabilitation events in RW-5 and the initial operation of RW-11 (see Table 3-7). Typical 2008 C-Zone potentiometric contours are presented in Figure 3-16.

#### B-Zone

Groundwater elevation hydrographs, along with potentiometric surface-contour maps, illustrate the hydraulic effects of the HCS in the B-Zone. RW-4, RW-5 and (as of November 16, 2008) RW-11 have induced inward (toward the recovery wells) hydraulic gradients over a large area (see Figures 3-4 and 3-15). B-Zone influence attributed to RW-4, RW-5, and RW-11 extends north to 120B, 123B, and 159B; west to 116B and 136B; and south to 137B and 168B.

The hydraulic depression in the vicinity of RW-11 was limited due to only 24-hours of operation prior to the water level measurement event.

B-Zone net drawdowns from static are presented in Table 3-6 and are calculated from May 4, 2004 static conditions. Drawdowns indicate that monitoring wells D-14, 146B, 149B, 151B and 163B exhibited reversals from static. Wells 146B, 149B, 151B and 163B are outside the designated source area. The August 13, 2008, reversal of D-14 (a B/C-Zone well) elevation above it’s April 2005 baseline elevation is attributed to the shut down of RW-10.

#### C-Zone

Groundwater elevation hydrographs, along with potentiometric surface-contour maps, illustrate the hydraulic effects of the HCS in the C-Zone. The C-Zone influence attributed to RW-4, RW-5 and (as of November 16, 2008) RW-11 extends north to 115C, 123C, and 159C, west to 136C. The south extent of influence extends to 137C and is obscured by the CECOS landfill between the recovery wells and monitoring wells 150C, 160C and 168C (see Table 3-7 and Figures 3-5 and 3-16). The hydraulic control in the C-Zone is improved significantly in the 4Q08 event with the early November rehabilitation of RW-5 and start-up of replacement well RW-11.

Similar to the B-Zone, C-Zone baseline hydraulic heads for comparison are from May 4, 2004. Generally, in 1Q08 and 2Q08 water levels remained only slightly below their baseline and the drawdown averages, of all the monitoring wells, were less then 1-foot and many locations were above the May 4, 2004, baseline (see Table 3-7). Additionally, 12 of 20 of the 3Q08 water levels were above baseline and the average drawdown was slightly negative. The loss of C-Zone hydraulic control in 3Q08 is attributed to the RW-10 shutdown and the continual loss of efficiency at RW-5. However, 4Q08 water levels indicate greatly improved control with water levels at only three wells above their baseline levels and the average drawdown of all monitoring wells improved to 1.29 feet. The well locations above baseline in 4Q08 were off site (and outside source area limits) wells 146C, 150C and 151C (see Table 3-7).

### 3.2.3 D, E and F Bedrock Water-Bearing Zones

Groundwater elevation hydrographs, along with potentiometric surface-contour maps, illustrate the effectiveness of the HCS in maintaining hydraulic control in the D, E and F-Zones (see Table 3-8, Figures 3-6 through 3-8 and 3-17 through 3-19).

In general, for 2008 all D/E/F-Zone groundwater hydraulic heads remained below the May 4, 2004 baseline for the entire reporting. Hydraulic gradients were toward the recovery wells throughout 2008 indicating the HCS is performing as designed.

## 3.3 Groundwater Chemistry Monitoring

### 3.3.1 Background

Extensive monitoring has been conducted at Necco Park dating back to the early 1980s when groundwater investigations pursuant to the 1986 Consent Decree and the 1989 Administrative Consent Order (ACO) were completed. Pre-Design investigations in the early 2000s enhanced our knowledge of conductivity variations within the flow zones and assisted in the initial estimation of source area extents as introduced in the Analysis of Alternatives (AOA) and negotiated Statement of Work (SOW). Groundwater monitoring will continue per the LGMP to meet the following objectives as defined in the SOW:

- ☐ Monitor the effectiveness of the recovery wells in reducing chemical concentrations in the zone-specific source areas.
- ☐ Monitor the far-field groundwater chemistry to determine if the recovery system is controlling off-site migration of chemical constituents associated with the Necco Park site.
- ☐ Monitor the presence of DNAPL.
- ☐ Monitor natural attenuation and intrinsic bioremediation in the source area and far-field.
- ☐ Continue to evaluate the effectiveness of the remedial action.

The 2005 Annual Report, the first annual status report following completion of hydraulic control elements of the Necco Park remedy, included an extensive discussion of the first monitoring results and how these results compared to source area criteria introduced in the AOA report. This 2008 report provides an update of groundwater chemistry trends, MNA evaluation, and, as appropriate, an update of source area limits.

The list of wells used for long-term monitoring was prepared and is included in the LGMP. In accordance with the LGMP, chemical monitoring is conducted on a semi-annual basis during the first three years of system operation. Sampling frequency thereafter will be annual. Monitoring completed in 2008 represents the first year of annual sampling following three years of semi-annual sampling. Locations of monitoring wells to be used for long-term monitoring are shown in Figure 3-1. Implementation of the long-term chemistry monitoring is discussed in Section 3.3.3. As discussed in Section 3.3.3, groundwater sample results from 2005 to 2008 support modification of the existing chemical monitoring program.

### 3.3.2 Discussion of Results

Original source area limits were provided in the AOA report. As described in the Final (100%) Design Report for Bedrock and Overburden Source Area Hydraulic Controls (CRG, 2003), source area limits for the A-Zone, B/C-Zones, and D/E/F-Zones were reassessed using results from 2000 baseline groundwater sampling event. Sample results from the baseline event, in conjunction with historical DNAPL observations, were used to estimate source area limits as provided in the Source Area Report (SAR) (CRG, 2001). Source area limits presented in the report were used to determine Pre-Design Investigation (PDI) groundwater pumping well locations.

For the purposes of remedial design, the 2000 baseline and Phase 2 PDI groundwater sampling results were used to interpolate source area limits. One of the objectives of the Phase 2 PDI was to refine the southeast limits of the B/C-Zone source area based on Phase 1 PDI observations. Because refinement of the B/C-Zone source area required additional groundwater sampling and analysis, DuPont elected to include sampling of the lower bedrock to also refine the D/E/F-Zone source area limits. Pumping tests conducted during the PDIs and subsequent full-scale operation have shown that the HCS will achieve and maintain hydraulic control of flow-zone specific source areas defined in the 100% design submittal.

Results from the 2008 groundwater sampling have been compared to the same historically employed criterion to evaluate source area limits. Consistent with the AOA, any location where DNAPL was observed at least once was included in the source area. Groundwater chemistry data for the 2008 sampling events was also compared to solubility criteria to evaluate source area extent. Consistent with previous assessments, these included effective solubility for a given compound and one percent of a given compounds' pure-phase solubility.

Effective solubility is defined as the theoretical upper-level aqueous concentration of a constituent in groundwater in equilibrium with a mixed DNAPL. Effective solubility is equal to pure-phase solubility of a given constituent multiplied by the mole fraction of that component in DNAPL. Use of effective solubility criteria is believed to be more representative of sites with DNAPL that consist of relatively complex mixtures of organic compounds (Feenstra et al., 1991), such as those are found at Necco Park site. Calculated solubility criteria for DNAPL compounds evaluated during this study are presented in Table 3-9. A comparison of 2005 through 2008 data to the effective solubility and one percent of pure-phase solubility criteria are provided in Tables 3-10 and 3-11, respectively. A discussion of the results by flow zone is provided below.

#### A-Zone

The A-Zone source area has been defined as the Necco Park property and a limited area south of the property line. The A-Zone source limits have not changed from those provided with the 100% design submittal. The 2008 sample results indicate no exceedances of the solubility criteria. There has been only one exceedance of the solubility criteria since long term monitoring began. The 2005 first round results for well D-11 reported hexachlorobutadiene above the one percent of solubility criteria.

Monthly DNAPL observations conducted at A-Zone well locations in 2008 indicated no DNAPL present at the monitoring locations. The most recent DNAPL observation at an A-Zone well was at well 131A in May 2006. This well is located on the landfill.

Groundwater flow in the A-Zone is predominantly downward. Therefore, hydraulic control of the upper bedrock groundwater flow will capture flow from the A-Zone. As discussed in Section 3.3, hydraulic monitoring completed with new recovery well RW-11 in operation indicate an enhanced degree of A-Zone hydraulic control. Based on the results of the 2008 HCS monitoring, the system is effective in controlling the A-Zone source area.

### B/C-Zone

The B-Zone source limits have not changed from those provided with the 100% design submittal. Results for the B-Zone wells indicated no exceedances of the effective solubility criteria. The 2008 sample results from wells 145C and 168C support the 2005 Annual Report conclusion of a less extensive C-Zone source area.

Exceedances of the more conservative one percent solubility criteria at well location 172B for hexachlorobutadiene (HCBD) represent the limit of the B-Zone source area. As discussed in Section 3.5, TVOC concentrations continue to decrease at this location. Hydraulic control extends to this location. B/C-Zone wells that exceeded the one percent criteria include 139B, 172B, 105C, 136C, and 137C.

DNAPL observations at B and C-Zone well locations in 2008 indicate DNAPL in the upper bedrock is limited to the southeast portion of the site and was only observed at recovery well RW-5. As discussed in Section 3.7, the frequency of DNAPL observations at this location was increased.

Well 105C, located on the landfill near known disposal areas, reported exceedances of the effective solubility and one percent pure phase solubility for a number of compounds. This well is used to monitor MNA in the source area.

Operation of recovery wells RW-4, RW-5, and RW-10 have achieved and maintained hydraulic control of the B/C-Zone source area. As discussed in Section 3.3, improved B/C-Zone hydraulic control in the western portion of the site from the operation of recovery well RW-11 is apparent. Cleaning of recovery well RW-5 in March and November 2008 improved short-term well yield. More aggressive well rehabilitation methods are planned in 2009 to improve yield that will enhance the overall effectiveness of the B/C-Zone HCS.

### D/E/F-Zone

Analytical results from well 146E indicate no exceedances for either solubility criteria since long term chemistry monitored began in April 2005. The 2002 sample results for this location reported TCE above the more conservative one percent solubility criterion.

As such, previously reported constituent concentrations at this location appear to be more indicative of aqueous constituents than the presence of DNAPL.

Based on an exceedance of the more conservative one percent of pure phase solubility criteria for HCBD at well location 165E, the southwest limit of the D/E/F-Zone source area limit lies between well locations 165 and 137, which is consistent with the previous sampling results.

Well 105D, located on the landfill near known disposal areas, reported exceedances of the effective solubility and one percent pure phase solubility for a number of compounds. This well is used to monitor MNA in the source area.

Monitoring conducted during 2008 confirms that the operation of recovery wells RW-8 and RW-9 has achieved and maintained hydraulic control of the D/E/F-Zone.

### 3.3.3 Sample Collection and Analysis

In accordance with the LGMP, annual groundwater sampling following three years of semi-annual sampling began in 2008. The annual sampling event was completed between June 10 and June 20, 2008. TestAmerica of Amherst, New York completed sampling with oversight by URS Diamond for DuPont CRG. Samples and associated quality assurance/quality control (QA/QC) samples were analyzed by TestAmerica located in North Canton, Ohio.

As described in the Necco Park SAMP, groundwater sampling was conducted using USEPA low-flow sampling methodology. Air-driven bladder pumps equipped with disposable Teflon bladders were used for sample collection. The pumps were fitted with dedicated Teflon-lined high-density polyethylene (HDPE) tubing. All monitoring wells were purged and sampled at flow rates between 100 and 600 milliliters per minute to reduce potential sample volatilization. Geochemical parameters (pH, temperature, dissolved oxygen, oxidation/reduction potential, specific conductivity, and turbidity) were recorded at 5-minute intervals throughout the entire purging period to determine when stabilization was achieved. Geochemical parameters were considered stable when all parameter values were within 10 percent of the previously recorded value with the exception of plus or minus 0.2 units for pH.

A review of field pH measurements from selected A-Zone, B-Zone and C-Zone monitoring wells indicates significant increases during the June 2008 sampling event as compared to the previous six sampling vents from the time of system start-up (2Q05). The pH levels from A-Zone overburden wells D-11, 137A, and 146A exhibited an increase of 2 or more standard units greater than previous levels.

**Select A-Zone Field pH Measurements**

| Location | Sample Event | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2Q05 | 4Q05 | 2Q06 | 4Q06 | 2Q07 | 4Q07 | 3Q08 |
| D-11 | 8.77 | 9.98 | 8.16 | 8.92 | 7.46 | 7.56 | 12.16 |
| 137A | 8.99 | 9.20 | 8.01 | 10.16 | 7.72 | 9.07 | 12.69 |
| 146A | 8.46 | 7.66 | 7.58 | 7.55 | 7.48 | 7.48 | 9.48 |

Similar magnitude increases were observed at B-Zone bedrock wells at locations 136, 137, 141, 145, 146, 149, and 151.

**Select B-Zone Field pH Measurements**

| Location | Sample Event | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2Q05 | 4Q05 | 2Q06 | 4Q06 | 2Q07 | 4Q07 | 3Q08 |
| 136B | 8.65 | 8.49 | 7.9 | 7.33 | 7.37 | 7.28 | 9.49 |
| 137A | 9.96 | 9.60 | 8.20 | 8.95 | 7.69 | 8.16 | 12.96 |
| 141B | 9.54 | 7.88 | -- | 7.48 | -- | 7.51 | 10.65 |
| 145B | 9.40 | 7.96 | 7.73 | 7.31 | 7.34 | 7.63 | 10.00 |
| 146B | 9.39 | 8.79 | 8.07 | 8.17 | 7.60 | 7.84 | 11.90 |
| 149B | 8.20 | 7.76 | 7.96 | 8.12 | 7.45 | 7.73 | 10.54 |
| 151B | 9.65 | 7.48 | 8.05 | 8.73 | 8.02 | 7.85 | 12.5 |

**Select C-Zone Field pH Measurements**

| Location | Sample Event | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2Q05 | 4Q05 | 2Q06 | 4Q06 | 2Q07 | 4Q07 | 3Q08 |
| 136C | 11.52 | 8.84 | 8.17 | 7.84 | 7.77 | 7.87 | 12.32 |
| 137C | 11.16 | 8.85 | -- | 7.40 | -- | 7.61 | 10.44 |
| 141C | 8.34 | 7.82 | -- | 7.52 | -- | 7.16 | 10.07 |
| 146C | 8.59 | 8.57 | 8.07 | 7.58 | 7.50 | 7.71 | 9.69 |

One deeper zone bedrock well, 148D, reported an elevated pH level in 2008.

Given the wide distribution of wells both horizontally and vertically, and the absence of more than a single round of data with elevated levels, no conclusions to the cause of the rise in pH is proposed at this time.

Samples were collected at 56 monitoring well locations during the annual event and included sampling at well locations used for the MNA evaluation. The well locations are listed in Table 3-12. Analytical indicator parameters and MNA parameters are listed in Tables 3-13 and 3-14, respectively. Analytical results for the sampling event conducted in 2008 are provided as Appendix B. For reporting purposes, the results are discussed as TVOCs. This is consistent with historic reporting where TVOCs are indicator compounds used to assess groundwater contamination and trends over time. Results for the respective flow zones are discussed below.

The current list of wells used for chemical monitoring was prepared for the LGMP before the HSC was operational. As described in previous annual reports, TVOC concentrations at many monitoring locations are either very low or are decreasing. This is especially true for the far-field wells. In accordance with Section 5.2 of the LGMP modification of the chemical monitoring program during remedial action is acceptable. A proposed list of wells to be used for modified chemical monitoring starting in 2010 is included on Table 3-12.

### 3.3.4 A-Zone

Results from the seven LGMP A-Zone wells indicate TVOC concentrations all below 400 µg/l. Sampling results for well 137A (300 µg/l) represents the location of the highest reported A-Zone TVOCs. With the exception of well 137A and another near source well D-11, TVOC concentrations were below 10 µg/l. The overall low TVOC concentrations are consistent with the negligible horizontal gradient and the predominant downward gradient from the A-Zone to the B-Zone that has been enhanced by the HCS. A-Zone TVOC concentrations are 1 to 2 orders of magnitude less than nearby B-Zone monitoring locations. The 2008 results are consistent with historical results in that they show no significant off-site horizontal chemical migration in the overburden.

Compared to historical sample results, TVOC results at source area well D-9 and D-13 have decreased by an order of magnitude. Further discussion of groundwater chemistry trends for all flow zones is provided in Section 3.6.

### 3.3.5 B/C-Zone

#### B-Zone

Results from the fourteen LGMP B-Zone wells indicate TVOC concentrations generally below 10,000 µg/l. TVOC concentrations at six of the locations were below 100 µg/l. TVOC concentrations for wells near the B/C-Zone source area limits ranged from 1,900 to 36,000 µg/l. Similar to previous years, the highest TVOC concentration (75,235 µg/l) was reported for the sample collected at well 139B. This well is used for the MNA program. This well is located very close to the landfill and is well within the area of hydraulic control.

Key source area limit wells 171B and 172B show a continued TVOC decline in 2008. Biogenic daughter compounds including cis-1,2-dichloroethene and vinyl chloride dominate TVOC results at these well locations. The trend towards increased daughter compounds coupled with a near absence of source area constituents is evident at well location 171B based on the 2007 and 2008 VOC results. The 2007 sample results reported hexachlorobenzene at 1.4 µg/l; no source area constituents were reported in the sample collected in 2008.

Compared to historical sample results, TVOC results at source area well 111B have decreased by two orders of magnitude. Far-field well 150B has decreased by an order of magnitude.

### C-Zone

Results from the ten LGMP C-Zone wells indicate TVOC concentrations generally below 10,000 μg/l. This includes wells within the source area such as 136C. Consistent with previous long term monitoring results, TVOC concentrations at well locations outside the source area limits were less than 100 μg/l and ranged from 8 μg/l to 32 μg/l.

Compared to historical results, source area well 145C continues to show a significant decrease in TVOC concentrations. As discussed in Section 3.6.2, in spite of the TVOC increase, natural anaerobic biodegradation of chlorinated solvent compounds in groundwater continues.

## 3.3.6 D/E/F-Zone

### D-Zone

Results from the eleven LGMP D-Zone wells indicate TVOC concentrations generally below 2,000 μg/l. This includes wells within the source area such as 139D and 165D. Consistent with previous long-term monitoring results, biogenic daughter compounds including cis-1,2-dichloroethene and vinyl chloride dominate TVOC results for wells 136D, 145D, 147D, and 165D. With the exception of wells 136D and 145D, TVOC concentrations at well locations outside the source area limits were less than 200 μg/l and ranged from 1.4 μg/l to 172 μg/l. TVOC concentrations at well 136D have decreased by an order of magnitude since the 2000 baseline sampling and have steadily declined over the from 2006 to the end of 2007. The 2008 sample results indicate a short-term increase though the TVOC concentration is an order of magnitude less than the concentration reported in 2000. Monitoring has shown hydraulic control from the HCS extends beyond the D/E/F-Zone source area limits.

Compared to historical sample results, TVOC results at source area well 139D have decreased by an order of magnitude. The decreased TVOC at well 139D is significant considering DNAPL was observed in the well in the past.

TVOC results for well 145D, located outside the source area limits, are stable discounting the low TVOC concentration for the 2005 second round event. TVOC concentrations at near source area well 165D indicate a return to historically lower TVOC levels.

### E-Zone

Results from the six LGMP E-Zone wells indicate TVOC concentrations generally below 15,000 μg/l. TVOC results for well 136E, the closest E-Zone well to the landfill, were under 100 μg/l. Biogenic daughter compounds including cis-1,2-dichloroethene and vinyl chloride dominate TVOC results for all the E-Zone wells. With the exception of wells 145E, 146E, and 150E, TVOC concentrations at well locations outside the source area limits were less than 100 μg/l and ranged from 1 to 27 μg/l.

TVOC results for wells 146E and 150E located outside the source area limits have returned to relatively lower concentrations following increases in 2005 and 2006.

Biogenic daughter compounds including cis-1,2-dichloroethene and vinyl chloride dominate TVOC results at these well locations. As discussed in Section 3.6, the presence of these biogenic daughter compounds is a clear indication that natural attenuation processes are occurring in the far-field.

#### F-Zone

Results from the five LGMP F-Zone wells indicate TVOC concentrations generally below 1,300 µg/l, which is consistent with the 2007 results. Similar to the results from the E-Zone wells TVOC results for all the F-Zone wells are dominated by biogenic daughter compounds cis-1,2-dichloroethene and vinyl chloride. TVOC concentrations at well locations outside the source area limits (147F and 156F) were less than 100 µg/l and ranged from 2 µg/l to 25 µg/l. TVOC concentrations at near source well 136F have steadily declined since HCS startup from 8,458 µg/l in 2005 to 239 µg/l. A similar decline in TVOC is apparent at well 136E.

Compared to historical sample results, TVOC results at far-field well 156F have decreased by two orders of magnitude. TVOC results at far-field well 147F have decreased by an order of magnitude.

### 3.3.7 G-Zone

Though not included in the SOW as a groundwater flow zone requiring hydraulic control, far-field wells 147G1, 147G2, and 147G3 are included in the long-term chemical monitoring program. TVOC concentrations from these well locations range from 1,353 µg/l to less than 8,000 µg/l. TVOC results continue to be dominated by biogenic daughter compounds including cis-1,2-dichloroethene and at greater concentrations, vinyl chloride.

## 3.4 Data Quality Control/Quality Assurance

The 2008 annual groundwater samples were submitted to TestAmerica Laboratories in North Canton, Ohio for all chemical analyses except gas phase hydrocarbons, which were analyzed at the TestAmerica Austin, Texas facility, and the Gene-Trac Dehalococcoides DNA assay, which was performed by SiRem Laboratories, Ontario, Canada.

### 3.4.1 Sample Collection

The samples were collected in accordance with the scope and technical requirements defined in the project Work Plan and Quality Assurance Project Plan (QAPP) (CRG, 2005). Samples were submitted in10 delivery groups received at the laboratories between June 11, 2008 and June 25, 2008. Based on laboratory receipt records, all samples were received in satisfactory condition, and within EPA holding time and temperature requirements (<6 degrees C). Field QC samples collected during the sampling round included 3 field duplicate pairs, 9 daily equipment blank samples, and 8 trip blanks (volatile organics).

In addition to the routine monitoring program analyses, the June 2008 sampling round included the collection of samples for gas phase hydrocarbons, natural attenuation/water quality parameters, and the DNA assay. Due to a scheduling error, sample aliquots for the DNA assay were collected at just 8 of the 16 wells included in the June, 2005 sampling round (3 additional well locations were included in 2008 that were not included in 2005). If it is determined that data for the missed well locations is needed, these samples will be collected during the next scheduled sampling round in June 2009.

### In-House Data Evaluation

The quality of the data set was evaluated by the DuPont CRG / URS Diamond ADQM Group, using the analytical results provided in hard-copy CLP-type data packages in conjunction with an automated data evaluation of the electronic data deliverables (the DuPont DDR process described below). The laboratory data packages presented a review of the QA/QC procedures conducted by the laboratory and included case narratives identifying any significant issues associated with sample receipt, preparation, and analysis.

The electronic data was processed through an automated program developed by DuPont, referred to as the DDR, where a series of checks were performed on the data, resulting in essentially a summary level validation. The data were evaluated against holding time criteria, checked for laboratory blank, equipment blank , and trip blank contamination, and assessed against the following:

- ☐ Matrix spike(MS)/matrix spike duplicate (MSD) recoveries
- ☐ Relative percent differences (RPDs) between MS/MSD samples
- ☐ Laboratory control sample(LCS)/control sample duplicate (LCSD) recoveries
- ☐ RPDs between LCS/LCSD
- ☐ RPDs between laboratory replicates
- ☐ Surrogate spike recoveries
- ☐ RPDs between field duplicate samples

The DDR also applied the following data qualifiers to analysis results, as warranted:

**Default qualifiers**

| Qualifier | Definition |
|---|---|
| B | Not detected substantially above the level reported in the laboratory or field blanks. |
| R | Unusable result. Analyte may or may not be present in the sample. |
| J | Analyte present. Reported value may not be accurate or precise. |
| UJ | Not detected.  Reporting limit may not be accurate or precise. |

It was noted that some method detection limits (MDL) and/or quantitation limits (PQL) reported by the laboratory for the inorganic and wet chemistry analyses differed from those specified in the project QAPP. In addition, some acceptance limits for laboratory control spikes and matrix spikes have been updated by the laboratory since the QAPP was written. The laboratories used their most recent statistically derived limits to report the data, therefore these limits were also used to evaluate data quality.

The precision between the three sets of field duplicate pairs was generally very good (see further discussion in the following paragraph). Dilutions required due to matrix interferences and/or high levels of target compounds affected a number of volatile and semi-volatile matrix spike and surrogate recoveries. In all cases, except as noted below, the results were qualified J or UJ, but were determined to be usable.

Elevated reporting limits were noted for a number of organic and inorganic target analytes. Based on the laboratory case narratives, matrix interferences were a significant factor in the analysis of these samples.

A number of the inorganic / wet chemistry target analytes, including chloride, sulfate, alkalinity, nitrate-nitrite, and total organic carbon, and the metals iron, manganese, and barium, were detected at trace levels in the equipment blanks. The results for the associated well samples that were reported in the same concentration range as the blanks were qualified with a B flag. Total sulfide and manganese were detected in the laboratory method blanks above the analyte reporting limits.

All analytes reported between the MDL and PQL were J qualified as estimated concentrations. The site-specific, non-target semi-volatile reported as TIC 01 was also J-qualified as an estimated concentration.

Due to the experimental nature of the SiRem Gene-Trac assay, these results were not included in the automated in-house review process or submitted for independent data validation.

### 3.4.2 Independent Data Validation

In addition to the in-house evaluation, approximately 10% of the sample locations, plus the associated field and laboratory QC samples were submitted for independent data validation by Environmental Standards, Inc., Valley Forge, PA. The wells were selected for validation based on importance to the program (key perimeter wells), and include well locations VH-136D (plus its field duplicate), VH-145C, VH-146E, VH-172B, VH-123D, and VH-D-11. The complete Quality Assurance report is included in the report appendix.

There were a number of validation qualifiers applied to the samples due to non-compliant QC checks, spike recoveries, or blanks contamination, however only the nitrate-nitrite results ( all non-detects) for samples VH-136D and its field duplicate, VH-146E, and VH-145C were qualified as unusable (R) due to very low matrix QC spike recoveries.

It was noted that the validator applied stricter precision and sample representativeness criteria to the data set than specified in the project QAPP (both results were >5x the PQL, and the RPD was <20%, or at least one result was <5x the PQL and the difference between the results was less than +/- the PQL). As a result, several analytes were J qualified as estimated concentrations. The reported positive results for total sulfide in sample VH-136D and its field duplicate were qualified as estimated concentrations because they exceeded the precision criteria.

## 3.5 Groundwater Chemistry Trends

An analysis of short-term and long-term groundwater chemistry trends has been completed to assess the effectiveness of the HCS and the former extraction system in reducing organic compound concentrations in groundwater. This analysis utilized TVOC concentration data from monitoring wells to identify chemistry trends in the flow zone units. The evaluation also serves to identify locations where TVOC concentrations exhibit significant changes (generally, changes greater than an order of magnitude). Historical TVOC data have been used to assess long-term chemistry trends, where applicable. TVOC concentration versus time plots for A-Zone overburden and bedrock B- through F-Zone monitoring wells are presented in Appendix D.

In general, operation of the HCS and the former groundwater recovery system, combined with the presence of the Subsurface Formation Repair (SFR), has contributed to an overall trend of declining TVOC concentrations in the A-Zone overburden and bedrock fractures zones. More recently, TVOC concentration decreases at several near source area and far-field wells are significant and coincide strongly with the onset of HCS operations in April 2005. Natural attenuation processes, as discussed in Section 3.6, are also contributing to the reduction in chemical mass in the bedrock fracture zones.

### A-Zone Overburden

Four of the seven wells used to monitor A-Zone chemistry, D-9, D-11, D-13, and 137A exhibit a decreasing TVOC trend. These wells are located directly south of the landfill. The greatest TVOC decline is at well 137A where concentrations have decreased by an order of magnitude since 2005. TVOC results for the remaining A-Zone wells show no discernable trends. TVOC concentrations at these four wells: 145A, 146AR, and 150A have been less than 200 µg/l since the 2000 baseline sampling event.

The 2008 results are consistent with historical results in that they show that there is not a significant downgradient plume in the overburden.

### B/C-Zone

B-Zone monitoring wells 111B, 150B, 171B, and 172B show a trend of decreasing TVOC concentrations. At source area well location 111B, TVOC concentrations have decreased by an order of magnitude since 1996. A long-term trend of decreasing TVOC is also observed at far-field well 150B, where TVOC concentrations have decreased by two orders of magnitude since 1998.

Continuing TVOC decreases have occurred at key wells used to define source area limits including 171B and 172B. TVOC concentrations at these monitoring locations have decreased by an order of magnitude between the 2005 and 2008 sampling events. These TVOC decreases coincident with the HCS startup demonstrate the effectiveness of the B/C-Zone extraction wells in hydraulically controlling the source area.

Similarly, historical C-Zone chemical results indicate a decrease in TVOC at source area well 145C. This well has been historically used to define the C-Zone source area limit. The long-term decreasing TVOC trend may be associated with the long term reduction in off-site migration resulting from hydraulic gradient reversal across the source area limits (as described above for the B-Zone). In spite of a few anonymously high TVOC concentrations, an overall trend of decreasing TVOC since HCS startup is evident.

A marked decrease in TVOC concentration at well locations 145C and 146C was observed shortly after completion of the Subsurface Formation Repair (SFR) in 1989. The SFR increased the capture zones of the former groundwater recovery wells and reduced off-site chemical migration. Based on the widespread drawdown observed since it began operation, it is expected that the HCS will further enhance the C-Zone capture zone.

Another notable C-Zone trend is the decline in TVOC concentrations for far-field well 151C by an order of magnitude since 2000. From a historical perspective, TVOC concentrations have decreased three orders of magnitude. With the exception of the 2005 second biannual results of 223 μg/l, TVOC concentrations at well 151C have been less than 25 μg/l since long term monitoring began. TVOC concentrations are stable at source area well 168C following a declining TVOC trend in 2006. The TVOC decline is significant considering the observation of DNAPL in the well shortly after installation of well in 2002.

TVOC trend plots for the declining B-Zone and C-Zone wells show a direct correlation between HCS startup and decreasing TVOC concentrations. TVOC results for near source area wells including 171B, 172B, 150C and 168C illustrate that the hydraulic effects of the HCS extend to the southeastern portions of the B/C source limits.

### D/E/F-Zone

Historical TVOC results for the D/E/F-Zone indicate an overall pattern of decreasing or stable chemistry trends. TVOC concentrations at far-field wells 147F and 156F have decreased by two orders of magnitude since 1996. The 2008 results support this significant trend of decreasing TVOCs in the far-field.

TVOC results for source area well 139D have shown a significant decease since 2000 and show a pattern of continuing TVOC reduction. TVOC concentrations have decreased by an order of magnitude at this location since startup of the HSC. With the exception of the 2008 results indicating short-term increase, results for near source area well 136D show a trend towards TVOC concentrations to below 500 μg/l that were reported for this well in the 1990s. A similar decreasing trend is occurring in the F-Zone at this location where TVOC concentrations have declined from 8,458 μg/l in 2005 to 239 μg/l in 2008 at well 136F. TVOC results for near source limit well 165D indicate decreasing trend after a short-term TVOC increase in 2006.

TVOC trend plots for far-field wells 146E and 146F show an overall decrease in TVOCs. The recent short-term TVOC increases at these locations (post-HCS start-up results) are attributed to the increased concentrations of cis-1,2-dichloroethene and vinyl chloride.

TVOC concentration trends for the D/E/F-Zone wells also correlate to the startup of the HCS. As illustrated on the trend plots for wells 136D, 139D, 145E, 136F, 150F and 156F. TVOC concentrations have apparently decreased at these locations in response to the startup of the HCS. The TVOC decline at far-field well 156F is significant considering its location in the distant far field.

### G-Zone

Results for wells 147G1, 147G2, and 147G3 indicate an overall trend of declining TVOC since 2005. Biodegradation daughter compounds dominate TVOCs reported at these locations. A short-term increase at these locations in 2005 was followed by declining TVOC concentrations in 2006 and 2007. The 2008 TVOC results for wells 147G1 and 147G2 indicate a modest short-term increase.

## 3.6 Monitoring Natural Attenuation (MNA) Assessment

This section focuses on the natural attenuation via anaerobic biodegradation of chlorinated solvent ethenes in groundwater at the Necco Park Site. Primary constituents of concern are the PCE and TCE. Degradation products, including three isomers of dichloroethene (DCE) - cis-1,2-DCE, trans-1,2-DCE, and 1,1-DCE – and vinyl chloride are also present in the groundwater. The biodegradation of PCE and TCE occurs through a process called reductive dechlorination, a sequential removal of chlorines ending in the harmless product ethene. Reductive dechlorination is a biological process dependent on conditions of low redox potential (ORP), sufficient electron donor and competent microorganisms and is carried out by a number of bacteria. However, only one organism, *Dehalococcoides ethenogenes*, has been shown to be capable of complete dechlorination of chlorinated ethenes to ethene. Low ORP, presence of dechlorination daughter products (cis DCE, VC and ethene) and presence of *Dehalococcoides sp*. are indicators of active natural attenuation of PCE and or TCE via reductive dechlorination.

### 3.6.1 MNA Background

One of the requirements of the Record of Decision (ROD) for the Necco Park Source Area Operable Unit is to further characterize groundwater in the far-field area. As defined in the ROD, the far-field is the area outside the source area where chemical constituents attributable to the Necco Park site have been found to have contaminated groundwater. The far-field aqueous plume is defined as the plume of dissolved contaminants down gradient of the source area. The 2005, 2006, and 2007 reports confirmed that concentrations of the target constituents (PCE, TCE and reduced by products) decrease as groundwater flows south and west away from the Necco Park site. Additionally, in many wells, historic TVOC results showed significant reduction in target constituents over time. These results are consistent with a published reference showing active anaerobic microbial degradation transforming PCE and TCE to cDCE, VC and ultimately ethene in all zones (Lee et al, 1993)

The initial MNA assessment for this site is contained in the 2005 Annual Report where data on the concentrations of chlorinated solvents in the groundwater and DNA results indicating the presence of a microbial population competent for degrading chlorinated ethenes was presented. This report on 2008 groundwater conditions at Necco Park is intended as an update to the 2006 and 2007 reports and the comprehensive 2005 report. The three recognized lines of evidence for monitored natural attenuation of contaminants are as follows (USEPA, Monitored Natural Attenuation Directive, 1999):

- ☐ Reduction of contaminant concentrations over time or distance,

- ☐ Geochemical data that demonstrate conditions favorable for contaminant destruction, and
- ☐ Microbiological data from field or microcosm studies that directly demonstrate the occurrence of a natural attenuation process and its ability to degrade contaminants of concern.

Based on *Dehalococcoides* analyses conducted and the conditions observed in the groundwater, all three of these lines of evidence are observable at Necco Park. Details of the Necco Park MNA monitoring program are presented in the *Long Term Groundwater Monitoring Plan* (CRG, 2005a). The MNA monitoring wells were sampled for a full suite of MNA parameters in 2000 and more recently during the 2005, 2006, 2007, and 2008 sampling events. The resultant data are discussed in the following sections for the B/C-Zone and the D/E/F-Zone.

### 3.6.2 B/C Zone Results

The results of the MNA monitoring program for the 13 B/C-Zone wells are shown in the figures in Appendix E. For each of the B/C-Zone wells, the data from the five sampling events are plotted as a function of time so that concentration trends are apparent. Concentrations are plotted in millimoles (molar equivalents) so that the relationships between parent compounds and daughter compounds (degradation products) are comparable on a molar basis. Observations of data trends, along with select data from the most recent sampling event in parts per billion (ppb), are posted on the figures. A summary of the MNA results in all of the B/C-Zone wells is presented in Table 3-15. The wells listed on each of these tables are arranged in the order of Upgradient, Source Area then Downgradient/Sidegradient. They are discussed below in that order. Geochemical parameters that help evaluate the degree to which biological reductive dechlorination is occurring are presented in Appendix B.

#### Upgradient B/C-Zone Wells

Both upgradient B/C-Zone wells, 141B and 141C are essentially uncontaminated. Only trace levels of PCE, TCE, and VC (all below 1 µg/L) were detected in 141C.

#### Source Area B/C-Zone Wells

All source area wells, except 111B demonstrated declining chlorinated ethene levels in 2008 compared to 2007. In the other source area B/C-Zone wells, total chlorinated ethene levels decreased on average by about one-third. In all B/C-Zone source wells except the most contaminated (105C), the predominant chlorinated ethene species are the daughter products cis DCE and VC. All wells, except 105C, exhibited sharp rises in the ultimate daughter product, ethene. The rise in total chlorinated ethenes observed in well 111B (from 746 µg/L to 1,657 µg/L), was entirely due to increases in the daughter products cisDCE and VC. The results in 111B, (increasing dechlorinated daughter products, ethene production) are similar to the other source area wells (137B, 139B, 105C, and 137C) and are strongly indicative of active natural attenuation of chlorinated solvents via reductive dechlorination. Geochemical data indicating low ORP conditions conducive to reductive dechlorination are supportive of this interpretation. Ferrous iron and methane are reduced products demonstrating that the biological processes of iron reduction and methanogenesis (both processes occurring under low redox conditions) are active. Similarly, the depression in sulfate concentrations and elevated sulfide in these wells indicates that sulfate reduction (also a biological process that occurs at low redox potential) is active. The process of sulfate reduction may compete with reductive dechlorination processes for electron donor (e.g. TOC) so decreased levels of sulfate may result in additional electron donor available to drive reductive dechlorination. All of the wells in the B/C zone have negative ORP values indicating anoxic and reducing conditions. In addition, 111B and 139B show elevated dissolved iron concentrations relative to upgradient wells and the two highest methane levels detected in the B/C-Zone. Wells 111B, 137B, 139B, and 137C are depleted in sulfate relative to other wells in the B/C zone. The source wells 137C, 111B, 105C and 137C were positive for *Dehalococcoides sp*. indicating that the key microbes for complete degradation of chlorinated ethenes are present at elevated population levels.

#### Downgradient/Sidegradient B/C-Zone Wells

There are five downgradient wells (145B, 145C, 149C, 151B, and 151C) and one sidegradient well (153B) in the B/C zone. The sidegradient well is uncontaminated. Of the downgradient wells, two – 149C and 151C – are only marginally above groundwater standards of 2 µg/L to 5 µg/L (e.g. VC at 6 and 7.8 µg/L, respectively) and are characterized exclusively by reductive dechlorination daughter products cis and trans DCE and VC and contain ethene Well 151C had earlier been more contaminated, but concentrations dropped dramatically between 2005 and 2006.

Total chlorinated ethenes in 145B, 145C, and 151B declined by half or more from the 2007 sampling, although 145B and 151B are still above levels seen in 2005. However, all VOC compounds in 151B are only marginally above the detection limit and less than 1 µg/L, compared to groundwater standards of 2 µg/L to 5 µg/L. In these wells, the dominant chlorinated ethene species are cisDCE and VC. Moderate to high ethene levels were also observed in these wells. The only exception being 151B, which is essentially free of VOCs. All three wells had negative ORP levels and contained methane, and the highest levels of dissolved iron and sulfide in the B/C zone were found in 145C. As noted above, these compounds are indicative of microbial processes that occur in low ORP environments, indicating conditions that are supportive of reductive dechlorination and consistent with the observation dechlorinated daughter products.

This overall downward trend in the downgradient wells continues to support the site conceptual model of a shrinking chlorinated ethene plume in the downgradient B/C-Zone

### 3.6.3 D/E/F-Zone Results

The results of the MNA monitoring program for the 14 D/E/F-Zone wells are shown in the figures in Appendix E. For each of the D/E/F-Zone wells, the data from the five sampling events are plotted as a function of time so that concentration trends are apparent. Concentrations are plotted in millimoles (molar equivalents) so that the relationships between parent compounds and daughter compounds (degradation products) are comparative on a molar basis. Observations of data trends, along with select data from the most recent sampling event in parts per billion (ppb), are posted on the figures. A summary of the MNA results in all of the D/E/F-Zone wells is presented in Table 3-16.

The wells listed on each of these tables are arranged in the order of Source Area then Downgradient/Sidegradient. They are discussed below in that order. Geochemical parameters that help evaluate the degree to which biological reductive dechlorination is occurring are presented in Appendix B.

### Source Area D/E/F-Zone Wells

Total chlorinated ethene concentrations decreased in all three of the source area D/E/F-Zone wells 137D, 139D, and 165D. Although concentrations in 137D are still elevated compared to historical results, MNA processes appear to have been very active in 165D where concentrations have dropped below groundwater standards for all chlorinated ethenes except for the reductive dechlorination daughter product, VC (18 µg/L). Low redox conditions supportive of natural attenuation via reductive dechlorination are present in these wells as indicated by the elevated methane, elevated dissolved iron (in wells 137D and 139D) and low ORP values.

In contrast to the B/C-Zone wells, a parent compound, TCE, is the dominant chlorinated ethene species in the two source area wells 137D and 139D, and ethene concentrations are much lower. For example, the ratio of ethene to total chlorinated ethenes is on a molar basis are 0.007 and 0.12 in these two wells compared to 0.48 in 137C and 0.28 in 139B. However, the presence of ethene in these wells is indicative of ongoing natural attenuation processes.

Concentration trends in the source area wells are also difficult to interpret because they are within the hydraulic capture zone of the pumping system and do not represent consistent flow conditions. Regardless of the difficulties in interpretation of the flow paths, the molar proportion of degradation products is 25% to 30% in wells 137D and 139D, supporting the interpretation that degradation is occurring. Additionally 16SrDNA tests were positive for *Dehalococcoides sp.* in well 139D.

### Downgradient D/E/F-Zone Wells

As shown on Table 3-16, concentrations of total chlorinated ethenes are decreasing in three of the eight downgradient D/E/F-zone wells (156D, 156E, and 146F), and essentially flat in four of the eight wells (136D, 136E, 147D, and 148D). Although the concentration of chlorinated ethenes in 136D doubled compared to the previous year (520 to 1,011 µg/L), it is still below the results observed in 2005 and 2006 and consists predominantly of dechlorinated daughter products cisDCE and VC. Additionally, ethene has increased steadily in this well since 2002. Chloroethenes in four (148D, 156D, 156E, and 136E) of the eight wells were reported at very low concentrations.

The only well that showed an increase in total chlorinated ethenes was 146E. Closer inspection of the individual compounds shows that this result was largely due to a more than doubling of cis-1,2 DCE , a degradation product. This increase in cis DCE was accompanied by stable vinyl chloride and increased ethene relative to 2007. This well, though designated a downgradient well, is located only about 200 feet south of source well cluster 165. The increase can most likely be attributed to an influx of contamination from the source area, which in turn is rapidly degrading to daughter products, as evidenced by the increased cis-1,2-DCE levels. This well exhibited the lowest ORP

(-452mV), elevated methane and the highest sulfide levels of all the D/E/F-Zone wells, indicating an environment conducive to natural attenuation via reductive dechlorination.

Well 146F had previously exhibited the highest chlorinated ethene levels among the downgradient D/E/F-Zone wells. However, its concentration has dropped by about 25% in the 2008 sampling. Furthermore, degradation products DCE and VC represent 99% of the chlorinated ethenes on a molar basis indicating natural attenuation processes have been active. The ORP at this well was strongly negative at -353 mV and the presence of dissolved iron, sulfide, and methane are indicative of a low redox potential environment consistent with natural attenuation of chlorinated ethenes via reductive dechlorination.

The two other downgradient wells exhibiting elevated levels of chlorinated ethenes were 136D and 147D. Whereas both of these wells exhibit a rather flat concentration history, both increased in 2008 compared to the 2007 sampling. Although chlorinated ethenes in 136D increased, there was more than five times as much ethene present than total chlorinated ethenes (on a molar basis), suggesting that the almost all the contaminants in this region are being completed dechlorinated. The low ORP (-378 mV) and elevated dissolved iron, sulfide and methane are important indicators of conditions supportive of reductive dechlorination in this area. At 147D, the low TOC (electron donor) and relatively elevated ORP (-172 mV) and indicate conditions less supportive for reductive dechlorination. At this well the total chlorinated ethenes level has remained constant at a relatively low concentration, albeit completely comprised of the daughter products DCE and VC suggesting that reductive dechlorination does occur in this area.

The overall downward trend in the downgradient wells continues to support the site conceptual model of a active natural attenuation processes resulting in a shrinking chlorinated ethene plume in the downgradient D/E/F-Zone.

#### Sidegradient D/E/F-Zone Wells

There are three sidegradient D/E/F-Zone wells: 149D, 145E, and 150F. 149D, while technically increasing in concentration, is essentially uncontaminated with all chlorinated ethene levels below groundwater standards and a steady trend of increasing ethene. The other two wells exhibit slightly decreasing chlorinated ethene concentrations consisting almost entirely of the daughter products DCE and VC. Both wells also contain the completely dechlorinated end-product ethene. Conditions in these two wells (145E and 150F) consist of low ORP levels and elevated dissolved iron, sulfide, and methane concentrations, and are consistent with natural attenuation of chlorinated ethenes via reductive dechlorination.

### 3.6.4 MNA Recommendations

The review of MNA parameters presented in this section demonstrates that biological activity continues to actively reduce concentrations of chlorinated ethenes in groundwater and contribute to the prevention of groundwater plume expansion. In accordance with the recommendations in the 2007 report, consideration was given to discontinuing monitoring of some downgradient and sidegradient wells where contamination is not present or just marginally above detection limits.

In the B/C-Zone, downgradient wells 151B and 151C and sidegradient well 153B contain little to no contamination, and have remained this way for the past three years. We recommend discontinuing sampling of these wells in future MNA assessment.

In the D/E/F-Zone, downgradient well 148D is consistently clean, but should continue to be monitored as farther downgradient well 147D continues to show contamination. However, downgradient wells 156D and 156E are recommended to be eliminated from future annual sampling.

## 3.7 DNAPL Monitoring and Recovery

As described in the LGMP and the DNAPL Monitoring and Recovery Plan, monitoring for the occurrence of DNAPL has been conducted routinely at the Necco Park site since the early 1980s. A monitoring and recovery program was instituted in 1989 to remove free-phase DNAPL from monitoring and groundwater recovery wells. The historically established monitoring program was modified based on results of the PDIs. The 2008 monthly DNAPL monitoring results are summarized in Table 3-17.

Consistent with the 2007 observations, the only recovery well that has accumulated DNAPL in recoverable quantities was RW-5. This well and B/C-Zone recovery well RW-4 are equipped with dedicated air-driven pumps for DNAPL recovery. DNAPL recovery is accomplished by groundwater pumping, which entrains DNAPL droplets and draws them into the well where they settle, coalesce, and accumulate. Routine monitoring completed in 2008 show that DNAPL was only observed at well RW-5. Beginning in April 2008, DNAPL observations were completed weekly at recovery well RW-5 to ensure that DNAPL did not rise to the level of the groundwater pump intake. The increased observations resulted in more frequent DNAPL removal event.

Approximately 512 gallons of DNAPL was recovered in 2008, all of which was recovered from well RW-5. A large portion of the DNAPL, 331 gallons, was recovered between April and July. The last observation of DNAPL in well RW-5 was made in October 2008. The total quantity of DNAPL recovered since the program has been in place is approximately 8,335 gallons.

## 3.8 Previous Report Recommendations

The following recommendations of 2007 Annual Report were completed in 2008:

- ☐ Replacement of B/C-Zone recovery well RW-10 with a new B/C-Zone recovery well installed in a BFBT.
- ☐ Replacement of compromised well 112C to continue C-Zone hydraulic monitoring in this portion of the site.
- ☐ Closure of former recovery wells RW-1 and RW-2.
- ☐ Installation of an A-Zone piezometer south of the CECOS secure cells at existing DuPont well location 168.

Numerous investigations conducted at Necco Park have shown that the B-Zone conductivity generally decreases moving east to west across the southern boundary of the site that has made selection of suitable location for a conventional vertical recovery challenging. The ineffectiveness of recovery well RW-10 in maintaining B/C-Zone hydraulic control in the western portion of the site corroborates this observation. To address the reduced efficiency of the HCS in maintaining hydraulic control of the B/C-Zone in the western portion of the Site, recovery well RW-10 was replaced with a new recovery well (RW-11) screened within a B-Zone blast-fractured bedrock trench (BFBT) and as a bedrock open-hole in the C-Zone.

Well 112C was installed in 1983 in the southeast corner of the landfill. Water levels recorded during the 4Q06 monitoring event indicate that the casing at well 112C had failed. As to not disrupt the landfill cap materials, a location south of well 112C was selected to install replacement C-Zone well 204C. Using the boring log from 112C and other C-Zone wells in the area, the well was completed in November 2008. The well completion log is provided in Appendix F. Well 204C will be used as a hydraulic monitor.

During mobilization for the BFBT installation, former B/C-Zone recovery wells RW-1 and RW-2 were closed by filling the bedrock hole with bentonite chips. Following hydration of the bentonite, the well casing was filled with a cement/bentonite grout. Before closure, tubing and DNAPL pumps were removed from the wells. Well closures records are provided in Appendix F.

In response to a USEPA comments on the 2Q06 Data Package (USEPA April 2007), the 2006 Annual Report included a recommendation to install an A-Zone piezometer at existing well location 168. An A-Zone piezometer, designated 168A, was installed during the BFBT mobilization. Piezometer construction details are provided in Appendix A. Use of groundwater elevations to prepare potentiometric surface maps began in 4Q08.

# 4.0 CAP MAINTENANCE

Remaining punch list items for the 2005 landfill cap construction activities were completed in June and August 2006. The August 2006 overseeding event has been successful as permanent vegetation is established across the entire site, including the slopes. A lawn maintenance contractor maintains both the landfill cap and ditch vegetation. Landfill cap maintenance activities are conducted in accordance with the CMMP. Results of the landfill cap maintenance inspection conducted in October 2008 are provided in Appendix G.

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Hydraulic Control Effectiveness

### 5.1.1 Conclusions

Groundwater elevation hydrographs along with potentiometric surface-contour maps, calculated drawdowns, and calculated horizontal hydraulic gradients illustrate the effectiveness of the HCS in creating source area hydraulic control in the AT, A, B, C, D, E and F-Zones at the DuPont Necco Park site. A qualitative summary of the 2008 effectiveness of the HCS on each zone is presented below as determined by a review of drawdowns, potentiometric contours, system pumping rates, and previous extents of hydraulic control effectiveness:

- ❑ AT-Zone: HCS was effective for the entire zone for 2008.
- ❑ A-Zone: HCS was effective for the entire zone for 2008.
- ❑ B-Zone: HCS was generally effective for 2008:
    - RW-5: limited to moderate hydraulic control for 1Q08, and good for 2Q08, 3Q08 and 4Q08 (after rehabilitation events).
    - RW-10: limited to moderate hydraulic control for 1Q08 and 2Q08, zero for 3Q08 (offline) and not applicable for 4Q08.
    - RW-11: limited to moderate hydraulic control for 4Q08 (with only 24-hours of operation).
- ❑ C-Zone: HCS was moderately effective for 2008:
    - RW-4: good hydraulic control for all of 2008.
    - RW-5: limited hydraulic control for 1Q08, good for 2Q08, moderate for 3Q08 and 4Q08.
    - RW-10: moderate hydraulic control for 1Q08 and 2Q08, zero for 3Q08 (offline) and not applicable for 4Q08.
    - RW-11: limited to moderate hydraulic control for 4Q08 (however, with only 24-hours of operation).
- ❑ D-Zone: HCS is effective for the entire zone.
- ❑ E-Zone: HCS is effective for the entire zone.
- ❑ F-Zone: HCS is effective for the entire zone.

The effect of RW-11 on hydraulic control was not fully evaluated with only 24-hours of operation prior to the 4Q08 water level event on November 13, 2008. Therefore, a preview of the improved hydraulic responses in the A-Zone, B-Zone and C-Zone are presented in Figures 3-20, 3-21 and 3-23, respectively, as derived from 1Q09 water levels collected on February 19, 2009. A summary of HCS 1Q09 hydraulic control is presented below:

- A-Zone: good hydraulic control for RW-5 and RW-11.
- B-Zone: good hydraulic control for RW-5 and RW-11.
- C-Zone: moderate hydraulic control at RW-5 and poor at RW-11 (but significantly improved from RW-10) as indicated by the responses at 105C (Figure 3-5).

The observed changes in recovery well pumping rates and reduced drawdown responses in monitoring wells were not unexpected with the installation of the BFBT (see Figure 3-23). The increases in flow zone transmissivities have resulted in an increase in the recovery well pumping rate, an increase in the extent of hydraulic influence and measureable drawdowns in distant wells (e.g. 150B [see Appendix A]). Additionally, there was significant improvement in the hydraulic control of the A-Zone as shown in the A-Zone 1Q09 potentiometric contours (Figure 3-20) as compared to previous A-Zone contours (Figure 3-10).

The installation of the BFBT and RW-11 have greatly enhanced the hydraulic control of the A-Zone and C-Zone in the west portion of the site as compared to RW-10 and are expected to have corrected the cause of RW-10 efficiency losses.

### 5.1.2 Recommendations

- Prepare a plan for routine rehabilitation of RW-5.
- Review and present options for continual or permanent rehabilitation or modification of RW-5.

## 5.2 Groundwater Chemistry Monitoring

### 5.2.1 Conclusions

The 2008 and historical chemistry monitoring results indicate the following:

- An overall decrease in TVOC concentrations for all groundwater flow zones in the source area and far-field.
- A-Zone chemistry results are consistent with historical results in that they show no significant off-site horizontal chemical migration in the overburden.
- TVOC decreases have occurred at key B/C-Zone source area limit wells including 171B and 172B.
- TVOC concentrations in the D/E/F-Zone are either stable or decreasing. TVOC concentrations at far-field wells 147F and 156F have decreased by two orders of magnitude since 1996.
- Analytical results for 2008 would not significantly change the A-Zone and B/C-Zone source area limits as delineated in the SAR.

- Analytical results for 2008 support the 2005 Annual Report conclusion of a reduced source area limit for the D/E/F-Zone as delineated in the SAR based on the analytical results from well 146E.
- The 2008 sample results indicate a short-term increase in groundwater pH at select overburden and upper bedrock monitoring locations that requires further monitoring to determine it’s significance.
- Results from groundwater sampling events completed since the startup of the HCS show the effectiveness of the HCS in controlling zone-specific source areas.
- Groundwater chemistry results from 2005 to 2008 support modification of the existing chemical monitoring well network.

### 5.2.2 Recommendations

The 2008 sampling program represents the seventh groundwater sampling event of the long term monitoring program. An assessment of the groundwater sample results compiled to date support a reduction of the number of monitoring locations as presented in this report. With Agency approval of the modifications to the chemical monitoring program implementation of the proposed changes will begin in 2010.

## 5.3 Monitored Natural Attenuation Assessment

### 5.3.1 Conclusions

Data on chlorinated ethenes in Necco Park is consistent with lines of evidence required for natural attenuation of contaminants (USEPA, Monitored Natural Attenuation Directive, 1999). Specifically, the results summarized above and in the 2008 report continue to show the following:

- contaminants in groundwater decrease along flowpaths from the source area to the down gradient zone,
- geochemical conditions are indicative of low redox conditions required for reductive dechlorination
- Previous results (2005) have confirmed the presence of bacteria competent for the complete dechlorination of chlorinated ethenes to ethane. The continued evidence of natural attenuation of chlorinated solvents is consistent with the presence of these organisms.

Overall, the generally observed stable to decreasing trends in total chlorinated solvents in both source area and downgradient wells and the presence of dechlorinated intermediates (cDCE, VC and ethene) strongly supports the interpretation that natural attenuation of chlorinated ethenes continues to occur at this site through bacterially mediated sequential reductive dechlorination.

### 5.3.2 Recommendations

In accordance with the recommendations in the 2007 report, consideration was given to discontinuing monitoring of some downgradient and sidegradient wells where contamination is not present or just marginally above detection limits.

In the B/C-Zone, downgradient wells 151B and 151C and sidegradient well 153B contain little to no contamination, and have remained this way for the past three years. We recommend discontinuing sampling of these wells in future MNA assessment.

In the D/E/F-Zone, downgradient well 148D is consistently clean, but should continue to be monitored as farther downgradient well 147D continues to show contamination. However, downgradient wells 156D and 156E are recommended to be eliminated from future annual sampling.

## 5.4 DNAPL Monitoring and Recovery

### 5.4.1 Conclusions

Results of the 2008 DNAPL monitoring and historical recovery efforts indicate the following:

- ☐ DNAPL was observed in only one of the 30 locations used for DNAPL monitoring
- ☐ Observations were limited to B/C-Zone recovery well RW-5
- ☐ 512 gallons of DNAPL recovered in 2008
- ☐ Approximately 8,335 gallons of DNAPL has been recovered since the recovery program was initiated in 1989.

### 5.4.2 Recommendations

Continue DNAPL monitoring and recover DNAPL where encountered.

## 5.5 Landfill Cap

### 5.5.1 Conclusions and Recommendations

With establishment of a continuous vegetative cover the landfill cap construction is complete and will be now be maintained in accordance with the CMMP.

# 6.0 REFERENCES

DuPont Corporate Remediation Group (CRG). 2009. *DuPont Necco Park Source Area Hydraulic Control System Fourth Quarter Monitoring Data Package 2008*. February 4, 2009.

_____. 2008c. *Necco Park Recovery Well RW-10 Replacement Work Plan*. March 14, 2008

_____. 2008. *DuPont Necco Park Source Area Hydraulic Control System First Quarter Monitoring Data Package 2008*. May 5, 2008.

_____. 2008a. *DuPont Necco Park Source Area Hydraulic Control System Second Quarter Monitoring Data Package 2008*. August 4, 2008.

_____. 2008b. *DuPont Necco Park Source Area Hydraulic Control System Third Quarter Monitoring Data Package 2008*. October 31, 2008.

_____. 2005. DuPont Necco Park *Operations and Maintenance Plan*. November 11, 2005.

_____. 2005a. *Initial Testing Program Plan*, Necco Park, Niagara Falls, New York. January 21, 2005.

______. 2003. *DuPont Necco Park , Final (100%) Design Report*. Necco Park, Niagara Falls, New York. December 19 2003.

______. 2001. *DuPont Necco Park Source Area Report*. Necco Park, Niagara Falls, New York. April 2001

.______. 2000. *Remedial Design Work Plan*, Necco Park, Niagara Falls, New York.

Feenstra, S., D.M. MacKay, and J.A. Cherry. 1991. "A method for assessing residual NAPL based on organic chemical concentrations in soil samples," in *Groundwater Monitoring Review*. Vol. 11, No. 2.

Lee, M.D., P. F. Mazierski, R.J. Buchanan, D.E. Ellis, L.S. Sehayek, 1993. *Intrinsic In Situ Anaerobic Biodegration of Chlorinated Solvents at an Industrial Landfill*. Intrinsic Bioremediation.

# TABLES

# Table 2-1
# HCS Recovery Well Performance Summary*
# 2008
# DuPont Necco Park

| | B/C-ZONE | | | | | | | | D/E/F-ZONE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **RW-4** | | **RW-5** | | **RW-10** | | **RW-11** | | **RW-8** | | **RW-9** | |
| | **Total Gallons Pumped** | **Uptime** | **Total Gallons Pumped** | **Uptime** | **Total Gallons Pumped** | **Uptime** | **Total Gallons Pumped** | **Uptime** | **Total Gallons Pumped** | **Uptime** | **Total Gallons Pumped** | **Uptime** |
| JANUARY | 10,269 | 90.8% | 86,064 | 85.8% | 21,704 | 100.0% | NA | NA | 287,729 | 100.0% | 524,275 | 100.0% |
| FEBRUARY | 7,227 | 97.4% | 48,613 | 45.4% | 18,976 | 97.4% | NA | NA | 244,081 | 95.0% | 614,731 | 94.8% |
| MARCH | 9,696 | 98.3% | 90,044 | 82.4% | 8,935 | 100.0% | NA | NA | 264,443 | 100.0% | 526,251 | 100.0% |
| APRIL | 15,427 | 98.7% | 94,356 | 90.1% | 17,335 | 100.0% | NA | NA | 246,372 | 100.0% | 594,559 | 100.0% |
| MAY | 8,465 | 97.5% | 91,118 | 61.1% | 29,044 | 97.5% | NA | NA | 240,575 | 100.0% | 607,070 | 100.0% |
| JUNE | 10,416 | 100.0% | 120,306 | 95.6% | 25,567 | 100.0% | NA | NA | 261,485 | 99.3% | 540,166 | 99.7% |
| JULY | 7,287 | 87.4% | 89,452 | 83.7% | 19,850 | 95.4% | NA | NA | 343,764 | 99.9% | 505,032 | 99.9% |
| AUGUST | 6,704 | 58.7% | 93,309 | 60.8% | 45,525 | 0.0% | NA | NA | 368,531 | 98.2% | 551,197 | 98.2% |
| SEPTEMBER | 6,930 | 89.3% | 131,959 | 86.3% | 0 | 0.0% | NA | NA | 390,929 | 99.7% | 551,733 | 99.7% |
| OCTOBER | 8,382 | 99.9% | 133,349 | 80.6% | 0 | 0.0% | NA | NA | 414,485 | 99.9% | 512,314 | 91.6% |
| NOVEMBER | 7,786 | 99.9% | 77,854 | 55.9% | NA | NA | 415,735 | 93.6% | 340,180 | 96.9% | 383,632 | 96.9% |
| DECEMBER | 4,673 | 73.0% | 45,210 | 28.7% | NA | NA | 547,075 | 63.7% | 278,425 | 74.1% | 299,610 | 74.1% |
| TOTAL / AVG. | 103,262 | 90.9% | 1,101,634 | 71.4% | 186,936 | 69.0% | 962,810 | 78.6% | 3,680,999 | 96.9% | 6,210,570 | 96.2% |

* Uptime totals include downtime as a result of routine scheduled maintenance.

# Table 2-2
# GWTF Process Sampling Results
# 2008
# DuPont Necco Park
# Niagara Falls, NY

| | | B/C INFLUENT | | | | D/E/F INFLUENT | | | | COMBINED EFFLUENT | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | | 3/6/08 | 5/15/08 | 8/13/08 | 11/13/08 | 3/6/08 | 5/15/08 | 8/13/08 | 11/13/08 | 3/6/08 | 5/15/08 | 8/13/08 | 11/13/08 |
| **Field Parameters** | | | | | | | | | | | | | |
| SPECIFIC CONDUCTANCE | umhos/cm | 42140 | 39790 | 28250 | 9865 | 4838 | 4806 | 4370 | 4389 | 9240 | 9213 | 7514 | 6651 |
| TEMPERATURE | degrees C | 10.8 | 12.5 | 17.8 | 13.4 | 13.2 | 12.8 | 14.8 | 11.5 | 13.6 | 13.9 | 16.2 | 13.5 |
| COLOR | ns | grey | grey | grey | grey | grey | grey | grey | grey | grey | grey | grey | grey |
| ODOR | ns | moderate | moderate | moderate | moderate | moderate | moderate | moderate | moderate | slight | slight | slight | moderate |
| PH | std units | 5.63 | 5.43 | 5.92 | 6.57 | 7.17 | 7.14 | 7.61 | 6.92 | 7.35 | 6.99 | 7.6 | 6.99 |
| REDOX | mv | -147 | -143 | -147 | -134 | -263 | -246 | -240 | -206 | -111 | -56 | -127 | -100 |
| TURBIDITY | ntu | 50.8 | 46.2 | 39.9 | 120 | 60.7 | 62.6 | 47.1 | 143 | 72.3 | 83.1 | 107.1 | 154 |
| **Inorganics** | | | | | | | | | | | | | |
| BARIUM, DISSOLVED | ug/l | 1370000 | 1230000 | 934000 | 33200 | 110 J | 160 J | 100 J | 100 J | 340 | 700 | 480 | 620 |
| BARIUM, TOTAL | ug/l | 1390000 | 1040000 | 991000 | 109000 | 92 J | 95 J | 90 J | 91 J | 31100 | 47100 | 27400 | 37500 |
| SULFATE | ug/l | 1580000 | 13600 J | 1000 | 9100 | 1050000 | 782000 | 871000 | 914000 | 608000 | 453000 | 647000 | 287000 |
| **Volatile Organics** | | | | | | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | ug/l | 6700 | 6700 | 4400 J | 1800 J | 1500 | 1700 | 1400 J | 1600 J | 1200 | 1100 J | 810 J | 1000 J |
| 1,1,2-TRICHLOROETHANE | ug/l | 2400 | 2100 | 1200 | 3000 | 2700 | 2700 | 2400 | 2900 | 1100 | 880 | 850 J | 870 |
| 1,1-DICHLOROETHENE | ug/l | 330J | 400 J | 140 J | 550 | 360J | 410 J | 360 J | 380 J | <9.5 | <6.3 | <6.3 | <7.6 |
| 1,2-DICHLOROETHANE | ug/l | 680 | 640 J | 360 J | 490 | 200J | 210 J | 220 J | 220 J | 54 | 51 | 54 | 60 |
| CARBON TETRACHLORIDE | ug/l | 1600 | 1600 | 880 | 1100 | 1100 | 1300 | 1500 | 1300 | <6.5 | 7.7 J | 8.5 J | 29 J |
| CHLOROFORM | ug/l | 13000 | 12000 | 5200 | 13000 | 4300 | 4300 | 4900 | 5300 | 270 | 290 | 330 | 370 |
| CIS-1,2-DICHLOROETHENE | ug/l | 17000 | 18000 | 9300 | 4500 | 12000 | 13000 | 11000 | 12000 | 600 | 700 | 680 | 260 |
| METHYLENE CHLORIDE | ug/l | 4100 | 4300 | 2300 B | 1600 J | 5700 | 5900 | 4900 | 3800 J | 520 | 570 J | 480 | 83 J |
| TETRACHLOROETHENE | ug/l | 4200 | 3300 | 1500 | 4300 | 1600 | 1400 | 1600 | 1900 | 25 J | 25 J | 32 J | 70 |
| TRANS-1,2-DICHLOROETHENE | ug/l | 990 | 1000 | 450 | 280 J | 940 | 960 | 730 | 800 | 16 J | 15 J | 15 J | <7.6 |
| TRICHLOROETHENE | ug/l | 13000 | 12000 | 5900 | 14000 | 8300 | 8400 | 7600 | 8400 | 150 | 180 | 190 | 220 |
| VINYL CHLORIDE | ug/l | 5600 | 7300 J | 2500 | 1400 | 2400 | 3200 J | 2100 | 2400 | <11 | 11 J | <7.3 UJ | <8.8 UJ |
| **Semivolatile Organics** | | | | | | | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | ug/l | <38 | <24 | <19 | 62 J | 380 | 320 | 270 | 390 | 420 | 220 | 240 J | 170 J |
| 2,4,6-TRICHLOROPHENOL | ug/l | <56 | <35 | <28 | 23 J | 190 | 160 | 130 | 180 | 230 | 110 | 120 J | 74 J |
| 3-METHYLPHENOL & 4-METHYLPHENOL | ug/l | 270 J | 320 J | 250 J | 200 | 11 J | 21 J | <0.75 | 24 J | 17 J | 52 J | 15 J | 110 J |
| HEXACHLOROBENZENE | ug/l | <2.6 | <1.6 | <1.3 | <1 | <0.81 | <0.65 | <0.65 | <1 | <0.65 | <0.65 | <0.65 | 12 J |
| HEXACHLOROBUTADIENE | ug/l | 980 | 680 | 640 | 390 | 98 J | 30 J | 32 J | 33 J | 31 J | 37 J | 70 J | 730 |
| HEXACHLOROETHANE | ug/l | 660 J | 510 J | 460 J | 95 J | 51 J | 9.8 J | 9.9 J | 13 J | <5.8 | <5.8 | 5.8 J | 110 J |
| PENTACHLOROPHENOL | ug/l | 180 J | 130 J | 71 J | 360 J | 770 | 630 | 510 | 700 | 840 | 420 J | 480 J | 380 J |
| PHENOL | ug/l | 260 J | 230 J | 150 J | 290 | 59 J | 60 J | 34 J | 58 J | 79 J | 64 J | 44 J | 150 J |
| TIC-1 | ug/l | 4200 J | 2400 J | 1100 J | 4000 J | 1700 J | 1100 J | 370 J | 870 J | 1700 J | 1500 J | 760 J | 1700 J |
| TOTAL VOLATILES | ug/l | **69,600** | **69,340** | **34,130** | **46,020** | **41,100** | **43,480** | **38,710** | **41,000** | **3,935** | **3,830** | **3,450** | **2,962** |

G indicates an elevated reporting limit. The sample required dilution for analysis due to matrix interference.

< and ND = Non detect at stated reporting limit
J= Analyte present. Reported value may not be precise.
UJ= Not detected. Reporting limit may not be accurate or precise.
NS= Not sampled
NA= Not applicable

## Table 3-1
## Hydraulic Monitoring Locations
## Long-Term Groundwater Monitoring
## DuPont - Necco Park

| Well ID | Zone | Monitoring Frequency | Well ID | Zone | Monitoring Frequency | Well ID | Zone | Monitoring Frequency |
|---|---|---|---|---|---|---|---|---|
| 111A | A | Quarterly | 111B | B | Quarterly | 151C | C | Quarterly |
| 119A | A | Quarterly | 115B | B | Quarterly | 160C | C | Quarterly |
| 123A | A | Quarterly | 116B | B | Quarterly | 161C | C | Quarterly |
| 129A | A | Quarterly | 118B | B | Quarterly | 162C | C | Quarterly |
| 131A | A | Quarterly | 119B | B | Quarterly | 168C | C | Quarterly |
| 137A | A | Quarterly | 120B | B | Quarterly | 204C | C | Quarterly |
| 140A | A | Quarterly | 129B | B | Quarterly | 105D | D | Quarterly |
| 145A | A | Quarterly | 130B | B | Quarterly | 115D | D | Quarterly |
| 146AR | A | Quarterly | 136B | B | Quarterly | 123D | D | Quarterly |
| 150A | A | Quarterly | 137B | B | Quarterly | 129D | D | Quarterly |
| 159A | A | Quarterly | 138B | B | Quarterly | 130D | D | Quarterly |
| 173A | A | Quarterly | 145B | B | Quarterly | 136D | D | Quarterly |
| 174A | A | Quarterly | 146B | B | Quarterly | 139D | D | Quarterly |
| 175A | A | Quarterly | 149B | B | Quarterly | 145D | D | Quarterly |
| 176A | A | Quarterly | 150B | B | Quarterly | 148D | D | Quarterly |
| 179A | A | Quarterly | 159B | B | Quarterly | 149D | D | Quarterly |
| 184A | A | Quarterly | 160B | B | Quarterly | 159D | D | Quarterly |
| 185A | A | Quarterly | 161B | B | Quarterly | 163D | D | Quarterly |
| 187A | A | Quarterly | 167B | B | Quarterly | 164D | D | Quarterly |
| 188A | A | Quarterly | 168B | B | Quarterly | 202D | D | Quarterly |
| 189A | A | Quarterly | 169B | B | Quarterly | 203D | D | Quarterly |
| 191A | A | Quarterly | 171B | B | Quarterly | RW-8 | D/E/F | Quarterly |
| 192A | A | Quarterly | 172B | B | Quarterly | 129E | E | Quarterly |
| 193A | A | Quarterly | 201B | B | Quarterly | 136E | E | Quarterly |
| 194A | A | Quarterly | BZTW-1 | B | Quarterly | 142E | E | Quarterly |
| D-11 | A | Quarterly | BZTW-2 | B | Quarterly | 145E | E | Quarterly |
| RDB-3 | A | Quarterly | D-23 | B | Quarterly | 146E | E | Quarterly |
| RDB-5 | A | Quarterly | PZ-B | B | Quarterly | 163E | E | Quarterly |
| D-13 | A | Quarterly | D-10 | B/C | Quarterly | 164E | E | Quarterly |
| PZ-A | A | Quarterly | D-14 | B/C | Quarterly | 165E | F | Quarterly |
| 129AT | AT | Quarterly | RW-10 | B/C | Quarterly | 203E | F | Quarterly |
| 168A | A | Quarterly | RW-4 | B/C | Quarterly | 129F | F | Quarterly |
| 184AT | AT | Quarterly | RW-5 | B/C | Quarterly | 130F | F | Quarterly |
| 185AT | AT | Quarterly | 105C | C | Quarterly | 145F | F | Quarterly |
| 188AT | AT | Quarterly | 112C | C | Quarterly | 146F | F | Quarterly |
| 189AT | AT | Quarterly | 115C | C | Quarterly | 148F | F | Quarterly |
| 190AT | AT | Quarterly | 123C | C | Quarterly | 150F | F | Quarterly |
| 191AT | AT | Quarterly | 129C | C | Quarterly | 163F | F | Quarterly |
| 192AT | AT | Quarterly | 130C | C | Quarterly | 164F | F | Quarterly |
| 193AT | AT | Quarterly | 136C | C | Quarterly | 165F | F | Quarterly |
| 194AT | AT | Quarterly | 137C | C | Quarterly | 202F | F | Quarterly |
| *PZ-195AT+* | *AT* | Quarterly | 138C | C | Quarterly | 203F | F | Quarterly |
| *PZ-196AT+* | *AT* | Quarterly | 139C | C | Quarterly | 130G | G | Quarterly |
| *PZ-197AT+* | *AT* | Quarterly | 145C | C | Quarterly | 136G | G | Quarterly |
| *MW-198AT+* | *AT* | Quarterly | 146C | C | Quarterly | 141G | G | Quarterly |
| *PZ-199AT+* | *AT* | Quarterly | 149C | C | Quarterly | 143G | G | Quarterly |
| *PZ-200AT+* | *AT* | Quarterly | | | | | | |

AT = Top-of-clay

Notes: 1. Well 204C installed in 2008 to replace 112C. Water levels began in 1Q09.
2. Piezometers PZ-A, PZ-B, and 168A installed in 2008.

# Table 3-2
## Select AT-Zone 2008 and 2009 Drawdowns
## Post HCS Startup
## DuPont Necco Park

| Well | 04/05/05 | 03/17/08 | 05/15/08 | 08/13/08 | 11/13/08 | 02/19/09 |
|---|---|---|---|---|---|---|
| 119AT | 0.00 | 3.57 | 3.38 | 3.72 | 3.73 | 3.43 |
| 129AT | 0.00 | 3.55 | 3.35 | 3.66 | 3.81 | 3.43 |
| 180AT | 0.00 | 4.35 | 5.63 | 5.86 | 6.13 | 3.75 |
| 184AT | 0.00 | 3.56 | 4.35 | 4.53 | 5.22 | 3.99 |
| 185AT | 0.00 | 3.66 | 4.55 | 4.74 | 5.31 | 3.99 |
| 186AT | 0.00 | 3.95 | 4.88 | 5.10 | 5.52 | 4.06 |
| 187AT | 0.00 | 4.01 | 4.96 | 5.22 | 5.59 | 3.93 |
| 188AT | 0.00 | 4.48 | 5.64 | 5.84 | 6.25 | 4.19 |
| 189AT | 0.00 | 4.73 | 5.97 | 6.20 | 6.55 | 4.31 |
| 190AT | 0.00 | 4.68 | 5.97 | 6.19 | 6.52 | 4.21 |
| 191AT | 0.00 | 4.60 | 5.89 | 6.13 | 6.40 | 4.08 |
| 192AT | 0.00 | 1.35 | 1.67 | 3.07 | 3.29 | 0.59 |
| 193AT | 0.00 | 0.99 | 3.71 | 4.51 | 5.19 | 1.61 |
| 194AT | 0.00 | 1.96 | 1.66 | 2.39 | 2.89 | 0.66 |

Notes:

1) Drawdowns calculated using April 5, 2005, water level event as baseline.
2) Monitoring well hydraulic heads above baseline (negative values) have been shaded.

# Table 3-3
# Select A-Zone 2008 and 2009 Drawdowns
# Post HCS Startup
# DuPont Necco Park

| Well | 4/5/05 | 3/17/08 | 5/15/08 | 8/13/08 | 11/13/08 | 2/19/09 |
|---|---|---|---|---|---|---|
| 111A | 0.00 | 4.05 | 3.81 | 4.26 | 4.49 | 4.77 |
| 119A | 0.00 | 2.98 | 3.35 | 3.68 | 3.28 | 3.62 |
| 123A | 0.00 | 2.26 | 2.06 | 2.41 | 2.36 | 2.03 |
| 129A | 0.00 | 3.41 | 3.40 | 3.75 | 3.29 | 3.37 |
| 137A | 0.00 | 2.14 | 3.17 | 3.14 | 3.73 | 2.74 |
| 146AR | 0.00 | 0.64 | 1.75 | 1.47 | 1.86 | 0.83 |
| 150A | 0.00 | 0.03 | 1.06 | 1.46 | 1.43 | 0.09 |
| 159A | 0.00 | 1.38 | 1.23 | 1.31 | 1.33 | 1.22 |
| 163A | 0.00 | 0.10 | 1.12 | 1.06 | 1.23 | 0.82 |
| 173A | 0.00 | 2.46 | 2.59 | 2.76 | 3.72 | 2.73 |
| 174A | 0.00 | 1.75 | 2.74 | 2.82 | 3.43 | 2.39 |
| 175A | 0.00 | 0.75 | 0.65 | 1.22 | 1.39 | 0.72 |
| 176A | 0.00 | 2.68 | 3.55 | 3.75 | 4.56 | 3.41 |
| 178A | 0.00 | 3.19 | 4.00 | 4.16 | 5.00 | 3.83 |
| 179A | 0.00 | 2.52 | 3.40 | 3.57 | 4.38 | 3.39 |
| 184A | 0.00 | 1.73 | 2.20 | 2.35 | 2.68 | 1.76 |
| 185A | 0.00 | 3.66 | 4.56 | 4.75 | 5.30 | 4.92 |
| 186A | 0.00 | 6.16 | 5.45 | 5.34 | 5.17 | 4.58 |
| 187A | 0.00 | 6.81 | 7.12 | 7.10 | 7.10 | 6.03 |
| 188A | 0.00 | 7.37 | 9.24 | 8.94 | 8.80 | 8.36 |
| 189A[4] | 0.00 | 8.31 | 8.63 | 8.09 | 7.90 | 7.29 |
| 190A | 0.00 | 5.65 | 6.03 | 5.56 | 5.45 | 5.06 |
| 191A | 0.00 | 2.84 | 3.36 | 2.85 | 2.97 | 1.83 |
| 192A | 0.00 | 3.01 | 3.51 | 3.04 | 3.13 | 0.77 |
| 193A | 0.00 | 0.66 | 0.88 | 1.05 | 0.88 | 0.78 |
| 194A | 0.00 | 2.67 | 3.25 | 2.70 | 2.80 | 2.05 |
| D-11 | 0.00 | 3.07 | 3.95 | 4.15 | 5.69 | 4.31 |
| D-13 | 0.00 | 1.31 | 2.05 | 2.35 | 2.38 | 2.00 |
| D-9 | 0.00 | 3.81 | 3.41 | 3.66 | 3.74 | 3.07 |
| RDB-3 | 0.00 | 0.33 | 1.03 | 0.93 | 1.16 | 0.73 |
| RDB-5 | 0.00 | 0.08 | 1.04 | 1.13 | 1.14 | 0.83 |

Notes:

1) Drawdowns calculated using April 5, 2005 water level event as baseline.
2) Monitoring well hydraulic heads above baseline (negative values) have been shaded.
3) NA = not availible.
4) Baseline elevation was recorded on May 5, 2004.

# Table 3-4
# 2008 Average AT-Zone to A-Zone Vertical Gradients
# DuPont Necco Park

| Well Pair | | A | B | C | D | |
|---|---|---|---|---|---|---|
| | | 2008 Average AT-Zone Head | 2008 Average A-Zone Head | AT-Zone Mid-Point of Well Screen | A-Zone Mid-Point of Well Screen | Vertical Gradtient[1,2] (B-A) / (C-D) |
| 119AT | 119A | 572.97 | 573.42 | 570.92 | 564.73 | 0.03 |
| 129AT | 129A | 573.00 | 573.16 | 567.24 | 563.25 | -0.02 |
| 184AT | 184A | 571.52 | 571.66 | 570.46 | 564.65 | -0.02 |
| 185AT | 185A | 571.48 | 571.90 | 569.24 | 566.50 | 0.18 |
| 186AT | 186A | 571.46 | 566.98 | 569.58 | 561.13 | -0.84 |
| 187AT | 187A | 571.67 | 566.73 | 570.33 | 561.99 | -0.79 |
| 188AT | 188A | 572.15 | 564.28 | 570.43 | 559.21 | -0.96 |
| 189AT | 189A | 572.19 | 565.41 | 569.76 | 559.30 | -0.92 |
| 190AT | 190A | 572.18 | 567.41 | 569.81 | 558.23 | -0.62 |
| 191AT | 191A | 572.27 | 570.77 | 569.48 | 558.20 | -0.27 |
| 192AT | 192A | 571.27 | 570.80 | 569.82 | 556.10 | -0.17 |
| 193AT | 193A | 576.12 | 572.24 | 572.38 | 559.76 | -0.54 |
| 194AT | 194A | 573.98 | 570.83 | 571.12 | 558.80 | -0.38 |

Note:

1) Unitless (ft/ft).
2) Negative values indicate a downward (from AT-Zone to A-Zone) gradient.
3) Average gradients were used to better reflect typical vertical gradients at the site.

# Table 3-5
# 2008 Average A-Zone to B-Zone Vertical Gradients
# DuPont Necco Park

| Well Pair | | A | B | C | D | |
|---|---|---|---|---|---|---|
| | | 2008 Average A-Zone Head | 2008 Average B-Zone Head | A-Zone Mid-Point of Well Screen | B-Zone Fracture Elevation[1] | Vertical Gradtient[2,3] (B-A) / (C-D) |
| 111A | 111B | 572.87 | 571.61 | 573.94 | 561.80 | -0.10 |
| 119A | 119B | 573.42 | 570.81 | 571.63 | 556.90 | -0.18 |
| 129A | 129B | 573.16 | 570.81 | 570.10 | 557.80 | -0.19 |
| 137A | 137B | 571.68 | 571.20 | 570.10 | 561.30 | -0.05 |
| 145A | 145B | 572.05 | 569.64 | 564.19 | 546.30 | -0.13 |
| 150A | 150B | 571.47 | 570.42 | 564.69 | 553.18 | -0.09 |
| 159A | 159B | 577.79 | 574.36 | 580.62 | 562.90 | -0.19 |

Note:

1) A B-Zone fracture was not observed in the 145B borehole, therefore the midpoint of the open hole was used.
2) Unitless (ft/ft).
3) Negative values indicate a downward (from A-Zone to B-Zone) gradient.
4) Average gradients were used to better reflect typical vertical gradients at the site.

# Table 3-6
# Select B-Zone 2008 and 2009 Drawdowns
# Post HCS Startup
# DuPont Necco Park

| Well[1] | 5/4/04 | 3/17/08 | 5/15/08 | 8/13/08 | 11/13/08 | 2/19/09 |
|---|---|---|---|---|---|---|
| 102B | 0.00 | 1.88 | 1.87 | 2.24 | 2.27 | 1.31 |
| 111B | 0.00 | 1.25 | 1.06 | 1.74 | 2.84 | 3.02 |
| 112B | 0.00 | 1.63 | 2.22 | 1.99 | 1.89 | 10.52 |
| 116B | 0.00 | 0.39 | 0.45 | 0.49 | 0.71 | 0.38 |
| 118B | 0.00 | 1.06 | 1.54 | 1.47 | 1.55 | 0.75 |
| 119B | 0.00 | 6.78 | 6.31 | 6.33 | 6.02 | 5.61 |
| 120B | 0.00 | 3.12 | 2.55 | 2.65 | 2.77 | 2.37 |
| 129B | 0.00 | 1.79 | 1.71 | 1.77 | 1.59 | 1.43 |
| 130B | 0.00 | 3.93 | 3.21 | 3.30 | 3.16 | 2.86 |
| 136B | 0.00 | 0.01 | 0.35 | 0.31 | 0.49 | 0.10 |
| 137B | 0.00 | 0.04 | 0.65 | 0.40 | 1.69 | 1.06 |
| 138B | 0.00 | 2.46 | 1.87 | 2.44 | 2.49 | 1.98 |
| 139B | 0.00 | 3.15 | 3.38 | 3.11 | 3.33 | 3.17 |
| 145B | 0.00 | 0.23 | 0.63 | 0.53 | 0.41 | 0.08 |
| 146B | 0.00 | -0.25 | 0.28 | 0.09 | 0.50 | 0.03 |
| 149B | 0.00 | -3.65 | 0.23 | 0.06 | 0.48 | 0.27 |
| 150B | 0.00 | 0.11 | 0.61 | 0.24 | 0.99 | 0.63 |
| 151B | 0.00 | -0.81 | -0.60 | -0.85 | -0.60 | -0.88 |
| 159B | 0.00 | 0.78 | 0.80 | 0.36 | 1.09 | 0.76 |
| 160B | 0.00 | 1.47 | 1.54 | 1.15 | 1.45 | 0.18 |
| 161B | 0.00 | 2.05 | 1.84 | 2.20 | 2.25 | 1.14 |
| 163B | 0.00 | -0.57 | 0.15 | 0.02 | 0.31 | -0.18 |
| 167B | 0.00 | 4.86 | 3.83 | 4.62 | 4.78 | 3.97 |
| 168B | 0.00 | 1.13 | 0.87 | 2.36 | 1.24 | 0.85 |
| 169B | 0.00 | 2.04 | 1.60 | 2.01 | 1.99 | 1.35 |
| 171B | 0.00 | 1.58 | 1.77 | 1.21 | 1.49 | 0.38 |
| 172B | 0.00 | 1.15 | 1.44 | 0.82 | 1.04 | 0.06 |
| PZ-B[3] | -- | -- | -- | 0.00 | 0.93 | 1.62 |
| D-14 | 0.00 | 0.94 | 1.04 | -0.51 | 2.50 | 1.92 |
| D-23 | 0.00 | 7.32 | 7.97 | 7.42 | 7.13 | 6.69 |
| RW-4 | 0.00 | 30.67 | 26.80 | 24.42 | 24.14 | 22.83 |
| RW-5 | 0.00 | 8.19 | 12.92 | 12.91 | 13.04 | 14.37 |
| RW-10 | 0.00 | 9.11 | 8.78 | 0.49 | 3.88 | 3.39 |
| RW-11[3] | -- | -- | -- | 0.00 | 0.74 | 2.78 |

Notes:

1) Drawdowns calculated using May 4, 2004 water level event as baseline.

2) Monitoring well hydraulic heads above baseline (negative values) have been shaded.

3) Baseline water elevation collected on August 13, 2008.

# Table 3-7
# Select C-Zone 2008 and 2009 Drawdowns
# Post HCS Startup
# DuPont Necco Park

| Well[1] | 5/4/04 | 3/17/08 | 5/15/08 | 8/13/08 | 11/13/08 | 2/19/09 |
|---|---|---|---|---|---|---|
| 105C | 0.00 | 0.37 | 0.32 | -0.20 | 2.32 | 2.00 |
| 112C | 0.00 | 2.27 | 0.79 | 0.69 | 0.27 | -0.67 |
| 115C | 0.00 | 1.16 | 0.96 | 0.55 | 2.33 | 2.13 |
| 129C | 0.00 | 3.12 | 2.87 | 2.96 | 3.05 | 2.75 |
| 130C | 0.00 | -0.03 | -1.94 | -1.45 | 2.07 | 1.39 |
| 136C | 0.00 | -0.13 | 1.61 | 0.87 | 0.68 | 0.24 |
| 137C | 0.00 | 0.04 | -2.90 | -3.50 | 1.48 | 0.91 |
| 138C | 0.00 | -0.19 | 1.31 | -0.20 | 2.01 | 1.42 |
| 139C | 0.00 | 2.70 | -5.61 | -6.37 | 2.24 | 1.41 |
| 145C | 0.00 | 0.64 | 2.31 | 1.68 | 0.62 | -0.57 |
| 146C | 0.00 | -0.60 | 5.19 | 5.05 | -0.13 | -0.47 |
| 149C | 0.00 | 0.09 | -1.46 | -1.88 | 0.44 | 0.04 |
| 150C | 0.00 | -0.58 | -0.69 | -1.05 | -0.52 | 0.13 |
| 151C | 0.00 | -0.08 | -1.98 | -2.38 | -0.33 | -0.71 |
| 159C | 0.00 | -0.09 | 6.95 | 6.51 | 0.58 | 0.18 |
| 160C | 0.00 | 1.06 | -7.00 | -7.68 | 1.08 | -0.31 |
| 161C | 0.00 | 1.40 | -0.01 | -0.25 | 1.56 | 0.10 |
| 162C | 0.00 | 1.95 | 7.08 | 6.93 | 3.08 | 2.51 |
| 168C | 0.00 | 1.79 | -1.03 | -1.55 | 1.72 | 0.84 |
| D-14 | 0.00 | 0.62 | 4.23 | -1.51 | 1.50 | 0.92 |
| RW-4 | 0.00 | 30.67 | 26.80 | 24.42 | 24.14 | 22.83 |
| RW-5 | 0.00 | 8.19 | 12.92 | 12.91 | 13.04 | 14.37 |
| RW-10 | 0.00 | 9.11 | 8.78 | 0.49 | 3.88 | 3.39 |
| RW-11[3] | -- | -- | -- | 0.00 | 0.74 | 3.52 |

Notes:

1) Drawdowns calculated using May 4, 2004 water level event as baseline unless otherwise noted.

2) Monitoring well hydraulic heads above baseline (negative values) have been shaded.

3) Baseline water elevation collected on August 13, 2008.

# Table 3-8
# Select D, E, and F-Zone 2008 and 2009 Drawdowns
# Post HCS Startup
# DuPont Necco Park

| Well[1] | 5/4/04 | 3/17/08 | 5/15/08 | 8/13/08 | 11/13/08 | 2/19/09 |
|---|---|---|---|---|---|---|
| 105D | 0.00 | 6.36 | 5.97 | 6.15 | 6.41 | 6.28 |
| 111D | 0.00 | 6.56 | 6.07 | 6.24 | 6.49 | 6.21 |
| 115D | 0.00 | 6.29 | 5.84 | 6.01 | 6.39 | 6.13 |
| 123D | 0.00 | 2.40 | 2.08 | 2.05 | 2.50 | 1.31 |
| 130D | 0.00 | 5.87 | 5.42 | 5.59 | 5.83 | 5.54 |
| 136D | 0.00 | 6.36 | 5.87 | 5.92 | 6.31 | 6.31 |
| 139D | 0.00 | 6.19 | 0.90 | 0.74 | 1.20 | 0.50 |
| 145D | 0.00 | 1.06 | 1.19 | 1.05 | 1.23 | 0.19 |
| 148D | 0.00 | 2.77 | 4.10 | 3.47 | 4.54 | 2.36 |
| 149D | 0.00 | 5.43 | 4.61 | 4.44 | 5.07 | 4.96 |
| 159D | 0.00 | 6.75 | 6.21 | 6.42 | 6.75 | 6.62 |
| 163D | 0.00 | 5.33 | 5.02 | 5.20 | 6.98 | 5.98 |
| 163D | 0.00 | 4.96 | 5.14 | 3.91 | 3.21 | 4.79 |
| 129E | 0.00 | 1.40 | 1.23 | 1.17 | 0.26 | 0.26 |
| 136E | 0.00 | 6.61 | 6.05 | 6.19 | 6.50 | 6.40 |
| 145E | 0.00 | 0.79 | 0.69 | 0.52 | 0.96 | -0.55 |
| 146E | 0.00 | 6.85 | 6.36 | 6.35 | 6.71 | 6.79 |
| 150E | 0.00 | 4.79 | 4.23 | 4.49 | 4.69 | 4.08 |
| 163E | 0.00 | 7.20 | 6.67 | 6.92 | 7.26 | 7.13 |
| 164E | 0.00 | 7.16 | 6.66 | 6.71 | 6.97 | 7.00 |
| 164E | 0.00 | 6.99 | 6.69 | 6.74 | 6.96 | 6.96 |
| 112F[3] | 0.00 | 0.90 | 0.95 | 0.63 | 1.01 | -0.27 |
| 129F | 0.00 | 1.40 | 1.36 | 1.44 | 1.65 | 0.13 |
| 130F | 0.00 | 6.39 | 6.02 | 6.24 | 6.47 | 6.19 |
| 136F | 0.00 | 6.91 | 6.42 | 6.44 | 6.74 | 6.74 |
| 145F | 0.00 | 0.82 | 0.89 | 0.78 | 1.04 | 0.16 |
| 146F | 0.00 | 6.49 | 5.95 | 5.85 | 6.28 | 6.46 |
| 148F | 0.00 | 2.80 | 1.00 | 0.54 | 2.00 | 2.42 |
| 150F | 0.00 | 4.40 | 4.08 | 4.16 | 4.49 | 4.06 |
| 163F | 0.00 | 7.00 | 6.48 | 6.53 | 6.81 | 6.85 |
| 164F | 0.00 | 6.95 | 6.53 | 6.59 | 6.85 | 6.90 |
| 164F | 0.00 | 7.34 | 7.00 | 7.03 | 7.19 | 7.20 |
| RW-8 | 0.00 | 8.69 | 8.01 | 9.12 | 9.12 | 9.12 |
| RW-9 | 0.00 | 8.27 | 8.25 | 8.21 | 8.23 | 8.19 |

Note:

1) Drawdowns calculated using May 4, 2004, water level event as baseline.
2) Monitoring well hydraulic heads above baseline (negative values) have been shaded.
3) Baseline water elevation collected on May 8, 2005.

# Table 3-9
# DNAPL Components and Solubility Criteria Values
# DuPont Necco Park

| Contaminant | Mole Fraction in DNAPL (%) | Pure-Phase Solubility (ug/l) | One-Percent Pure-Phase solubility (ug/l) | Effective Solubility (ug/l) |
|---|---|---|---|---|
| Hexachlorobutadiene | 59 | 2,000 | 20 | 1,180 |
| Hexachloroethane | 9 | 50,000 | 500 | 4,500 |
| Hexachlorobenzene | 2 | 11 | 0.11 | 0.22 |
| Carbon tetrachloride | 5 | 800,000 | 8,000 | 40,000 |
| Chloroform | 1 | 8,000,000 | 80,000 | 80,000 |
| Tetrachloroethene | 3 | 150,000 | 1,500 | 4,500 |
| 1,1,2,2-Tetrachloroethane | 5 | 2,900,000 | 29,000 | 145,000 |
| Trichloroethene | 4 | 1,100,000 | 11,000 | 44,000 |

# Table 3-10
# 2005 - 2008 Annual Sampling
# Effective Solubility Concentration Exceedances for DNAPL Compounds
# DuPont Necco Park

| Well ID | Flow Zone | Analyte | Criteria (ppb) | 2005 |  | 2006 |  | 2007 |  | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  | 1st Event | 2nd Event | 1st Event | 2nd Event | 1st Event | 2nd Event |  |
| 105C | C | Carbon Tetrachloride | 40,000 | N/S | N/S | N/S | BC | N/S | BC | BC |
|  |  | Hexachlorobutadiene | 1,180 | 1,700 | BC | N/S | N/S | N/S | N/S | N/S |
|  |  | Chloroform | 80,000 | BC | 180,000 | N/S | 120,000 | N/S | 90,000 | 82,000 |
|  |  | Tetrachloroethene | 4,500 | 32,000 | 35,000 | N/S | 36,000 | N/S | 37,000 J | 32,000 |
|  |  | Trichloroethene | 44,000 | 280,000 | 190,000 | N/S | 190,000 | N/S | 160,000 | 140,000 |
| 105D | D | Carbon Tetrachloride | 40,000 | 150,000 | 83,000 | N/S | 170,000 | N/S | 190,000 | BC |
|  |  | Chloroform | 80,000 | 98,000 | 35,000 | N/S | 80,000 | N/S | 90,000 | 96,000 |
|  |  | Tetrachloroethene | 4,500 | 12,000 | 57,000 | N/S | 11,000 | N/S | 13,000 J | 12,000 |
|  |  | Trichloroethene | 44,000 | 120,000 | 51,000 | N/S | 110,000 | N/S | 120,000 | 130,000 |
| 137C | C | Tetrachloroethene | 4,500 | 8,500 | 22,000 | N/S | 7,900 | N/S | BC | BC |
| 137D | D | Tetrachloroethene | 4,500 | 5,100 | 4,900 | N/S | BC | N/S | 7,200 | 5,300 J |
|  |  | Trichloroethene | 44,000 | 64,000 | 76,000 | N/S | BC | N/S | 91,000 | 70,000 |
|  |  | Hexachlorobenzene | 0.22 | 3.0 | 11.0 | N/S | N/S | N/S | N/S | N/S |
| 139D | D | Hexachlorobutadiene | 1,180 | 1,200 | BC | N/S | N/S | N/S | N/S | N/S |
| 171B | B | Hexachlorobutadiene | 1,180 | 2,100 | BC | BC | BC | N/S | BC | BC |
|  |  | Hexachlorobenzene | 0.22 | BC | 4.0 | 31 J | 3.4 J | N/S | 1.4 J | BC |

BC: Below Criteria
N/S: Not Sampled
Note: Wells 105C and 105D are located on the landfill and are MNA Source Area wells.

## Table 3-11
## 2005 - 2008 Annual Sampling
## 1% of Pure-Phase Solubility Concentration Exceedances for DNAPL Compounds
## DuPont Necco Park

| | | | | 2005 | | 2006 | | 2007 | | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Well ID** | **Flow Zone** | **Analyte** | **Criteria (ppb)** | **1st Event** | **2nd Event** | **1st Event** | **2nd Event** | **1st Event** | **2nd Event** | |
| 105C | C | Hexachlorobutadiene | 20 | 1,700 | BC | N/S | N/S | N/S | N/S | N/S |
| | | Carbon Tetrachloride | 8,000 | 25,000 | BC | N/S | BC | N/S | BC | BC |
| | | Chloroform | 80,000 | 250,000 | 180,000 | N/S | 120,000 | N/S | 90,000 | 82,000 |
| | | Tetrachloroethene | 1,500 | 32,000 | 35,000 | N/S | 36,000 | N/S | 37,000 J | 32,000 J |
| | | Trichloroethene | 11,000 | 280,000 | 190,000 | N/S | 190,000 | N/S | 160,000 | 140,000 |
| 105D | D | Hexachlorobutadiene | 20 | 95.0 | BC | N/S | N/S | N/S | N/S | N/S |
| | | Carbon Tetrachloride | 8,000 | 150,000 | 83,000 | N/S | 170,000 | N/S | 190,000 | 190,000 |
| | | Chloroform | 80,000 | 98,000 | BC | N/S | 80,000 | N/S | 90,000 | 96,000 |
| | | Tetrachloroethene | 1,500 | 12,000 | 5,700 | N/S | 11,000 | N/S | 13,000 J | 12,000 J |
| | | 1,1,2,2-Tetrachlorethane | 29,000 | N/S | N/S | N/S | 88,000 | N/S | 79,000 | 76,000 |
| | | Trichloroethene | 11,000 | 120,000 | 51,000 | N/S | 110,000 | N/S | 120,000 | 130,000 |
| 136C | C | Tetrachloroethene | 1,500 | 4,100 | 3,600 | 3,300 | 3,100 | 5,200 | 3,800 | 4,800 |
| 137C | C | Tetrachloroethene | 1,500 | 8,500 | 22,000 | N/S | 7,900 | N/S | 2,200 | 2,700 |
| | | Trichloroethene | 11,000 | BC | 19,000 | N/S | 16,000 | N/S | 20,000 | 70,000 |
| 137D | D | Tetrachloroethene | 1,500 | 5,100 | 4,900 | N/S | BC | N/S | 7,200 | 5,300 |
| | | Trichloroethene | 11,000 | 64,000 | 76,000 | N/S | 27,000 | N/S | 91,000 | 70,000 |
| 139B | B | Tetrachloroethene | 1,500 | N/S | N/S | N/S | 2000 J | N/S | 4,600 | 3,100 |
| | | Hexachlorobutadiene | 20 | 78 | BC | N/S | N/S | N/S | N/S | N/S |
| | | 1,1,2,2-Tetrachlorethane | 29000 | N/S | N/S | N/S | 29,000 | N/S | BC | BC |
| 139D | D | Hexachlorobenzene | 0.11 | 38.0 | 11.0 | N/S | N/S | N/S | N/S | N/S |
| | | Tetrachloroethene | 1,500 | 1,900 | BC | N/S | BC | N/S | BC | BC |
| 165E | E | Hexachlorobutadiene | 20 | 27.0 | BC | 32 J | 46 J | BC | 45 J | 91 J |
| 168C | C | Hexachlorobutadiene | 20 | 330 | 64.0 | 54 J | N/S | 44 J | BC | BC |
| 171B | B | Hexachlorobutadiene | 20 | 2,100 | 130 | BC | BC | BC | BC | BC |
| | | Hexachlorobenzene | 0.11 | BC | 4.0 | 3.1 J | 3.4 J | BC | 1.4 J | BC |
| 172B | B | Hexachlorobutadiene | 20 | 140 | 89 | 140 J | 110 | BC | 110 | 54 |
| | | Tetrachloroethene | 1,500 | 1,800 | BC | BC | BC | BC | BC | BC |
| D-11 | A | Hexachlorobutadiene | 20 | 29 | BC | BC | BC | BC | BC | BC |

BC: Below Criteria

N/S: Not Sampled

Note: Wells 105C and 105D are located on the landfill and are MNA Source Area wells.

# Table 3-12
# Chemical Monitoring List
# Long-Term Monitoring
# DuPont Necco Park

**Current list of wells monitored**

| MONITORING WELL | ZONE | MONITORING WELL | ZONE |
|---|---|---|---|
| D-11 | A | **105D** | D |
| D-13 | A | 123D | D |
| D-9 | A | 136D | D |
| 137A | A | **137D** | D |
| 145A | A | 145D | D |
| 146AR | A | 148D | D |
| 150A | A | **139D** | D |
| **111B** | B | 147D | D |
| 136B | B | 149D* | D |
| 137B | B | 156D | D |
| **139B** | B | 165D | D |
| **141B** | B | 136E | E |
| 145B* | B | 145E | E |
| 146B | B | 146E | E |
| 149B* | B | 150E | E |
| 150B | B | 156E | E |
| 151B* | B | 165E | E |
| **153B** | B | 136F | F |
| 168B | B | 146F | F |
| 171B | B | 147F | F |
| 172B | B | 150F* | F |
| **105C** | C | 156F | F |
| 136C | C | 147G1 | G1 |
| **137C** | C | 147G2 | G2 |
| **141C*** | C | 147G3 | G3 |
| 145C* | C | | |
| 146C* | C | | |
| 149C | C | | |
| 150C* | C | | |
| 151C | C | | |
| 168C | C | | |

*Well does not meet bedrock zone water bearing criteria (k<10-$^{4}$ cm/sec).

Wells shown in **bold** are used solely for the MNA evaluation and will not be used for Long-term chemistry monitoring.

**Proposed list of wells to be monitored**

| MONITORING WELL | ZONE | MONITORING WELL | ZONE |
|---|---|---|---|
| 137A | A | 136D | D |
| 145A | A | **137D** | D |
| 146AR | A | 145D | D |
| 150A | A | 148D | D |
| 136B | B | 165D | D |
| 137B | B | 146E | E |
| 145B* | B | 150E | E |
| 146B | B | 165E | E |
| 150B | B | 136F | F |
| 168B | B | 146F | F |
| 171B | B | 150F* | F |
| 172B | B | | |
| 137C | C | | |
| 145C* | C | | |
| 146C* | C | | |
| 150C* | C | | |
| 168C | C | | |

*Well does not meet bedrock zone water bearing criteria (k<10-$^{4}$ cm/sec).
Wells shown in **bold** are used solely for the MNA evaluation and will

# Table 3-13
# Indicator Parameter List
# Long-Term Groundwater Monitoring
# DuPont Necco Park

| INORGANIC AND GENERAL WATER QUALITY PARAMETERS | VOLATILE ORGANIC COMPOUNDS | SEMIVOLATILE ORGANIC COMPOUNDS |
|---|---|---|
| pH* | Vinyl chloride | Hexachloroethane |
| Specific conductivity* | 1,1-dichloroethene | Hexachlorobutadiene |
| Temperature* | Trans-1,2-dichloroethene | Phenol |
| Turbidity* | Cis-1,2-dichloroethene | 2,4,6-trichlorophenol |
| Dissolved oxygen * | Chloroform | 2,4,5-trichlorophenol |
| Redox potential* | Carbon tetrachloride | Pentachlorophenol |
| Chloride | 1,2-dichloroethane | Hexachlorobenzene |
| Dissolved barium | Trichloroethene | 4-methlyphenol |
|  | 1,1,2-trichloroethane | TIC-1 |
|  | Tetrachloroethene |  |
|  | 1,1,2,2-tetrachloroethane |  |

*Field parameter

# Table 3-14
# Monitored Natural Attenuation Parameters
# DuPont Necco Park

| **Field Parameters** | **Miscellaneous Parameters** |
|---|---|
| Specific Conductance | Alkalinity |
| Temperature | Chloride |
| Dissolved Oxygen | Nitrate Nitrogen |
| pH | Sulfate |
| Eh (Redox) | Sulfide as S |
| **Gases** | Total Organic Carbon |
| Ethane | |
| Ethene | |
| Methane | |
| Propane | |
| **Dissolved Metals** | |
| Iron | |
| Manganese | |

# Table 3-15
# MNA B/C Zone Wells
# DuPont Necco Park

## MNA B/C Zone Wells

| Well | Location | Last NAPL observation | Conc. Trend 2005 - 2008 | Dominant Cl - Ethene species | 2008 Ethene Production | 2005 Total Cl-Ethenes (ug/L) | 2006 Total Cl-Ethenes (ug/L) | 2007 Total Cl-Ethenes (ug/L) | 2008 Total Cl-Ethenes (ug/L) | ORP (mv) | Fe (ug/L) | Cl (ug/L) | $SO^4$ (ug/L) | S (ug/L) | $CH^4$ (ug/L) | TOC (ug/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 141B | Upgradient | NA | Clean | NA | Moderate | 0 | 0 | 0 | 0 | -436 | 0 | 1E+06 | 689000 | 7000 | 1300 | 14000 |
| 141C | Upgradient | NA | Flat | PCE, TCE, VC | Weak | 2 | 1 | 1 | 2 | -362 | 0 | 752000 | 419000 | 1300 | 320 | 15000 |
| 111B | Source Area | NA | Slight Increase | cDCE, VC | Good | 758 | 398 | 746 | 1,657 | -474 | 103000 | 5E+06 | 69600 | 0 | 13000 | 1E+06 |
| 137B | Source Area | NA | Decreasing | TCE, cDCE, VC | Moderate | 1,114 | 664 | 750 | 463 | -519 | 0 | 753000 | 9300 | 4800 | 1700 | 34000 |
| 139B | Source Area | 1992 | Increasing | PCE, TCE, tDCE, cDCE, VC | Good | 1,447 | 23,800 | 50,300 | 41,200 | -271 | 260000 | 4200 | 0 | 1400 | 9600 | 160000 |
| 105C | Source Area | 1992 | Slight Decrease | PCE, TCE cDCE, tDCE, 1,1 DCE, VC | Good | 260,800 | 260,800 | 231,200 | 202,900 | -217 | 900 | 7E+06 | 403000 | 4600 | 3000 | 300000 |
| 137C | Source Area | NA | Decreasing | PCE, TCE cDCE, VC | Good | 51,200 | 45,110 | 38,220 | 8,760 | -454 | 160 | 1E+06 | 54200 | 3800 | 4300 | 63000 |
| 145B | Downgradient | NA | Slight Increase | TCE, cDCE, VC | Good | 4,400 | 29,850 | 30,690 | 17,350 | -422 | 0 | 6E+06 | 707000 | 5100 | 5000 | 21000 |
| 145C | Downgradient | NA | Flat | cDCE, VC | Moderate | 8,900 | 7,650 | 15,560 | 6,412 | -261 | 825000 | 5E+07 | 559000 | 95000 | 2700 | 43000 |
| 149C | Downgradient | NA | Flat | cDCE, VC | Weak | 10 | 16 | 27 | 12 | -270 | 0 | 294000 | 204000 | 6100 | 1400 | 6000 |
| 151C | Downgradient | NA | Decreasing | tDCE, VC | Weak | 220 | 12 | 8 | 12 | -365 | 200 | 1E+06 | 2E+06 | 52000 | 3600 | 7000 |
| 151B | Downgradient | NA | Flat | All | Weak | 0 | 2.24 | 8.36 | 3.8 | -373 | 0 | 422000 | 8000 | 0 | 180 | 2000 |
| 153B | Sidegradient | NA | Clean | NA | BDL | 0 | 0 | 0 | 0 | -142 | 1200 | 397000 | 230000 | 640 | 260 | 4000 |

NA = Not Applicable
ND= No Data
BDL = Below Detection Limit
ORP = Oxidation/Reduction Potential
Fe = Dissolved Iron
Cl = Chloride
$SO^4$ = Sulfate
S = Sulfide
$CH^4$ = Methane
TOC = Total Organic Carbon
(ug/L) = Micrograms per Liter
(mv) = Millivolts

# Table 3-16
# MNA D/E/F Zone Wells
# DuPont Necco Park

## MNA D/E/F Zone Wells

| Well | Location | Last NAPL Observation | Conc. Trend 2005 - 2008 | Dominant Cl - Ethene Species | 2008 Ethene Production | 2005 Total Cl-Ethenes (ug/L) | 2006 Total Cl-Ethenes (ug/L) | 2007 Total Cl-Ethenes (ug/L) | 2008 Total Cl-Ethenes (ug/L) | ORP (mv) | Fe (ug/L) | Cl (ug/L) | $SO^4$ (ug/L) | S (ug/L) | $CH^4$ (ug/L) | TOC (ug/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 137D | Source Area | NA | Flat | PCE, TCE , cDCE, VC, tDCE, 1,1,DCE | Moderate | 94,500 | 35,470 | 120,700 | 93,700 | -376 | 310 | 2E+06 | 1E+06 | 7000 | 1500 | 270000 |
| 139D | Source Area | 1992 | Decreasing | TCE | Weak | 2,690 | 1,843 | 1,845 | 1,219 | -349 | 1100 | 945000 | 1E+06 | 3800 | 790 | 3000 |
| 165D | Source Area | NA | Decreasing | VC | Moderate | 1,102 | 597 | 498 | 23 | -307 | 0 | 336000 | 12800 | 640 | 200 | 9000 |
| 136D | Downgradient | NA | Flat | TCE, cDCE VC | Good | 1,819 | 1,170 | 468 | 950 | -378 | 120 | 258000 | 65100 | 65100 | 1500 | 10000 |
| 147D | Downgradient | NA | Flat | cDCE, VC | Weak | 183 | 168 | 164 | 172 | -172 | 730 | 33000 | 1E+06 | 0 | 140 | 1000 |
| 148D | Downgradient | NA | Flat | cDCE | Weak | 1 | 1 | 1 | 1 | -256 | 0 | 61800 | 431000 | 0 | 380 | 4000 |
| 156D | Downgradient | NA | Slight Decrease | VC | BDL | 5 | 3 | 2 | 2 | -223 | 1100 | 193000 | 691000 | 4400 | 450 | 3000 |
| 136E | Downgradient | NA | Flat | TCE, cDCE, VC , tDCE | Good | 17 | 16 | 36 | 9 | -344 | 120 | 189000 | 328000 | 12000 | 1000 | 5000 |
| 146E | Downgradient | NA | Increase | cDCE, VC | Good | 17,120 | 15,060 | 12,020 | 18,430 | -452 | 0 | 1E+06 | 394000 | 130000 | 4300 | 88000 |
| 156E | Downgradient | NA | Slight Decrease | cDCE, VC | BDL | 3 | 2 | 1 | 1 | -318 | 1700 | 205000 | 691000 | 7000 | 270 | 2000 |
| 146F | Downgradient | NA | Slight Decrease | cDCE, VC | Moderate | 20,470 | 20,310 | 22,160 | 15,720 | -353 | 270 | 3E+06 | 889000 | 5400 | 3100 | 80000 |
| 149D | Sidegradient | NA | Flat | cDCE, VC | Weak | 0 | 1 | 2 | 4 | -363 | 0 | 313000 | 942000 | 6200 | 3300 | 7000 |
| 145E | Sidegradient | NA | Slight Decrease | cDCE, VC | Good | 11,750 | 3,010 | 14,760 | 9,647 | -280 | 10900 | 4E+06 | 1E+06 | 1400 | 5000 | 28000 |
| 150F | Sidegradient | NA | Slight Decrease | cDCE, VC | Weak | 2,755 | 1,740 | 1,707 | 1,220 | -345 | 199000 | 1E+07 | 1E+06 | 21000 | 6100 | 210000 |

NA = Not Applicable
ND= No Data
BDL = Below Detection Limit
ORP = Oxidation/Reduction Potential
Fe = Dissolved Iron
Cl = Chloride
$SO^4$ = Sulfate
S = Sulfide
$CH^4$ = Methane
TOC = Total Organic Carbon
(ug/L) = Micrograms per Liter
(mv) = Millivolts

# Table 3-17
# 2008 DNAPL Recovery Summary
# DuPont Necco Park

| Well ID | Frequency | 8-Jan | | 13-Feb | | 9-Mar | | 12-Apr | | 18-May | | 15-Jun | | 20-Jul | | 23-Aug | | 28-Sep | | 26-Oct | | 26-Nov | | 18-Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS | FT | GALS |
| **RW-1** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **RW-2** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **RW-4** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **RW-5** | Monthly | **9.0** | **28.0** | **4.0** | **17.0** | **5.0** | **20.0** | **9 to 12** | **87.0** | **7 to 15** | **89.0** | **7 to 10** | **103.0** | **6 to 7** | **52.0** | **8.0** | **29.0** | **7.0** | **43.0** | **3 to 6** | **44.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **TRW-6** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **TRW-7** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **D-23** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-117A** | Monthly | na | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-123A** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-129A** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-129C** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | TRACE | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-160B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-160C** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-161B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-161C** | Monthly | 0.0 | | 0.0 | | TRACE | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-162C** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-190A** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-167B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-168B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-168C** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-169B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-170B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-171B** | Monthly | TRACE | | TRACE | | TRACE | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-172B** | Monthly | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| **VH-131A** | Semi-annually | na | | na | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | na | | na | | 0.0 | | na | | na | | na | |
| **VH-139A** | Semi-annually | na | | na | | 0.0 | | 0.0 | | na | | 0.0 | | na | | na | | 0.0 | | na | | na | | na | |
| **VH-139C** | Semi-annually | na | | na | | 0.0 | | 0.0 | | na | | 0.0 | | na | | na | | 0.0 | | na | | na | | na | |
| **CECOS52SR** | Semi-annually | na | | na | | 0.0 | | 0.0 | | na | | 0.0 | | na | | na | | 0.0 | | na | | na | | na | |
| **CECOS18SR** | Semi-annually | na | | na | | 0.0 | | 0.0 | | na | | 0.0 | | na | | na | | 0.0 | | na | | na | | na | |
| **CECOS-53** | Semi-annually | na | | na | | 0.0 | | 0.0 | | na | | 0.0 | | na | | na | | 0.0 | | na | | na | | na | |

na - not applicable/not taken
GALS - gallons purged

# FIGURES

**DUPONT**

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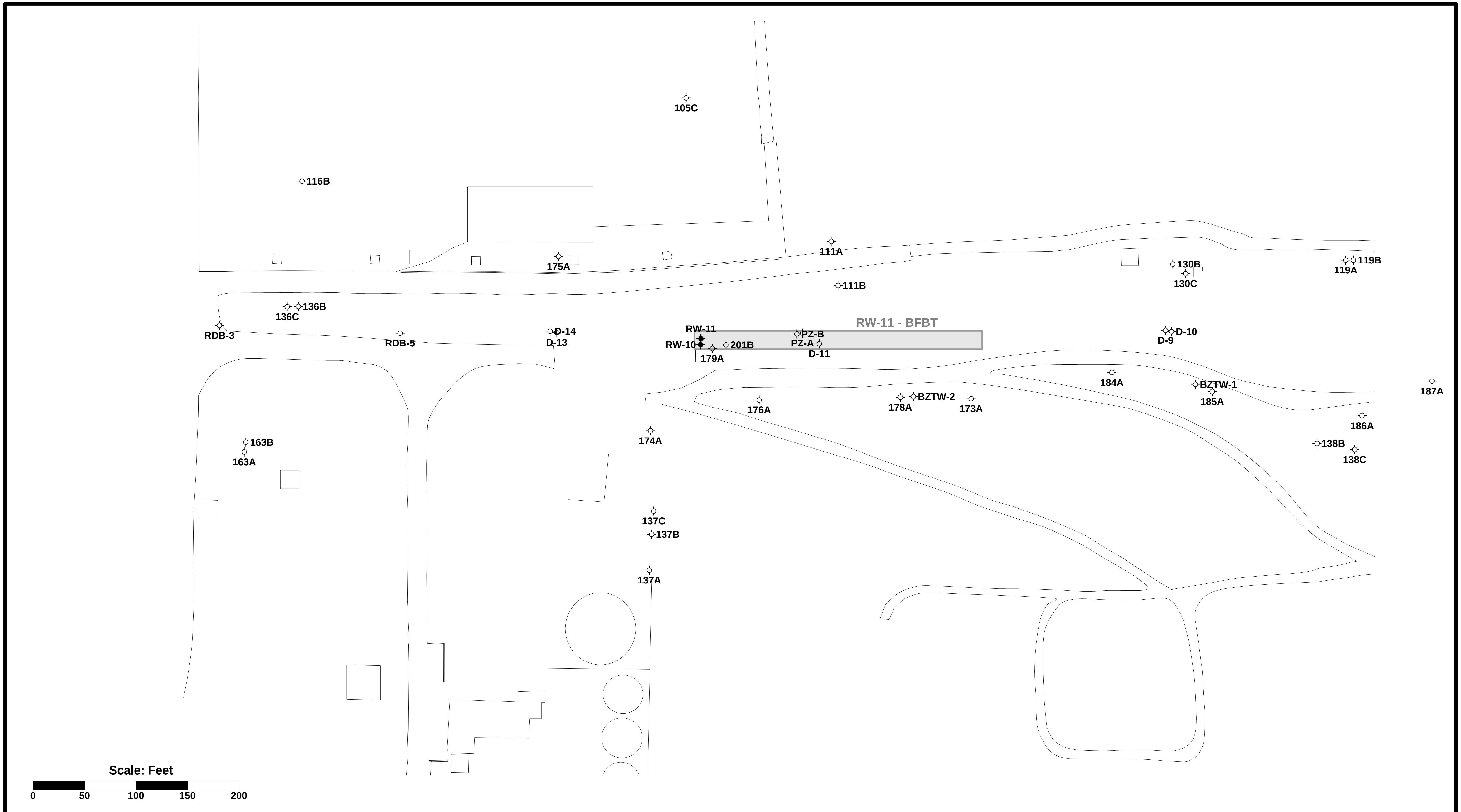
*An Alliance between*
*DuPont and URS Diamond*

Barley Mill Plaza, Building 27
Wilmington, Delaware 19805

## SITE LOCATION MAP

Necco Park Site
Niagara Falls, New York

SCALE No Scale
DESIGNED
DRAWN DEL
CAD FILE NO. Site_Location
DATE 10/16/03
CHECKED KAS
APPROVED
FIGURE 1



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**Niagara Falls, NY 14302**

## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour | ▭ | Blast Fractured Bedrock Trench |
| ✧ | Monitoring Well | ▭ | Structure | | |
| ✦ | Pumping Well | | Road | | |

# Figure 2-1
# BFBT Location Map
# DuPont Necco Park

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf

## Legend

- ⌖ DuPont Monitoring Well
- ✦ Allied Waste Monitoring Well
- ⬠ DuPont Extraction Well
- ▣ Former DuPont Extraction Well
- ☒ DuPont Peizometer
- ○ Chemical Monitoring Location

NOTE: Wells in bold will be used
for the MNA evaluation.

Peizometer ID Conversions

| New ID | Former ID |
|---|---|
| 184A | RDB-12 |
| 185A | 177A |
| 187A | RDB-15 |
| 188A | 166A |
| 189A | 181A |
| 190A | 167A |
| 191A | 182A |
| 192A | 183A |
| 193A | RDB-22 |

N:\18983203.00005\DB\GIS\locations.apr CHEMICAL MONITORING LOCATIONS_2
3/22/2008

WARNING

IT IS VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON OTHER THAN WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

| NO. | DATE | DESCRIPTION | NO. | DATE | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 11/08/05 | REVISION #1 | | | |
| | | | | | |
| | | | | | |

REVISIONS

DESIGNED BY: SPM
DRAWN BY: CNE
CHECKED BY: XXX
PROJ. ENGR. XXX

URS
Group Consultants
77 Goodell Street, Buffalo, New York 14203
(716)856-5636 - (716)856-2545 fax

JOB No. 18983203.00005

DUPONT
NECCO PARK

NIAGARA FALLS NEW YORK

WELL AND PIEZOMETER LOCATIONS
DUPONT NECCO PARK

175 0 175 350 Feet

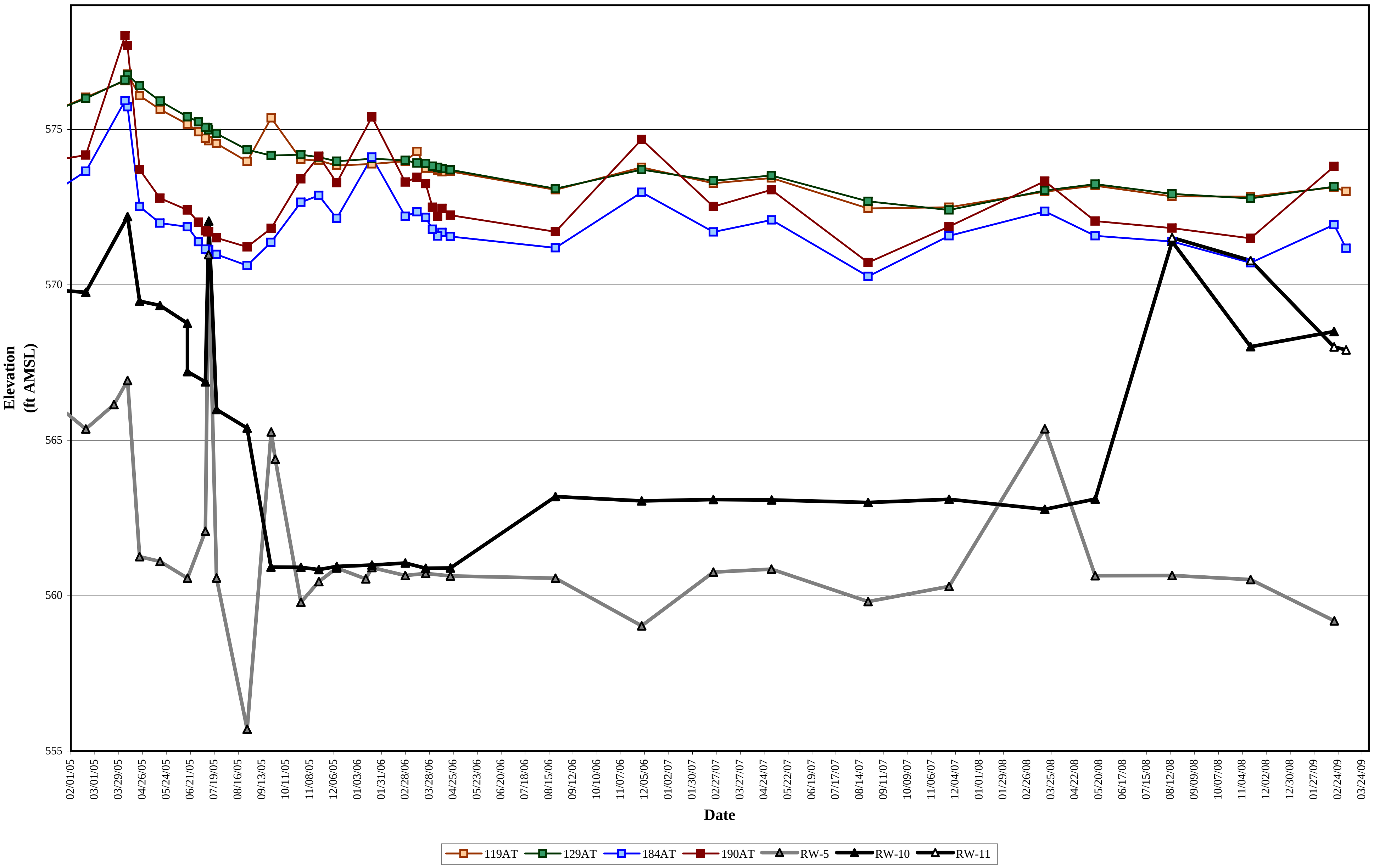
Scale: 1" = 175' - 0'

Date: OCT 2005

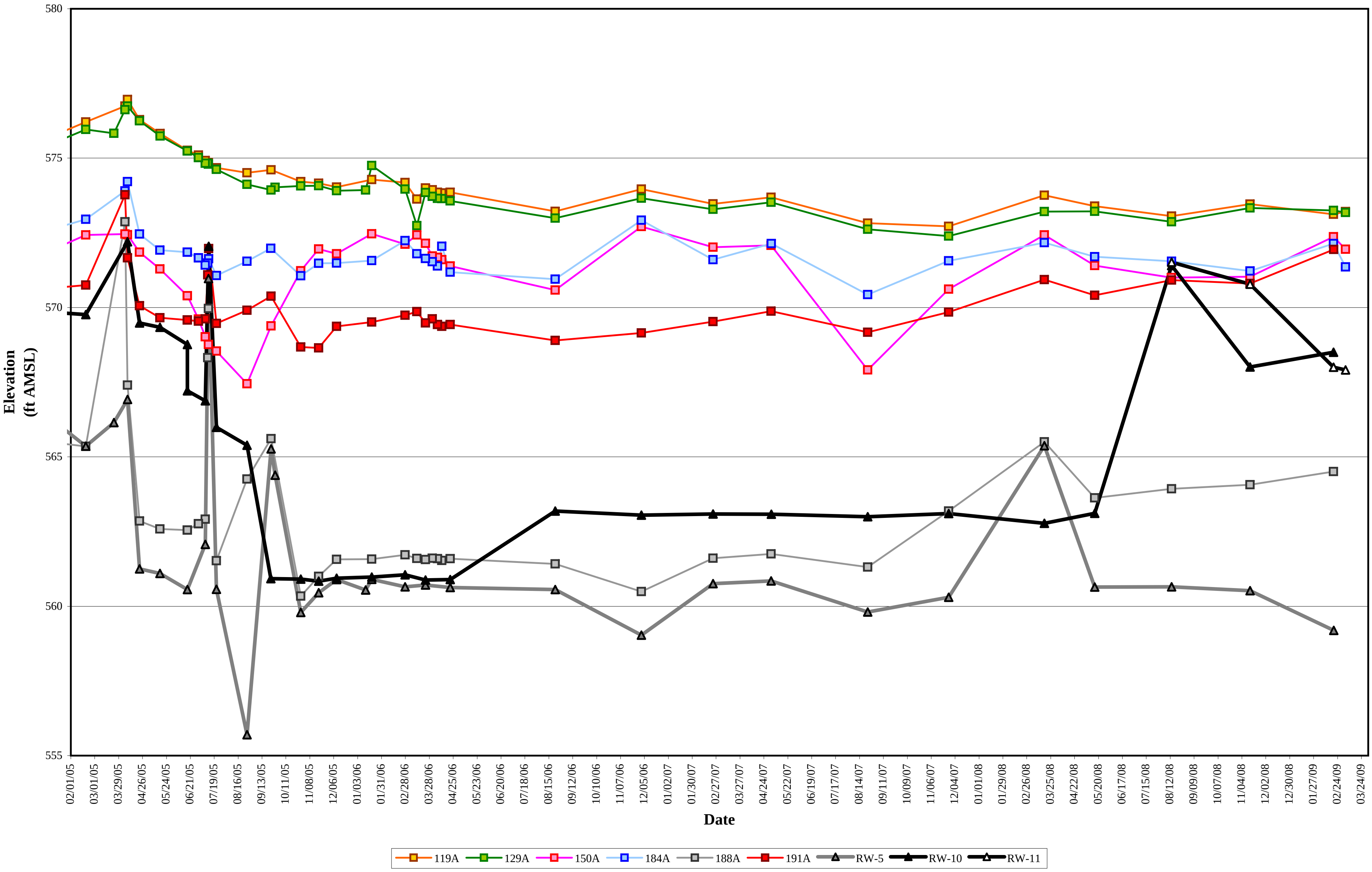
FIGURE 3-1

This drawing was computer generated. Any changes and/or revisions should be made to the GIS application.

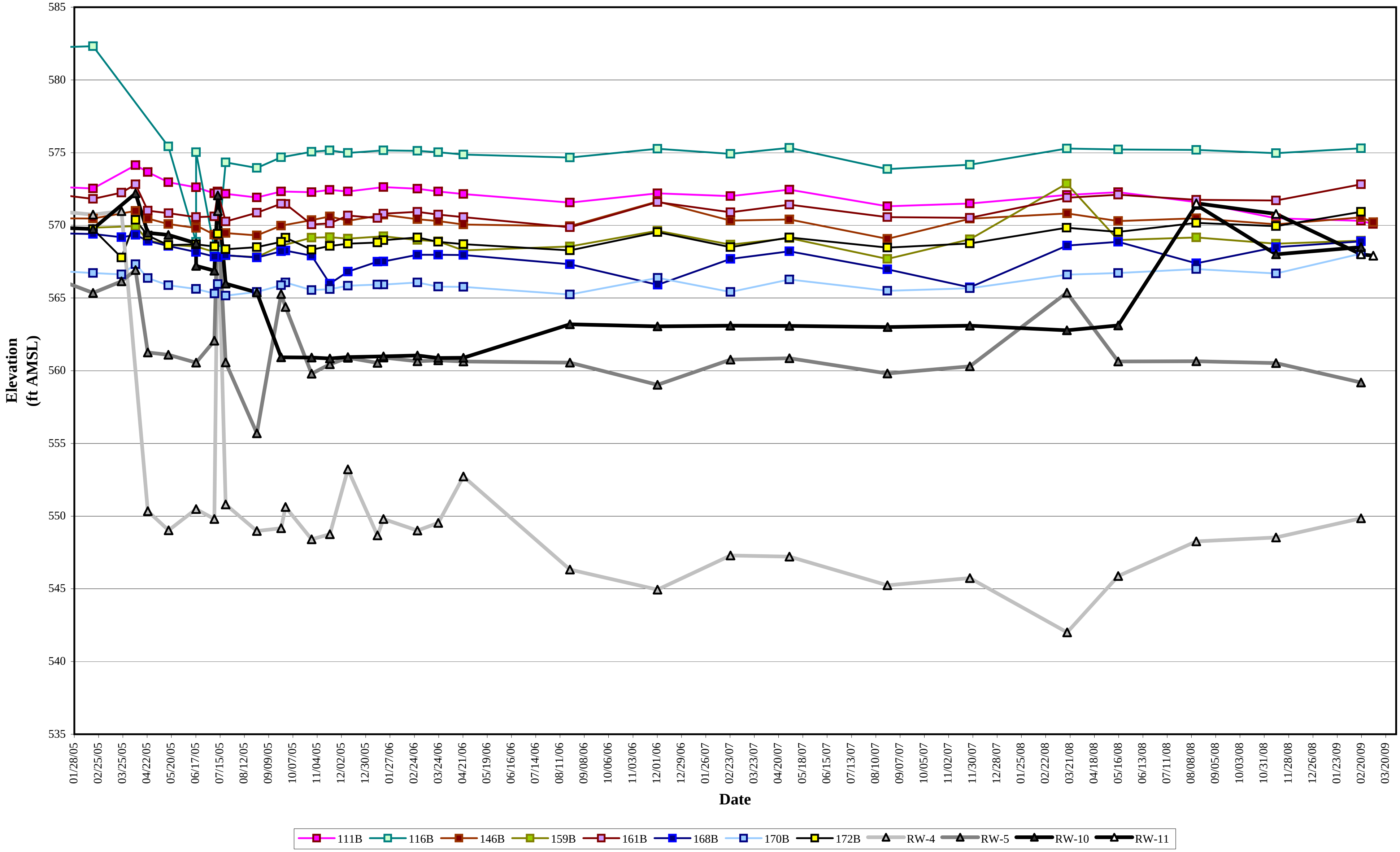
# Figure 3-2
# Select AT-Zone Monitoring Wells
# Groundwater Elevations 1Q05 - 1Q09
# DuPont Necco Park



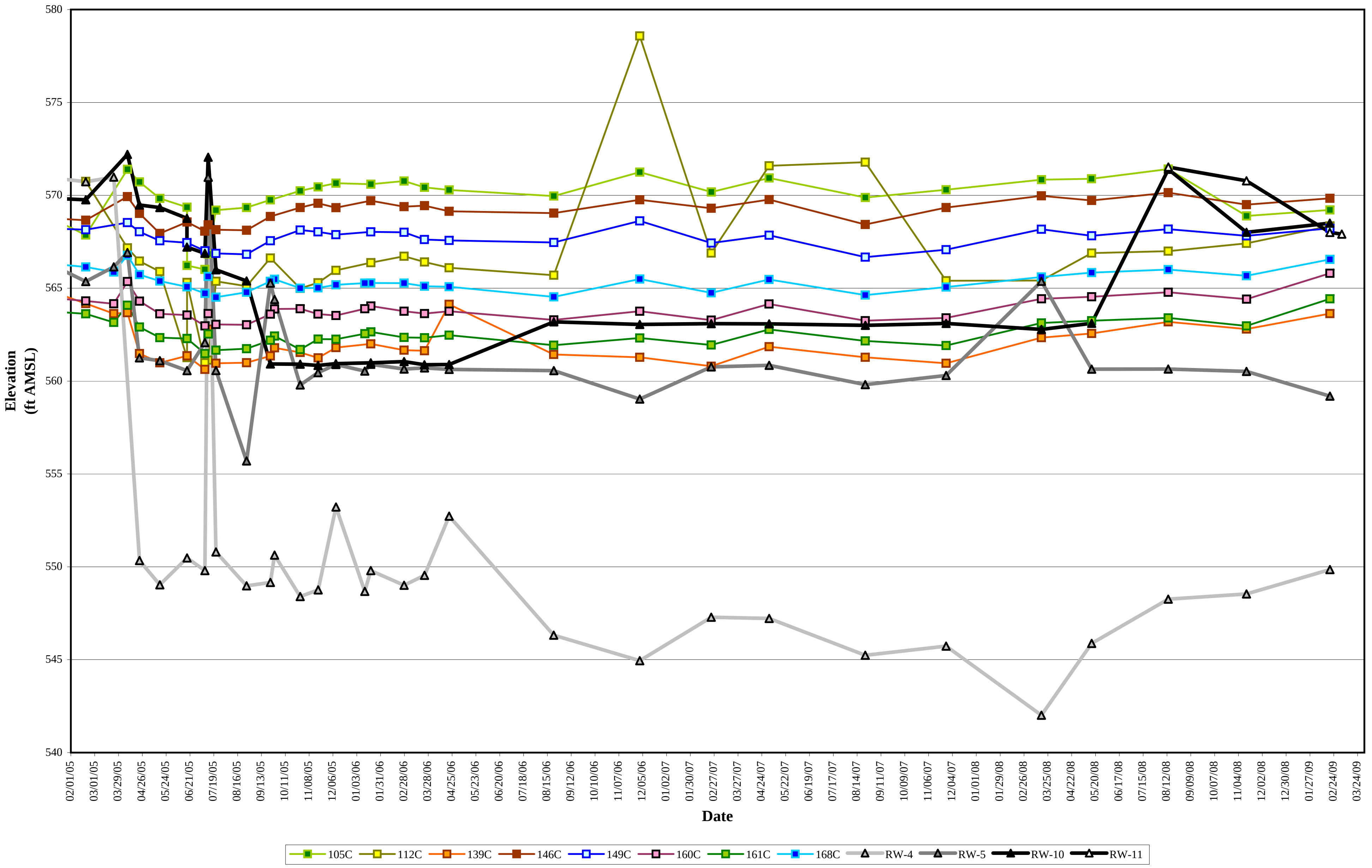
# Figure 3-3
# Select A-Zone Monitoring Wells
# Groundwater Elevations 1Q05 - 1Q09
# DuPont Necco Park



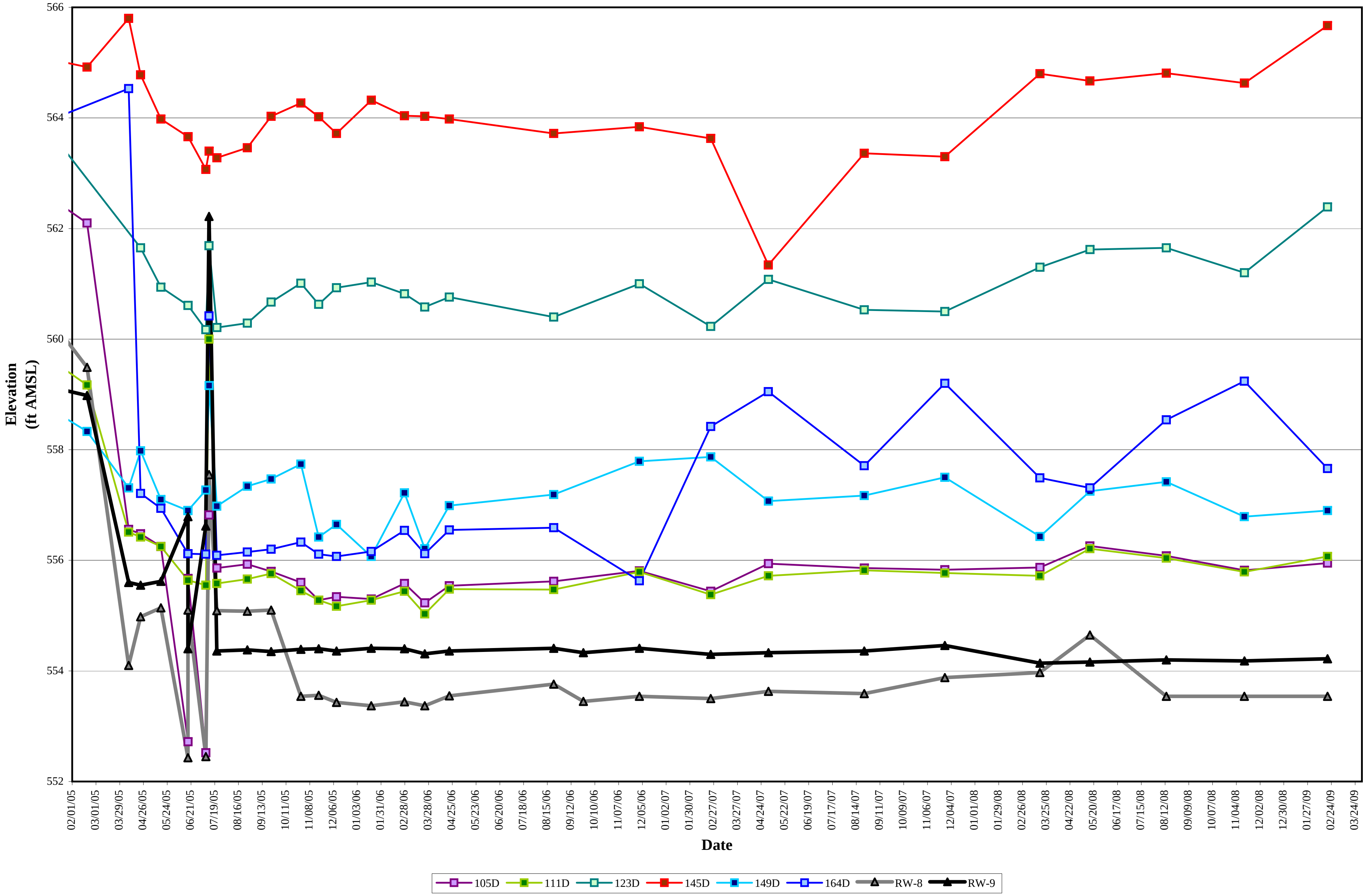
# Figure 3-4
# Select B-Zone Monitoring Wells
# Groundwater Elevations 1Q05 to 1Q09
# DuPont Necco Park



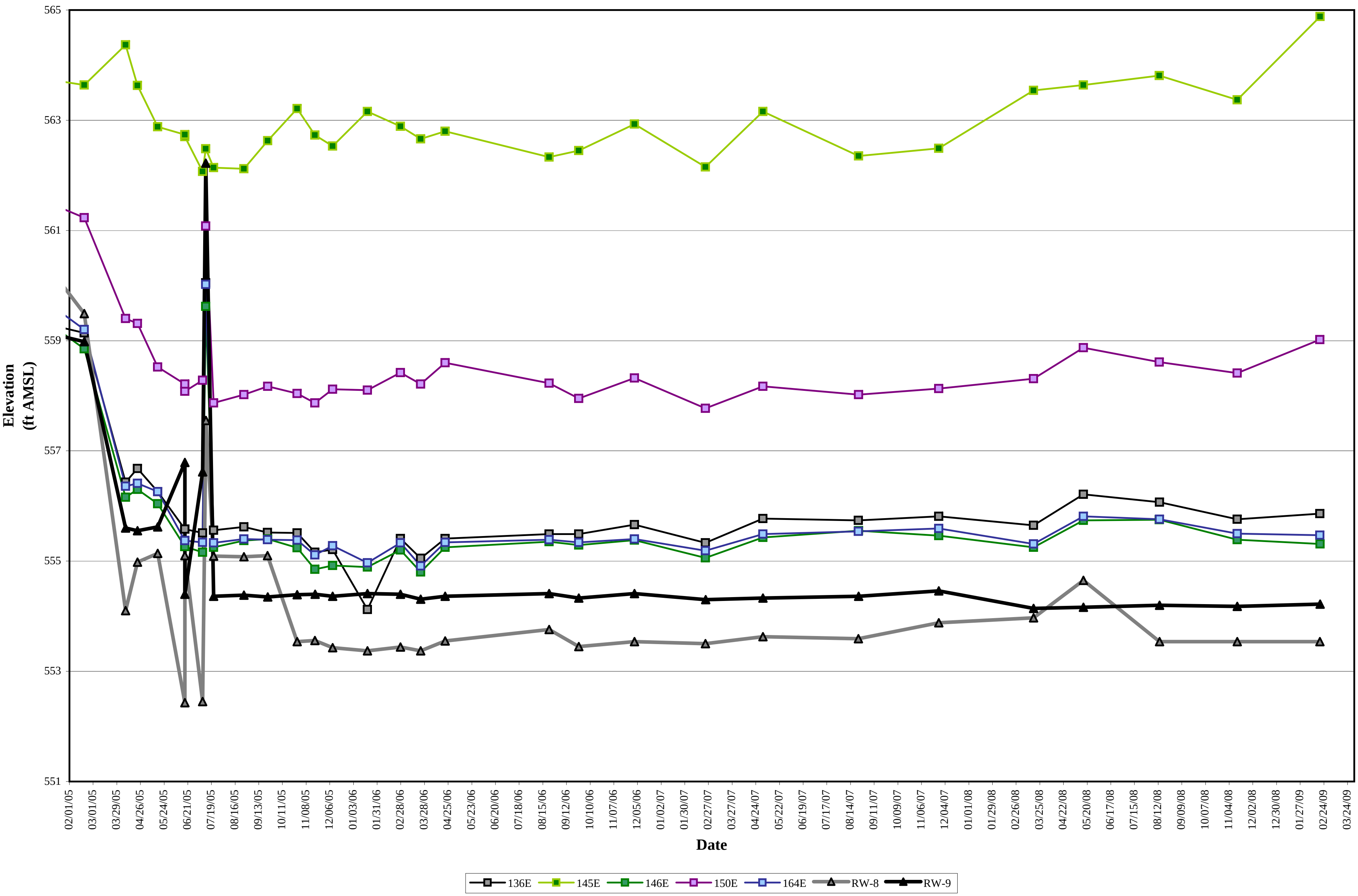
# Figure 3-5
# Select C-Zone Monitoring Wells
# Groundwater Elevations 1Q05 to 1Q09
# DuPont Necco Park



# Figure 3-6
# Select D-Zone Monitoring Wells
# Groundwater Elevations 1Q05 to 1Q09
# DuPont Necco Park



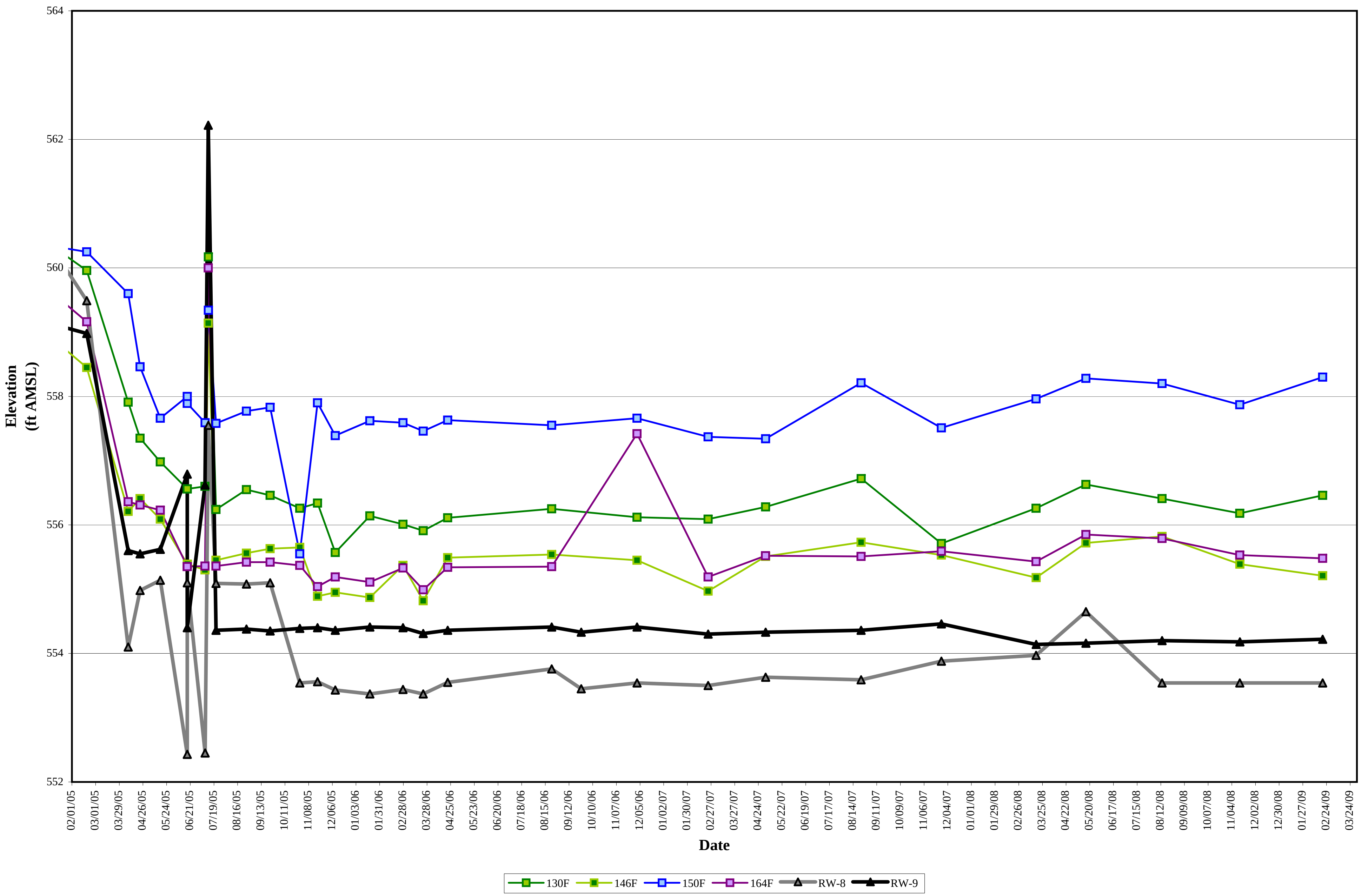
# Figure 3-7
# Select E-Zone Monitoring Wells
# Groundwater Elevations 1Q05 to 1Q09
# DuPont Necco Park

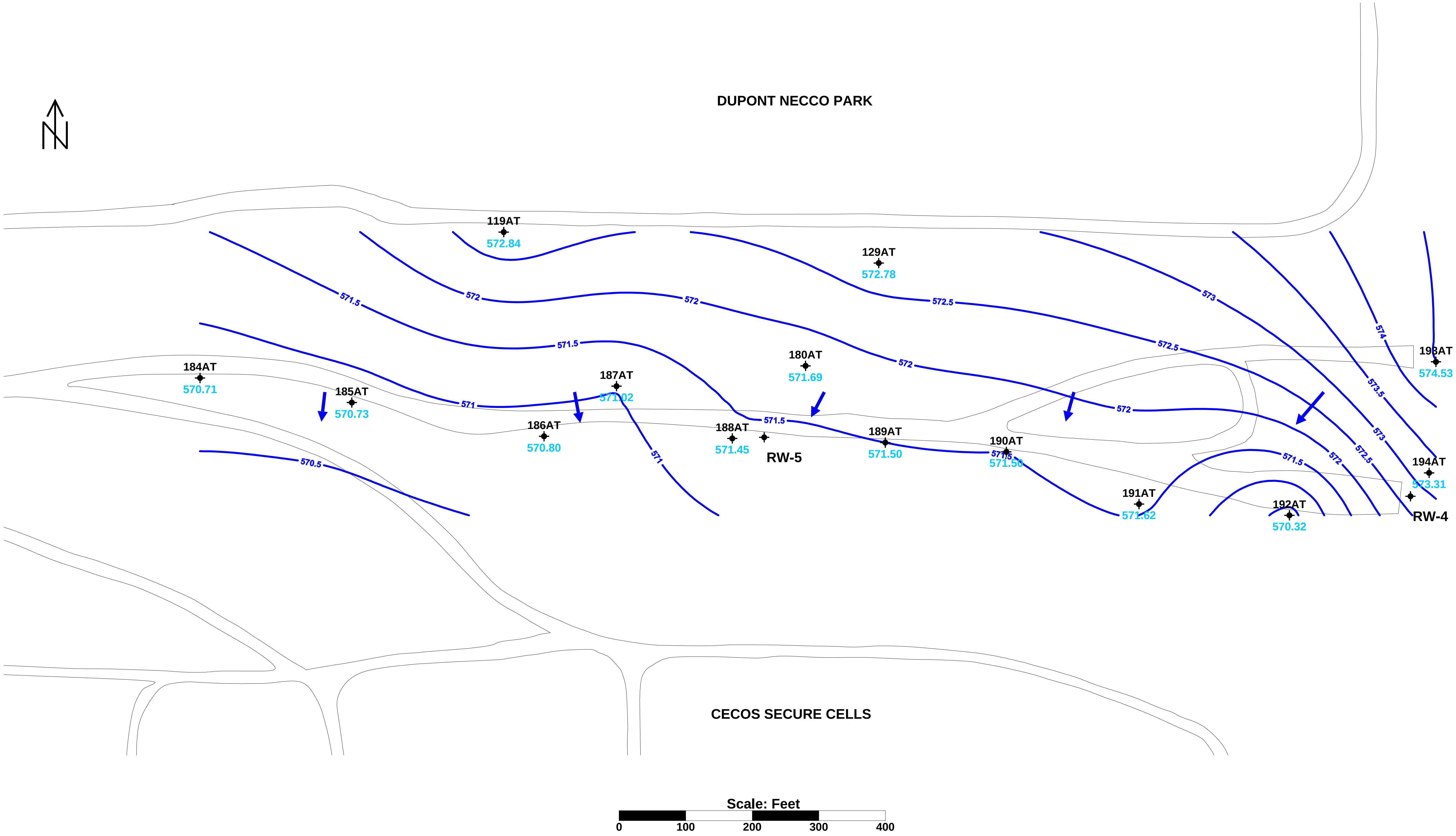


3/17/2009
8:14 AM

2008 of GW Elevation Trends - E Zone DRAFT.xls
Selected

# Figure 3-8
# Select F-Zone Monitoring Wells
# Groundwater Elevations 1Q05 to 1Q09
# DuPont Necco Park





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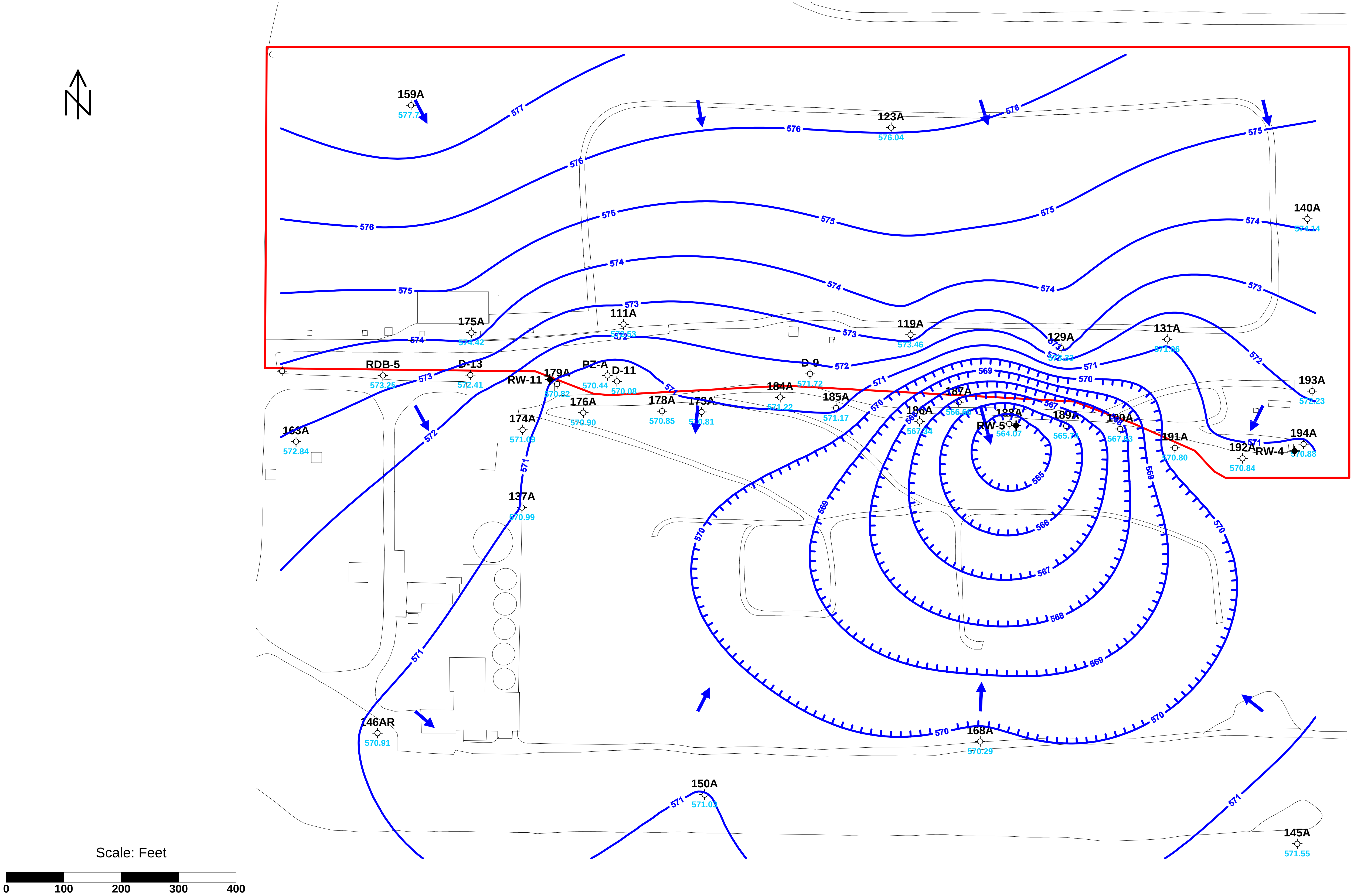
Niagara Falls, NY 14302

**LEGEND**

| | |
|---|---|
| 3B | Well ID |
| ⌖ | Monitoring Well |
| ● | Pumping Well |
| | Potentiometric Contour |
| ▭ | Structure |
| | Road |

## Figure 3-9
## Potentiometric Surface Map
## DuPont Necco Park: AT-Zone
## November 13, 2008



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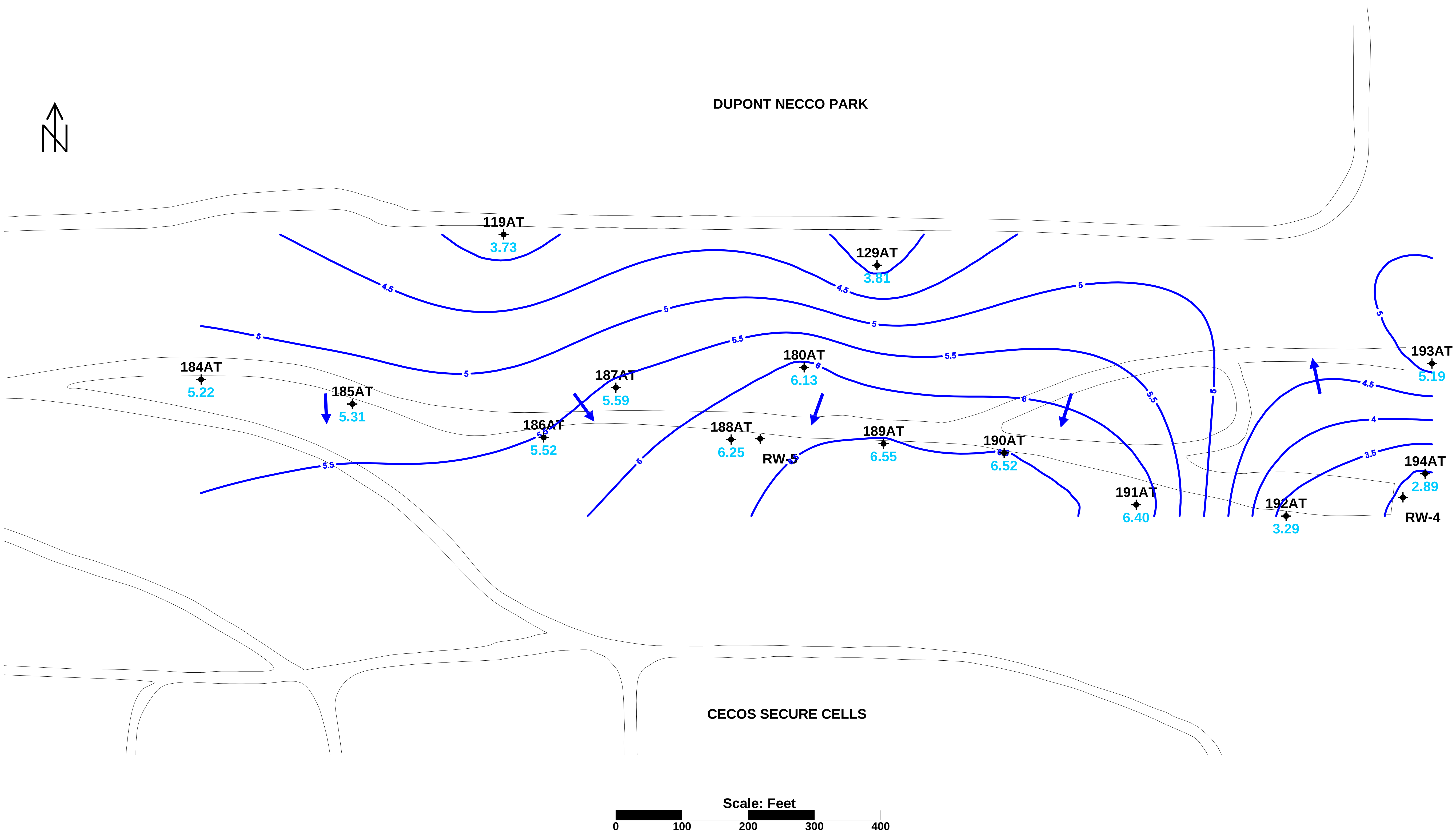
**Niagara Falls, NY 14302**

## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 3B | **Well ID** | | **Potentiometric Contour** | | **Source Area Delineation** |
| ✧ | **Monitoring Well** | ▭ | **Structure** | | |
| ◆ | **Pumping Well** | | **Road** | | |

# Figure 3-10
# Potentiometric Surface Map
# DuPont Necco Park: A-Zone
# November 13, 2008

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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**LEGEND**

3B Well ID

Monitoring Well

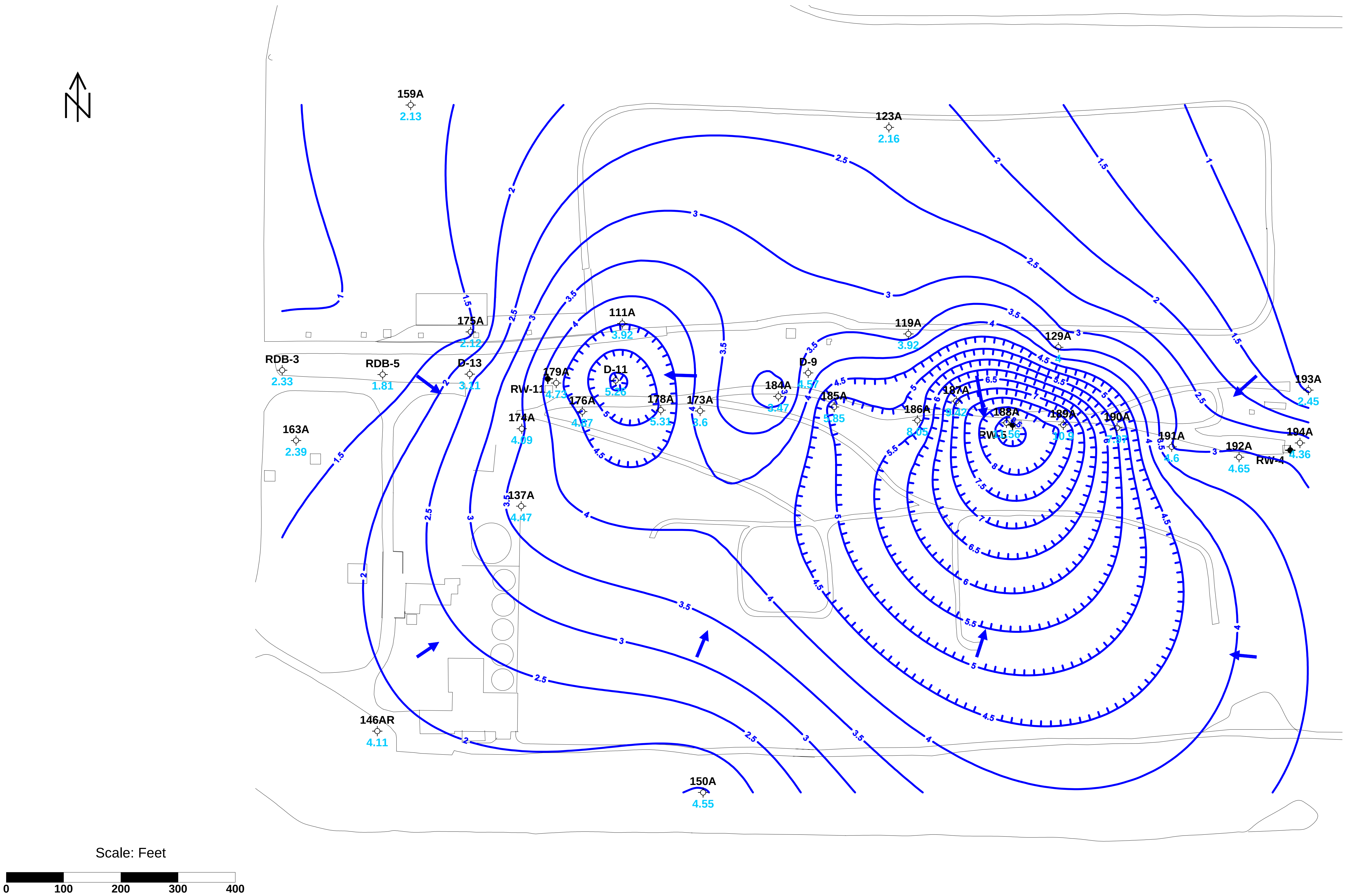
Pumping Well

Potentiometric Contour

Structure

Road

## Figure 3-11
## Drawdown Contour Map
## DuPont Necco Park: AT-Zone
## April 5, 2005 (Static) to November 13, 2008



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**Niagara Falls, NY 14302**

## LEGEND

**3B** Well ID
⌖ **Monitoring Well**
● **Pumping Well**
**Potentiometric Contour**
▭ **Structure**
**Road**

# Figure 3-12
# Drawdown Contour Map
# DuPont Necco Park: A-Zone
# April 5, 2005 (Static) to May 15, 2008

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf

Note:
Negative values indicate downward gradients.

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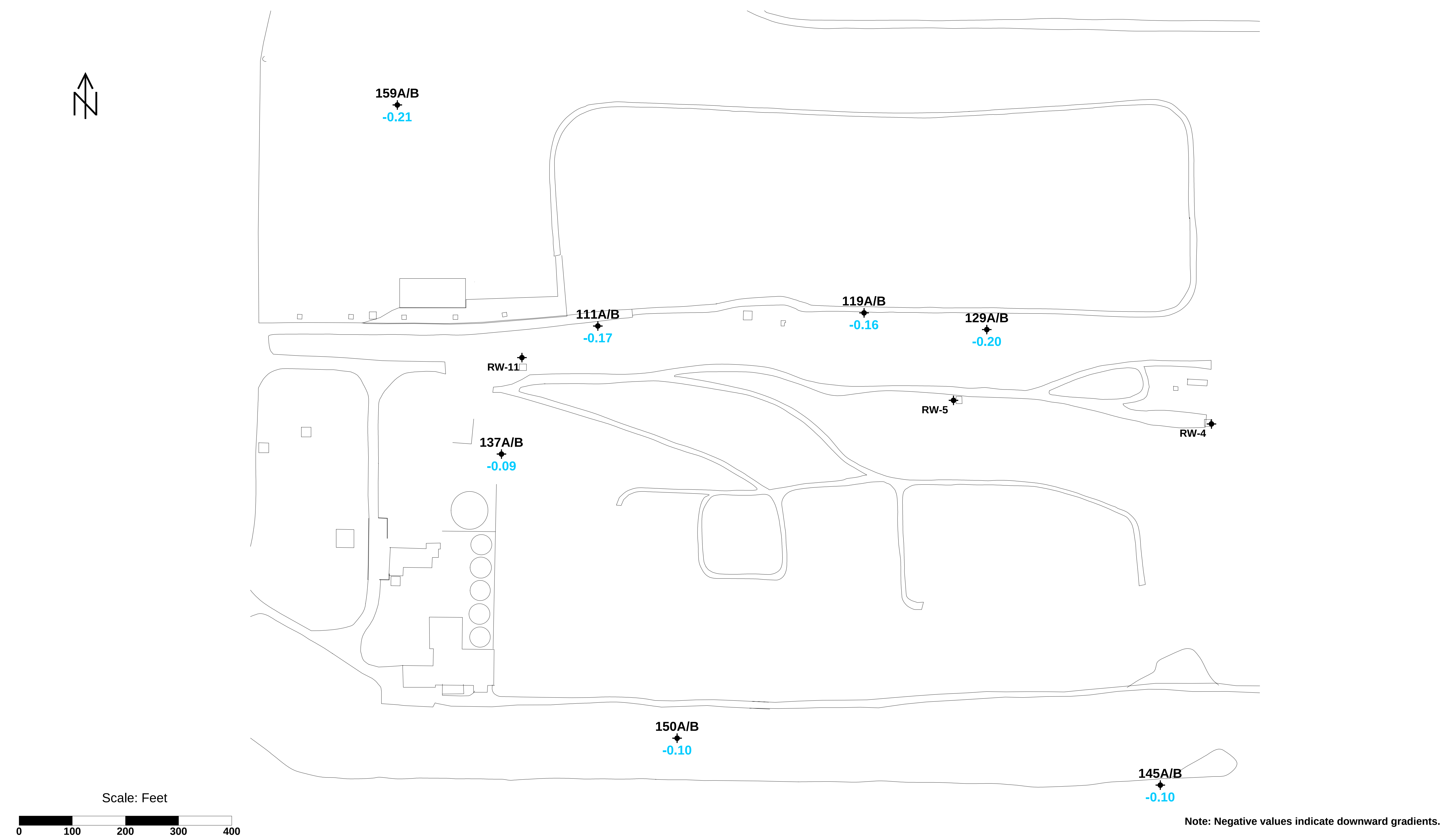
**LEGEND**

| | |
|---|---|
| 3B | Well ID |
| ⌖ | Monitoring Well |
| ● | Pumping Well |
| | Potentiometric Contour |
| ▭ | Structure |
| | Road |

## Figure 3-13
## Vertical Gradient: AT-Zone to A-Zone
## DuPont Necco Park
## November 13, 2008



Note: Negative values indicate downward gradients.

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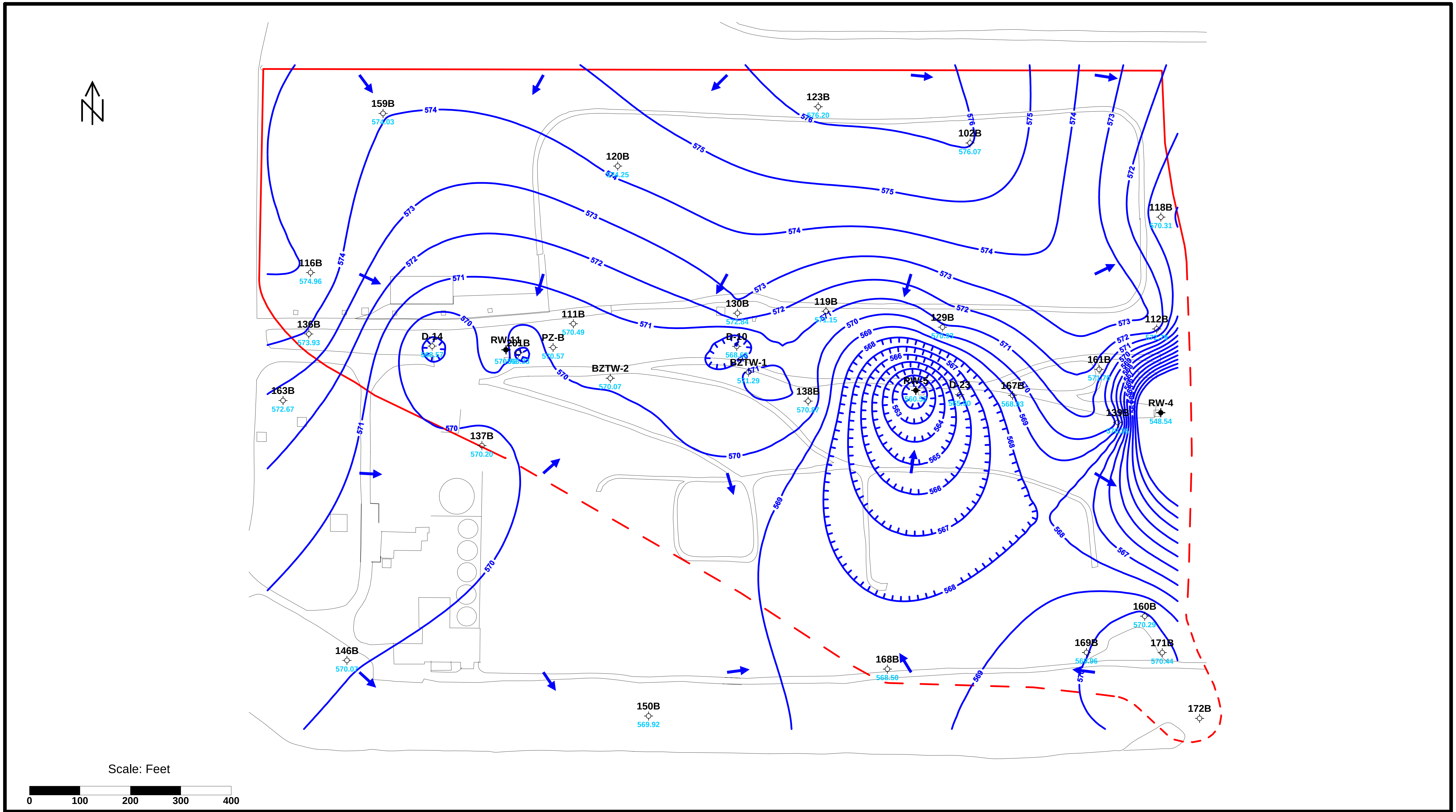
**Niagara Falls, NY 14302**

**LEGEND**

| | | | |
|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour |
| ✧ | Monitoring Well | ▭ | Structure |
| ✦ | Pumping Well | | Road |

# Figure 3-14
# Vertical Gradient: A-Zone to B-Zone
# DuPont Necco Park
# November 13, 2008

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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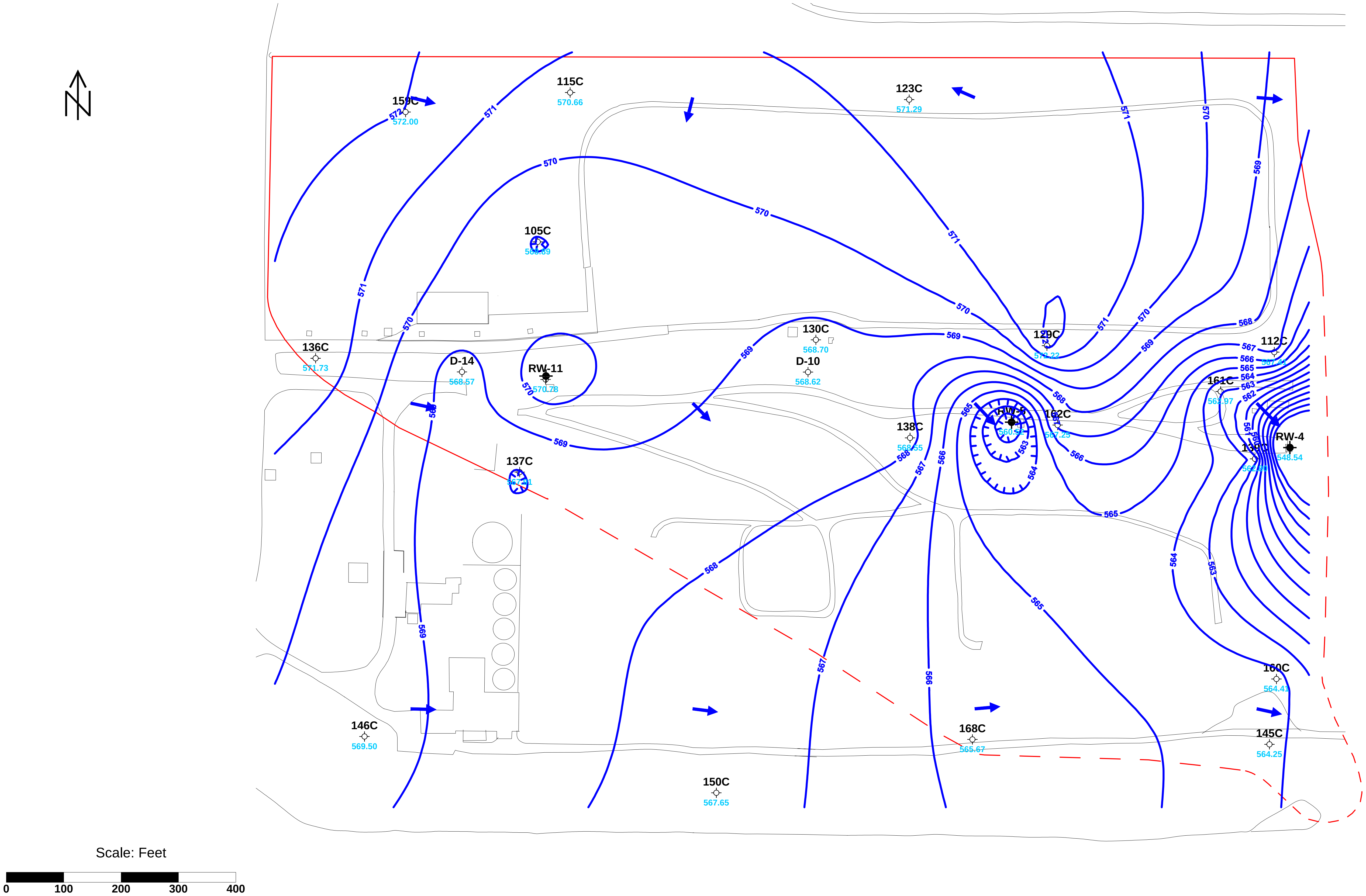
## LEGEND

3B Well ID
⌖ Monitoring Well
● Pumping Well
Potentiometric Contour
Structure
Road
Source Area Delineation

## Figure 3-15
## Potentiometric Surface Map
## DuPont Necco Park: B-Zone
## November 13, 2008

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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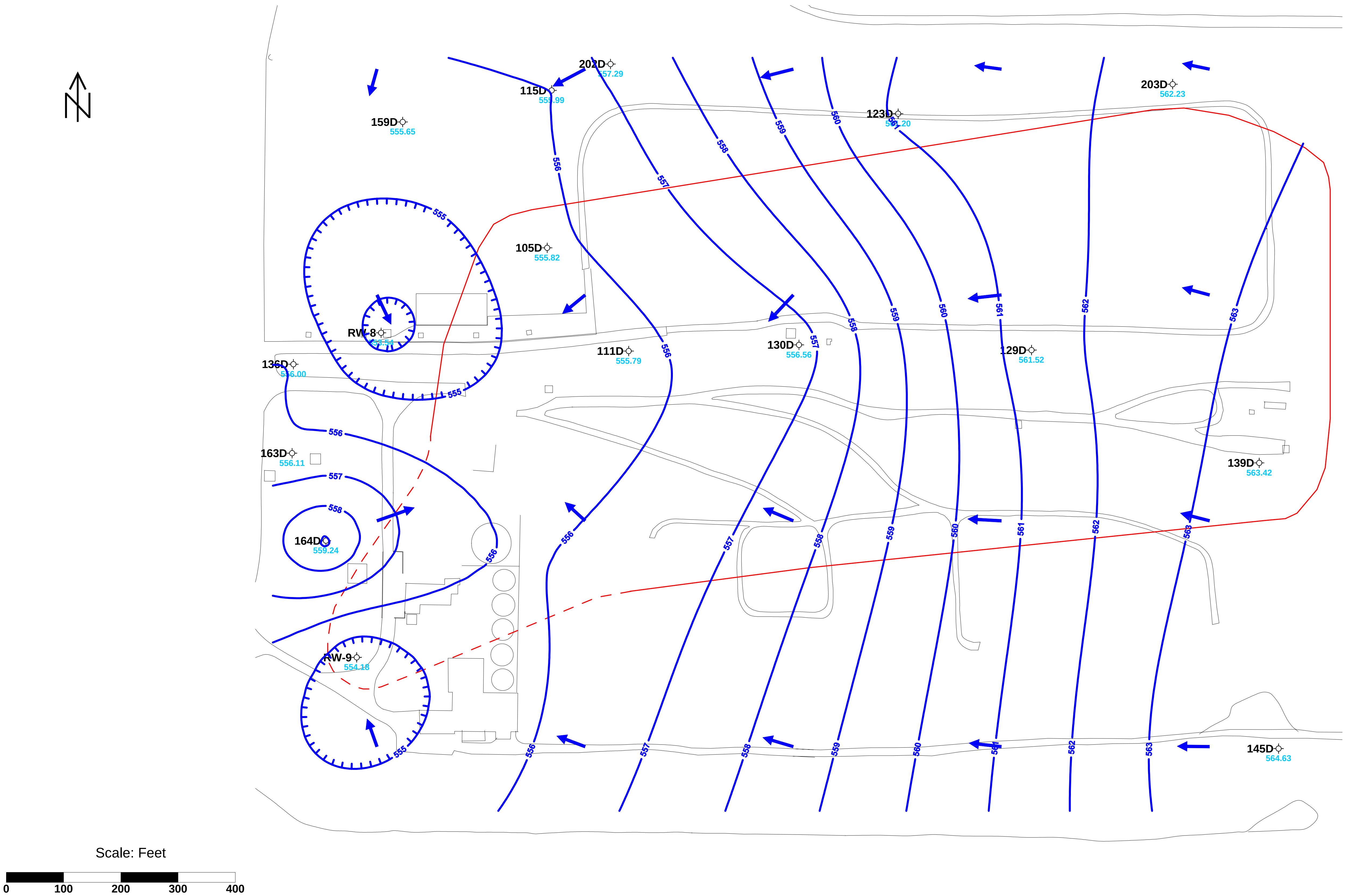
**Niagara Falls, NY 14302**

**LEGEND**

| | | | | | |
|---|---|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour | | Source Area Delineation |
| ⌖ | Monitoring Well | ▭ | Structure | | |
| ● | Pumping Well | | Road | | |

# Figure 3-16
# Potentiometric Surface Map
# DuPont Necco Park: C-Zone
# November 13, 2008



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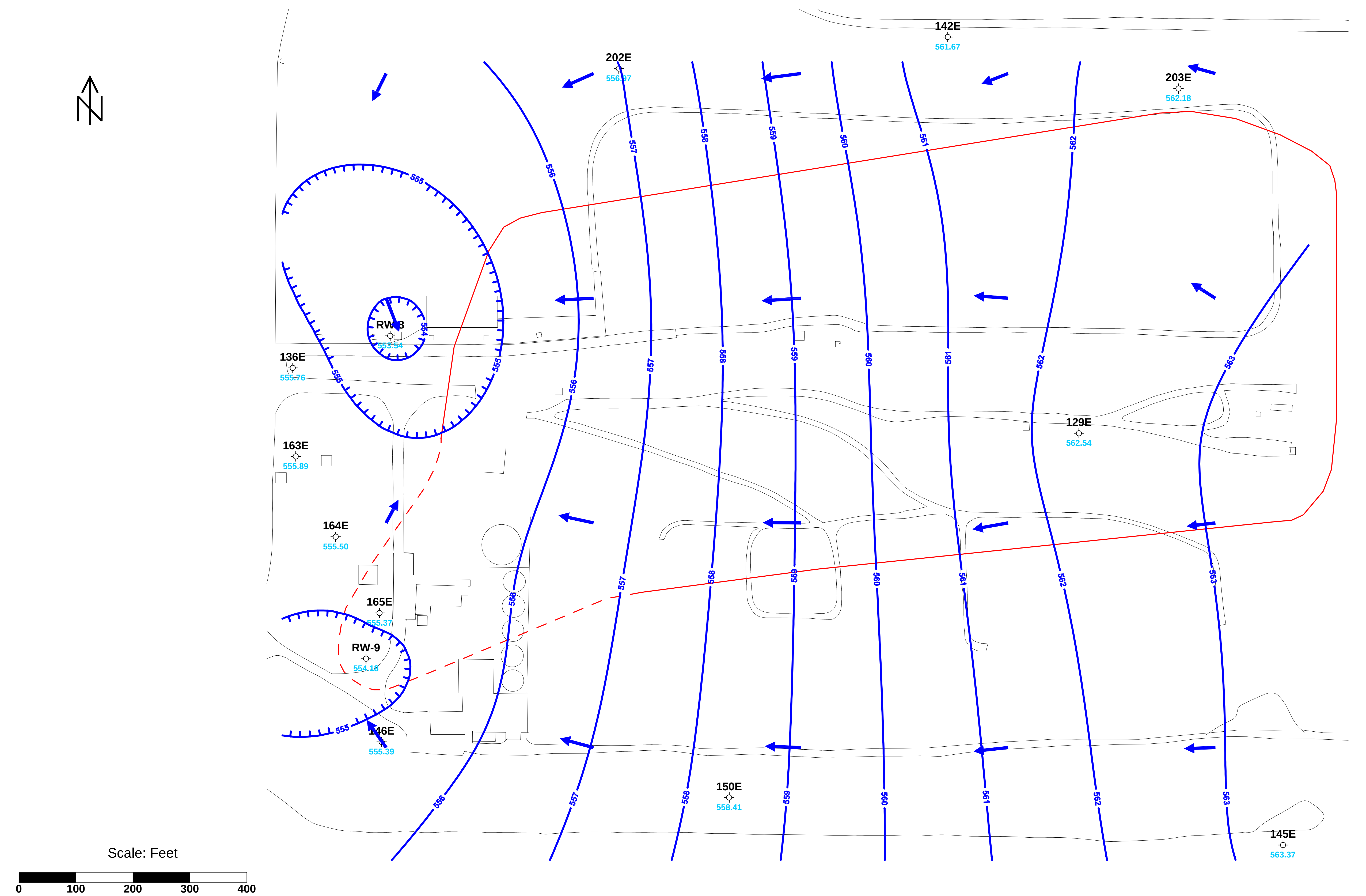
## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour | | Source Area Delineation |
| ⌖ | Monitoring Well | ▭ | Structure | | |
| ✦ | Pumping Well | | Road | | |

# Figure 3-17
# Potentiometric Surface Map
# DuPont Necco Park: D-Zone
# November 13, 2008

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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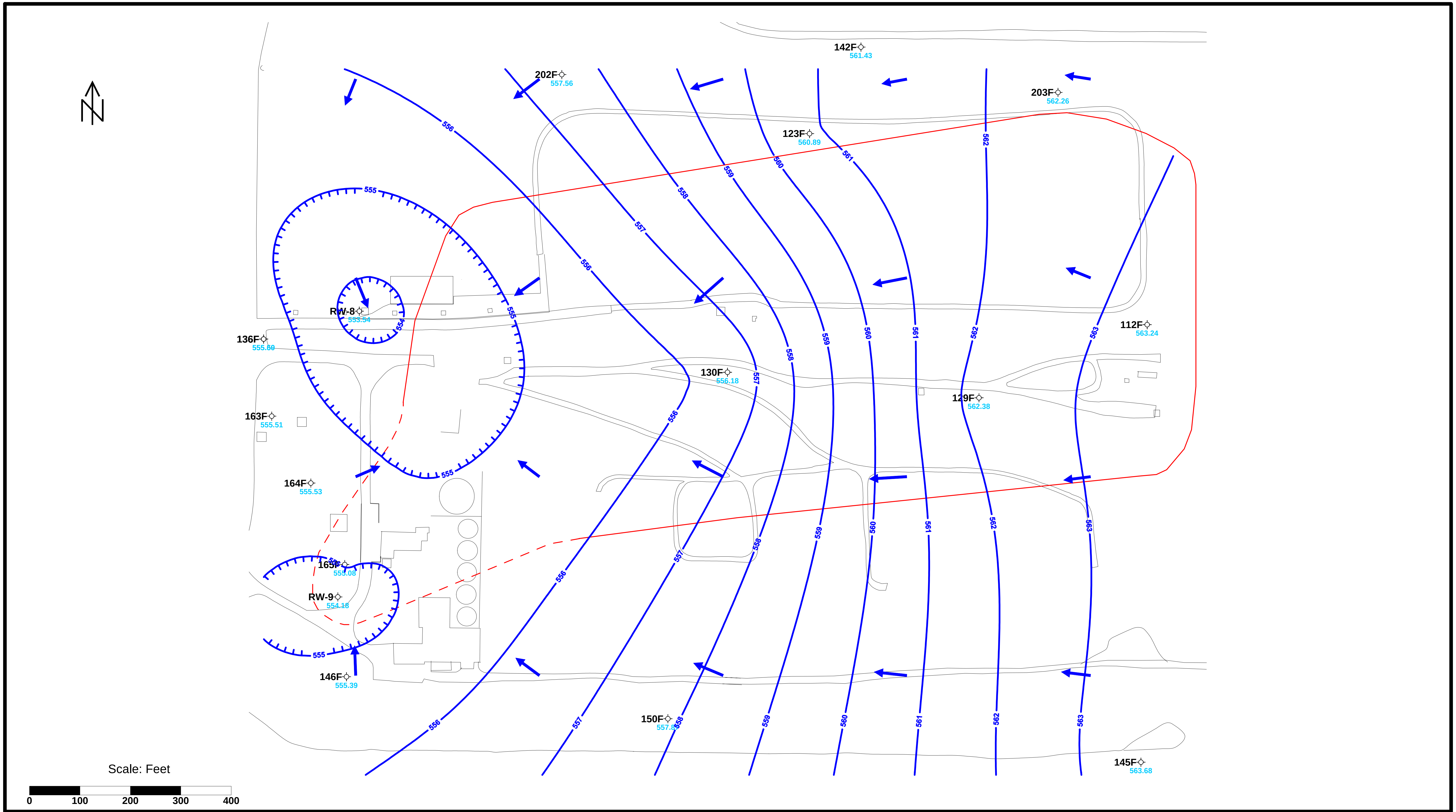
**Niagara Falls, NY 14302**

## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour | | Source Area Delineation |
| ⌖ | Monitoring Well | ▭ | Structure | | |
| ● | Pumping Well | | Road | | |

# Figure 3-18
# Potentiometric Surface Map
# DuPont Necco Park: E-Zone
# November 13, 2008

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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**LEGEND**

3B Well ID

✧ Monitoring Well

✦ Pumping Well

Potentiometric Contour

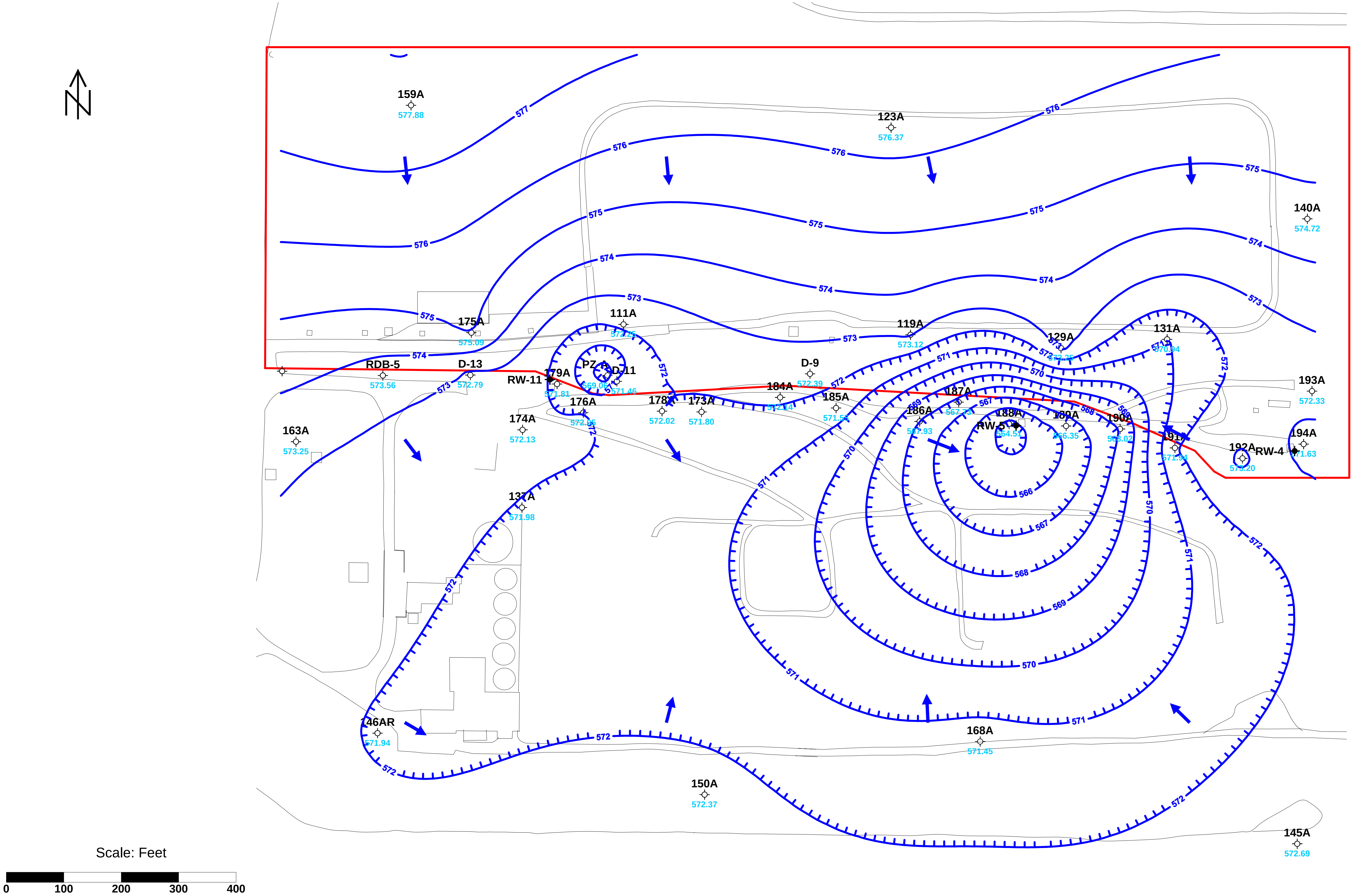
Structure

Road

Source Area Delineation

# Figure 3-19
# Potentiometric Surface Map
# DuPont Necco Park: F-Zone
# November 13, 2008

Necco Park/General Surfer Grid Files and Data/2007Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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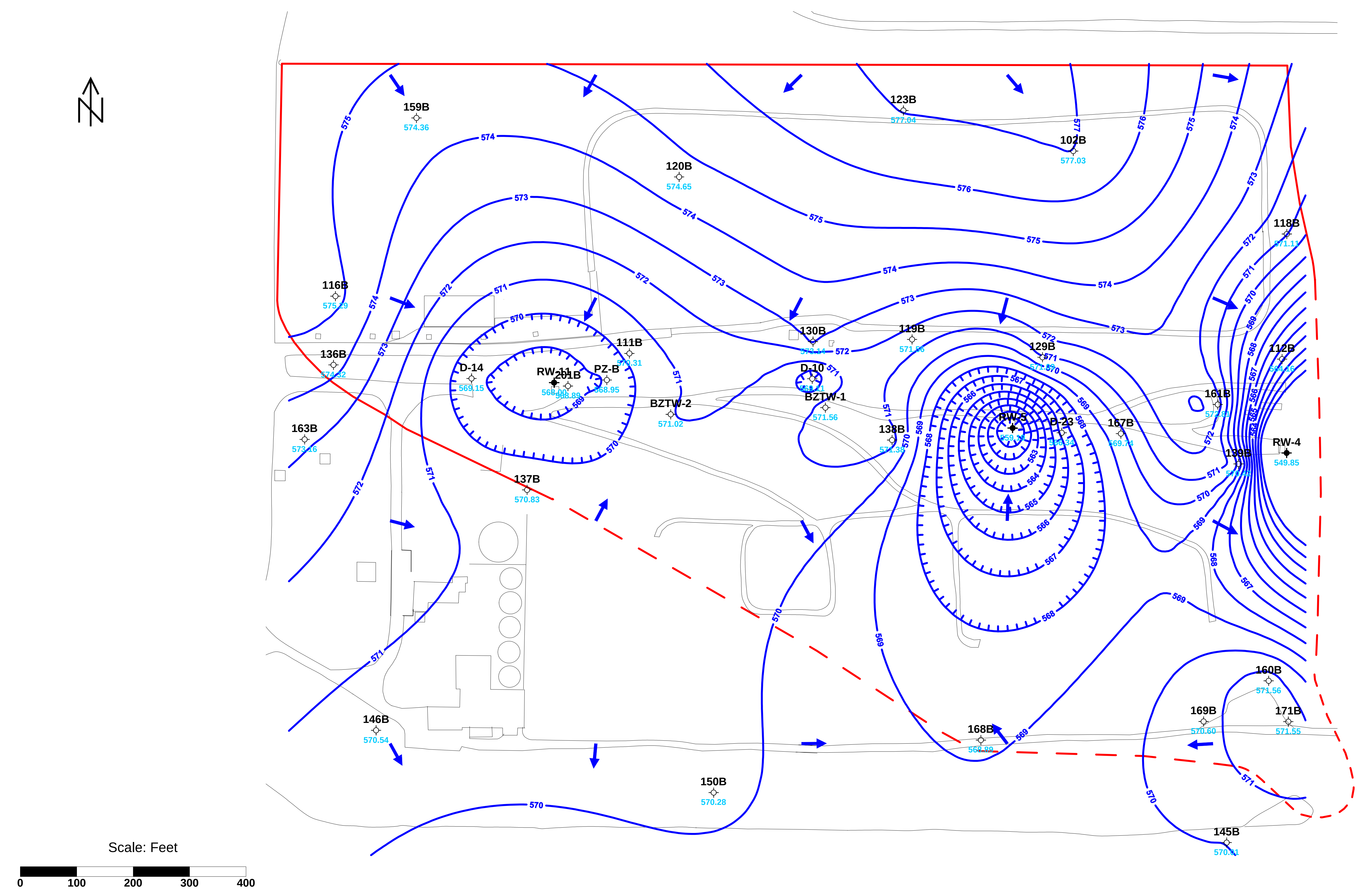
**LEGEND**

| | | | | | |
|---|---|---|---|---|---|
| 3B | **Well ID** | | **Potentiometric Contour** | | **Source Area Delineation** |
| ⌖ | **Monitoring Well** | ▭ | **Structure** | | |
| ◆ | **Pumping Well** | | **Road** | | |

## Figure 3-20
## Potentiometric Surface Map
## DuPont Necco Park: A-Zone
## February 19, 2009

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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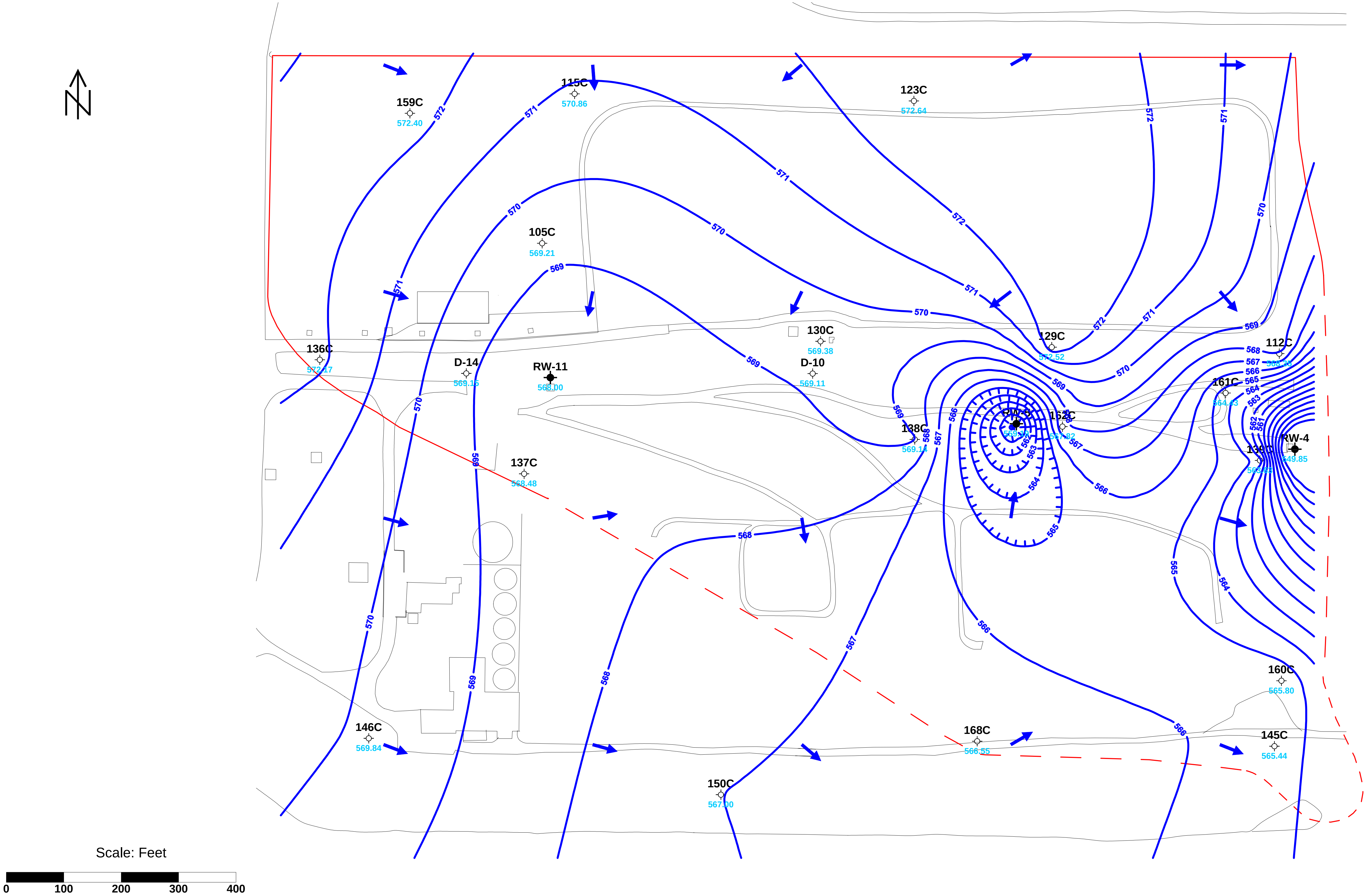
**Niagara Falls, NY 14302**

## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour | | Source Area Delineation |
| ⌖ | Monitoring Well | ▭ | Structure | | |
| ● | Pumping Well | | Road | | |

# Figure 3-21
# Potentiometric Surface Map
# DuPont Necco Park: B-Zone
# February 19, 2009

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf



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**Niagara Falls, NY 14302**

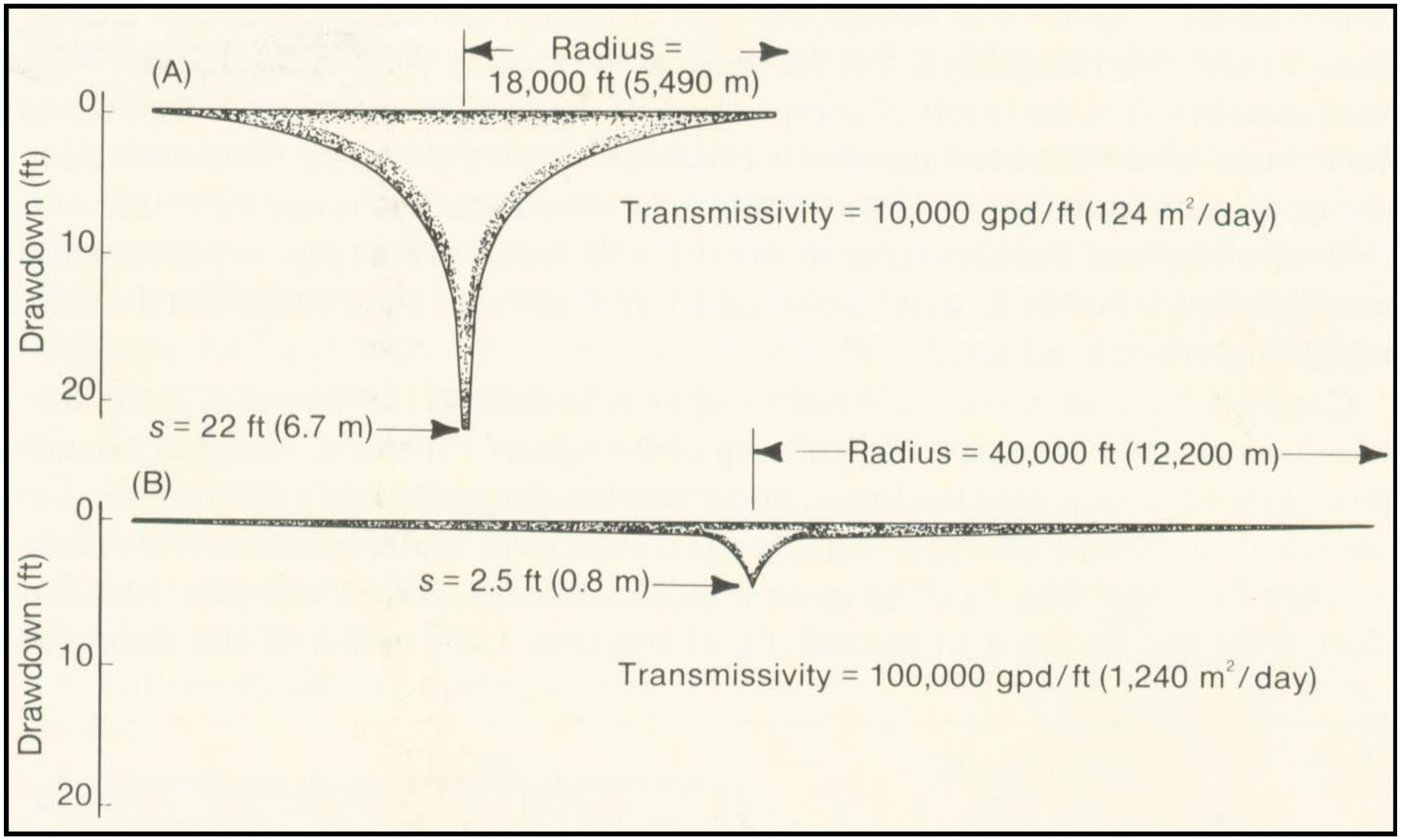
## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 3B | **Well ID** | | **Potentiometric Contour** | | **Source Area Delineation** |
| ⌖ | **Monitoring Well** | ▭ | **Structure** | | |
| ● | **Pumping Well** | | **Road** | | |

# Figure 3-22
# Potentiometric Surface Map
# DuPont Necco Park: C-Zone
# February 19, 2009

Necco Park/General Surfer Grid Files and Data/2007 2Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf

## Figure 3-23
## Effect of Different Transmissivities
## DuPont Necco Park



Effect of different transmissivities on the shape, depth and extent of the cones of depression (pumping rates and other factors are constant). Modified from Driscoll, 1989.

# APPENDICES

# APPENDIX A
# 2008 SEMI-ANNUAL GROUNDWATER SAMPLING & RECOVERY WELL RESULTS

# Table A-1
## Summary of A-Zone Analytical Results
## 2008
## DuPont Necco Park

| | | VH-D-9 | VH-D-11 | VH-D-13 | VH-137A | VH-145A | VH-146AR | VH-150A |
|---|---|---|---|---|---|---|---|---|
| | | 6/11/08 | 6/12/08 | 6/11/08 | 6/17/08 | 6/19/08 | 6/20/08 | 6/13/08 |
| **Analyte** | **Units** | FS | FS | FS | FS | FS | FS | FS |
| **Field Parameters** | | | | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | TAN | CLEAR | CLEAR | CLEAR | CLEAR | GREY | CLEAR |
| ODOR (FIELD) | NS | NONE | NONE | NONE | NONE | NONE | NONE | NONE |
| PH (FIELD) | STD UNITS | 6.85 | 12.16 | 8.68 | 12.69 | 6.65 | 9.48 | 7.07 |
| REDOX (FIELD) | MV | -161 | -458 | -318 | -264 | -101 | -220 | -151 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 4060 | 1850 | 6540 | 7420 | 1810 | 1870 | 2060 |
| TEMPERATURE (FIELD) | DEGREES C | 13.1 | 13.1 | 13.8 | 13.2 | 11.5 | 14 | 16.2 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 61.4 | 1.97 | 3.74 | 1.63 | 2.75 | 13.27 | 2.55 |
| **Volatile Organics** | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | <0.18 | <0.3 UJ | <0.18 | <0.45 | <0.18 | <0.18 | <0.18 UJ |
| 1,1,2-TRICHLOROETHANE | UG/L | <0.27 | <0.45 | <0.27 | <0.68 | <0.27 | <0.27 | <0.27 |
| 1,1-DICHLOROETHENE | UG/L | <0.19 | 8.9 | <0.19 | 11 | <0.19 | 0.34 J | <0.19 |
| 1,2-DICHLOROETHANE | UG/L | 1.8 | 1.2 J | <0.22 | 3.9 | <0.22 | <0.22 | <0.22 |
| CARBON TETRACHLORIDE | UG/L | <0.13 | <0.22 | <0.13 | <0.32 | <0.13 | <0.13 | <0.13 |
| CHLOROFORM | UG/L | <0.16 | 1.4 J | <0.16 | 0.61 J | <0.16 | <0.16 | <0.16 |
| CIS-1,2 DICHLOROETHENE | UG/L | <0.17 | 11 | 0.39 J | 75 | 0.29 J | 0.3 J | 0.49 J |
| TETRACHLOROETHYLENE | UG/L | <0.29 UJ | 10 | <0.29 UJ | 50 J | <0.29 UJ | <0.29 UJ | <0.29 UJ |
| TRANS-1,2-DICHLOROETHENE | UG/L | <0.19 | 1.8 | 0.35 J | 5.7 | <0.19 | <0.19 | <0.19 |
| TRICHLOROETHENE | UG/L | <0.17 | 45 | 1.1 | 97 | <0.17 | <0.17 | <0.17 |
| VINYL CHLORIDE | UG/L | 0.29 J | 5.5 | 0.35 J | 57 | <0.22 | 1.5 | 0.23 J |
| **Semivolatile Organics** | | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | <0.96 | 1.1 J | <0.96 | <3.8 | <0.96 | 8.6 J | <0.96 |
| 2,4,6-TRICHLOROPHENOL | UG/L | <1.4 | <1.4 | <1.4 | <5.6 | <1.4 | <1.4 | <1.4 |
| 3- AND 4- METHYLPHENOL | UG/L | <0.75 | 4.4 J | 1.8 J | 29 J | <0.75 | <0.75 | <0.75 |
| HEXACHLOROBENZENE | UG/L | <0.065 | <0.065 | <0.065 | <0.26 | <0.065 | <0.065 | <0.065 |
| HEXACHLOROBUTADIENE | UG/L | <0.51 | 1.7 J | <0.51 | <2 | <0.51 | <0.51 | <0.51 |
| HEXACHLOROETHANE | UG/L | <0.58 | <0.58 | <0.58 | <2.3 | <0.58 | <0.58 | <0.58 |
| PENTACHLOROPHENOL | UG/L | <0.48 | 3.3 J | <0.48 | <1.9 | <0.48 | 1.1 J | <0.48 |
| PHENOL | UG/L | <0.96 | 13 | 20 | 150 | <0.96 | <0.96 | <0.96 |
| TIC01 | UG/L | 2.8 J | 18 J | 7.6 J | 41 J | <NS J | 0.97 J | <NS J |
| **Inorganics** | | | | | | | | |
| BARIUM, DISSOLVED | UG/L | 97 B | 57 B | 240 | 8500 | 42 B | 20 B | 50 B |
| IRON, DISSOLVED | UG/L | NS | NS | NS | NS | NS | NS | NS |
| MANGANESE, DISSOLVED | UG/L | NS | NS | NS | NS | NS | NS | NS |
| ALKALINITY, TOTAL | UG/L | NS | NS | NS | NS | NS | NS | NS |
| CHLORIDE | UG/L | 1180000 | 213000 B | 1120000 | 596000 B | 66600 B | 445000 B | 113000 B |
| NITRATE/NITRITE NITROGEN | UG/L | NS | NS | NS | NS | NS | NS | NS |
| SULFATE | UG/L | NS | NS | NS | NS | NS | NS | NS |
| SULFIDE | UG/L | NS | NS | NS | NS | NS | NS | NS |
| TOTAL ORGANIC CARBON | UG/L | NS | NS | NS | NS | NS | NS | NS |
| **Gases** | | | | | | | | |
| ETHANE | UG/L | NS | NS | NS | NS | NS | NS | NS |
| ETHENE | UG/L | NS | NS | NS | NS | NS | NS | NS |
| METHANE | UG/L | NS | NS | NS | NS | NS | NS | NS |
| PROPANE | UG/L | NS | NS | NS | NS | NS | NS | NS |
| **Total Volatiles** | | **2.1** | **84.8** | **2.2** | **300.2** | **0.3** | **2.1** | **0.7** |
| **Gene-Trac *Dehalococcoides* Assay** | | | | | | | | |
| PERCENT DHC | | NS | NS | NS | NS | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | NS | NS | NS | NS | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = Analyte present. Reported value may not be accurate or precise.
UJ = Not detected. Reporting limit may not be accurate or precise.
B = Not detected substantially above the level reported in the lab or field blanks.

## Table A-1
## Summary of B-Zone Analytical Results
## 2008
## DuPont Necco Park

| | | VH-111B | VH-136B | VH-137B | VH-139B | VH-141B | VH-145B | VH-146B | VH-149B | VH-150B | VH-151B | VH-153B | VH-168B | VH-171B | VH-172B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6/18/08 | 6/18/08 | 6/17/08 | 6/19/08 | 6/13/08 | 6/19/08 | 6/20/08 | 6/16/08 | 6/13/08 | 6/11/08 | 6/17/08 | 6/17/08 | 6/18/08 | 6/12/08 |
| **Analyte** | **Units** | FS | FS | FS | FS | FS | FS | FS | FS | FS | FS | FS | FS | FS | FS |
| **Field Parameters** | | | | | | | | | | | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | YELLOW | BLACK | CLEAR | GREY | CLEAR | GREY | CLEAR | CLEAR | GREY | CLEAR | ORANGE | GREY | CLEAR | BLACK |
| ODOR (FIELD) | NS | SLIGHT | NONE | NONE | MODERATE | NONE | SLIGHT | NONE | NONE | SLIGHT | NONE | NONE | SLIGHT | SLIGHT | SLIGHT |
| PH (FIELD) | STD UNITS | 8.04 | 9.49 | 12.96 | 6.77 | 10.65 | 10 | 11.9 | 10.54 | 6.94 | 12.5 | 7.01 | 7.32 | 7.13 | 7.5 |
| REDOX (FIELD) | MV | -474 | -267 | -519 | -271 | -436 | -422 | -382 | -250 | -340 | -373 | -142 | -339 | -318 | -244 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 17000 | 2000 | 8540 | 34800 | 4420 | 16100 | 1481 | 2690 | 8660 | 4670 | 3560 | 37800 | 14640 | 9200 |
| TEMPERATURE (FIELD) | DEGREES C | 18.6 | 12.4 | 11.9 | 13.4 | 15.9 | 12.5 | 12.4 | 15.4 | 13 | 17.1 | 15.7 | 12.4 | 17.7 | 12.3 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 9.83 | 7.71 | 6.5 | 3.16 | 2.9 | 7.58 | 4.63 | 2 | 6.46 | 5.95 | 37.1 | 10.3 | 18.04 | 6.17 |
| **Volatile Organics** | | | | | | | | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | <22 | <9 | <0.9 | 14000 | <2.2 UJ | <75 | <0.18 | <0.18 | <0.36 UJ | <0.18 | <0.18 | <180 | <1.4 | 37 J |
| 1,1,2-TRICHLOROETHANE | UG/L | <34 | <14 | <1.4 | 1200 | <3.4 | 160 J | <0.27 | <0.27 | <0.54 | <0.27 | <0.27 | 3600 | <2.2 | <14 |
| 1,1-DICHLOROETHENE | UG/L | 230 | <9.5 | 19 | <130 | <2.4 | 190 J | 3.6 | 0.63 J | <0.38 | 0.35 J | <0.19 | 420 J | <1.5 | <9.5 |
| 1,2-DICHLOROETHANE | UG/L | 270 | <11 | 4.8 J | 270 J | <2.8 | <92 | <0.22 | <0.22 | <0.44 | <0.22 | <0.22 | 850 J | 2 J | <11 |
| CARBON TETRACHLORIDE | UG/L | <16 | <6.5 | <0.65 | <87 | <1.6 | <54 | <0.13 | <0.13 | <0.26 UJ | <0.13 | <0.13 | <130 | <1 | <6.5 |
| CHLOROFORM | UG/L | 120 | <8 | 1.1 J | 5300 | <2 | 240 J | <0.16 | <0.16 | <0.32 | <0.16 | <0.16 | 550 J | <1.3 | 17 J |
| CIS-1,2 DICHLOROETHENE | UG/L | 810 | 560 | 120 J | 20000 | <2.1 | 12000 | 21 | 7.7 | <0.34 | 0.88 J | <0.17 | 19000 | 160 | 1100 |
| TETRACHLOROETHYLENE | UG/L | <36 | 1500 | 65 J | 3100 J | <3.6 UJ | <120 UJ | <0.29 UJ | <0.29 | <0.58 UJ | <0.29 UJ | <0.29 UJ | <290 UJ | <2.3 | 190 J |
| TRANS-1,2-DICHLOROETHENE | UG/L | 37 J | 25 J | 9.4 | 4600 | <2.4 | 960 | 2 | 0.81 J | 0.4 J | 0.93 J | <0.19 | 460 J | 6.2 J | 100 |
| TRICHLOROETHENE | UG/L | 110 J | 370 | 130 | 4600 | <2.1 | 2000 | 1.3 | 0.8 J | <0.34 | 0.98 J | <0.17 | <170 | <1.4 | 42 J |
| VINYL CHLORIDE | UG/L | 470 | 32 J | 120 J | 8900 | <2.8 | 2200 | 11 | 8.9 | <0.44 UJ | 0.66 J | <0.22 | 11000 | 250 | 390 |
| **Semivolatile Organics** | | | | | | | | | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | NS | 3200 | <3.8 | NS | NS | <4.8 | 36 | 5.3 J | <9.6 | <0.96 | NS | <48 | <4.8 | <1.9 |
| 2,4,6-TRICHLOROPHENOL | UG/L | NS | 620 J | <5.6 | NS | NS | <7 | 6.1 J | <1.4 | <14 | <1.4 | NS | <70 | <7 | <2.8 |
| 3- AND 4- METHYLPHENOL | UG/L | NS | <0.75 | 28 J | NS | NS | 30 J | 8.5 J | <0.75 | 17 J | <0.75 | NS | <0.75 | <0.75 | 1.4 J |
| HEXACHLOROBENZENE | UG/L | NS | <6.5 | <0.26 | NS | NS | <0.32 | <0.065 | <0.065 | <0.65 | <0.065 | NS | <3.2 | <0.32 | <0.13 |
| HEXACHLOROBUTADIENE | UG/L | NS | <51 | <2 | NS | NS | <2.6 | <0.51 | <0.51 | <5.1 | <0.51 | NS | <26 | <2.6 | 54 |
| HEXACHLOROETHANE | UG/L | NS | <58 | <2.3 | NS | NS | <2.9 | <0.58 | <0.58 | <5.8 | <0.58 | NS | <29 | <2.9 | <1.2 |
| PENTACHLOROPHENOL | UG/L | NS | 7700 | <1.9 | NS | NS | <2.4 | 52 | <0.48 | <4.8 | <0.48 | NS | <24 | <2.4 | <0.96 |
| PHENOL | UG/L | NS | <96 | 110 | NS | NS | <4.8 | <0.96 | <0.96 | <9.6 | 2.8 J | NS | 200 J | <4.8 | 2.2 J |
| TIC01 | UG/L | NS | <NS J | NS | NS | NS | 840 J | 8.6 J | 4.9 J | 2.2 J | 11 J | NS | | 310 J | 42 J |
| **Inorganics** | | | | | | | | | | | | | | | |
| BARIUM, DISSOLVED | UG/L | NS | 66 B | 7600 | NS | NS | 55 B | 22 B | 60 B | 47600 | 280 | NS | 650 | 200 | 37 B |
| IRON, DISSOLVED | UG/L | 103000 | NS | <81 | 260000 | <81 | <81 | NS | NS | NS | <81 | 1200 | NS | NS | NS |
| MANGANESE, DISSOLVED | UG/L | 1400 | NS | 0.73 B | 4200 | 1.3 B | 44 | NS | NS | NS | 0.67 B | 230 | NS | NS | NS |
| ALKALINITY, TOTAL | UG/L | 770000 | NS | 1500000 J | 180000 B | 95000 B | 120000 B | NS | NS | NS | 840000 | 120000 B | NS | NS | NS |
| CHLORIDE | UG/L | 4820000 B | 180000 B | 753000 B | 12800000 B | 1270000 B | 6120000 | 291000 B | 561000 B | 2830000 B | 422000 B | 397000 B | 15600000 B | 5280000 B | 2740000 B |
| NITRATE/NITRITE NITROGEN | UG/L | 100 | NS | <20 | <20 | <20 R | <20 | NS | NS | NS | 200 B | <20 | NS | NS | NS |
| SULFATE | UG/L | 69600 B | NS | 9300 B | 114000 B | 689000 B | 707000 B | NS | NS | NS | 8000 B | 230000 B | NS | NS | NS |
| SULFIDE | UG/L | <380 UJ | NS | 4800 | 1400 B | 7000 | 5100 | NS | NS | NS | <380 | 640 B | NS | NS | NS |
| TOTAL ORGANIC CARBON | UG/L | 1300000 | NS | 34000 | 160000 | 14000 | 21000 | NS | NS | NS | 2000 | 4000 | NS | NS | NS |
| **Gases** | | | | | | | | | | | | | | | |
| ETHANE | UG/L | <0.062 | NS | 53 | 150 | 17 | 45 | NS | NS | NS | 2.7 | 20 | NS | NS | NS |
| ETHENE | UG/L | 7500 | NS | 530 | 3500 | 18 | 1400 | NS | NS | NS | 1.3 | <0.057 | NS | NS | NS |
| METHANE | UG/L | 13000 | NS | 1700 | 9600 | 1300 | 5000 | NS | NS | NS | 180 | 260 | NS | NS | NS |
| PROPANE | UG/L | <0.088 | NS | 2.1 | 15 | 4.2 | 3.2 | NS | NS | NS | 1.6 | 0.63 | NS | NS | NS |
| **Total Volatiles** | | **2,047** | **2,487** | **469.3** | **61,970** | **0** | **17,750** | **38.9** | **18.8** | **0.4** | **3.8** | **0** | **35,880** | **418.2** | **1,876** |
| **Gene-Trac *Dehalococcoides* Assay** | | | | | | | | | | | | | | | |
| PERCENT DHC | | 0.002-0.006% | NS | NA (1) | NA (1) | NA (1) | NS | NS | NS | NS | NS | NA (1) | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | 5 x $10^4$/liter | NS | ND (2,3) | ND (2) | ND (2) | NS | NS | NS | NS | NS | ND (2, 3,4) | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = estimated concentration

UJ = Not detected. Reporting limit may not be accurate or precise.

B = Not detected substantially above the level reported in the lab or field blank.

# Table A-1
# Summary of C-Zone Analytical Results
## 2008
## DuPont Necco Park

| | Sample ID | VH-105C | VH-136C | VH-137C | VH-141C | VH-145C | VH-146C | VH-149C | VH-150C | VH-151C | VH-168C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | 6/20/08 | 6/18/08 | 6/17/08 | 6/13/08 | 6/12/08 | 6/20/08 | 6/16/08 | 6/13/08 | 6/11/08 | 6/17/08 |
| **Analyte** | **Units** | FS | FS | FS | FS | FS | FS | FS | FS | FS | FS |
| **Field Parameters** | | | | | | | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | YELLOW | CLEAR | GREY | YELLOW | GREY | CLEAR | CLEAR | GREY | GREY | BLACK |
| ODOR (FIELD) | NS | MODERATE | NONE | SLIGHT | NONE | MODERATE | NONE | NONE | SLIGHT | NONE | SLIGHT |
| PH (FIELD) | STD UNITS | 9.68 | 12.32 | 10.44 | 10.07 | 6.8 | 9.69 | 7.26 | 8.22 | 7.26 | 6.22 |
| REDOX (FIELD) | MV | -217 | -171 | -454 | -362 | -261 | -308 | -270 | -429 | -365 | -408 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 20000 | 2350 | 3690 | 2990 | 10000 | 1680 | 1418 | 5560 | 5460 | 56900 |
| TEMPERATURE (FIELD) | DEGREES C | 13.6 | 13.3 | 12.1 | 18.4 | 20.3 | 16.3 | 14.9 | 15.8 | 19.5 | 13.3 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 20.1 | 4.35 | 9.83 | 17.2 | 18.1 | 9.51 | 8.11 | 3.69 | 13.5 | 10.28 |
| **Volatile Organics** | | | | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | <900 | <30 | 29 J | <0.18 UJ | <36 UJ | <0.18 | <0.18 | <0.18 UJ | <0.18 | 1500 |
| 1,1,2-TRICHLOROETHANE | UG/L | 11000 | <45 | 42 J | <0.27 | 440 | <0.27 | <0.27 | <0.27 | <0.27 | 2200 |
| 1,1-DICHLOROETHENE | UG/L | 3000 J | <32 | 140 | <0.19 | 82 J | 0.23 J | 0.43 J | 1.1 | <0.19 | 230 |
| 1,2-DICHLOROETHANE | UG/L | 1400 J | <37 | 18 J | <0.22 | 120 J | <0.22 | <0.22 | <0.22 | <0.22 | 100 J |
| CARBON TETRACHLORIDE | UG/L | 3800 J | <22 | 80 J | <0.13 | <26 | <0.13 | <0.13 | <0.13 | <0.13 | 460 |
| CHLOROFORM | UG/L | 82000 | <27 | 890 | <0.16 | 64 J | <0.16 | <0.16 | 0.33 J | <0.16 | 1500 |
| CIS-1,2 DICHLOROETHENE | UG/L | 20000 | 72 J | 1800 | <0.17 | 4100 | 2.6 | 5.2 | 12 | 1.9 | 1500 |
| TETRACHLOROETHYLENE | UG/L | 32000 J | 4800 | 2700 | 0.96 J | <58 UJ | <0.29 UJ | <0.29 | 0.57 J | <0.29 UJ | 320 J |
| TRANS-1,2-DICHLOROETHENE | UG/L | 5300 | <32 | 120 | <0.19 | 150 J | 0.26 J | 0.62 J | 2.6 | 2.1 | 330 |
| TRICHLOROETHENE | UG/L | 140000 | 1200 | 2300 | 0.34 J | 180 J | 1 | <0.17 | 8.9 | <0.17 | 2600 |
| VINYL CHLORIDE | UG/L | 2600 J | <37 | 1700 | 0.32 J | 1900 | 3.8 | 6 | 6.5 | 7.8 | 420 |
| **Semivolatile Organics** | | | | | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | NS | 1000 J | NS | NS | <48 | <0.96 | 1 J | <0.96 | <0.96 | <48 |
| 2,4,6-TRICHLOROPHENOL | UG/L | NS | 1900 J | NS | NS | <70 | <1.4 | <1.4 | <1.4 | <1.4 | <70 |
| 3- AND 4- METHYLPHENOL | UG/L | NS | <0.75 | NS | NS | 97 J | <0.75 | 2.7 J | <0.75 | <0.75 | <0.75 |
| HEXACHLOROBENZENE | UG/L | NS | <26 | NS | NS | <3.2 | <0.065 | <0.065 | <0.065 | <0.065 | <3.2 |
| HEXACHLOROBUTADIENE | UG/L | NS | <200 | NS | NS | <26 | 0.54 J | <0.51 | <0.51 | <0.51 | <26 |
| HEXACHLOROETHANE | UG/L | NS | <230 | NS | NS | <29 | <0.58 | <0.58 | <0.58 | <0.58 | <29 |
| PENTACHLOROPHENOL | UG/L | NS | 31000 | NS | NS | <24 | 0.6 J | <0.48 | <0.48 | <0.48 | <24 |
| PHENOL | UG/L | NS | <380 | NS | NS | 220 J | <0.96 | <0.96 | <0.96 | <0.96 | 110 J |
| TIC01 | UG/L | NS | <NS J | NS | NS | 6900 J | 2.6 J | 8.5 J | 16 J | 15 J | |
| **Inorganics** | | | | | | | | | | | |
| BARIUM, DISSOLVED | UG/L | NS | 51 B | NS | NS | 960 | 32 B | 45 B | 100 B | 29 B | 340 |
| IRON, DISSOLVED | UG/L | 900 | NS | 160 | <81 | 825000 | NS | <81 | NS | 200 | NS |
| MANGANESE, DISSOLVED | UG/L | 28 | NS | 2.4 B | 8.6 B | 28300 | NS | 34 | NS | 67 | NS |
| ALKALINITY, TOTAL | UG/L | 1800000 | NS | 260000 B | 82000 B | 340000 B | NS | 25000 B | NS | 150000 B | NS |
| CHLORIDE | UG/L | 6610000 | 186000 B | 1130000 B | 752000 B | 52200000 B | 274000 B | 294000 B | 1250000 B | 1130000 | 22500000 B |
| NITRATE/NITRITE NITROGEN | UG/L | <20 | NS | <20 | <20 R | <20 R | NS | 60 B | NS | <20 R | NS |
| SULFATE | UG/L | 403000 B | NS | 54200 B | 419000 B | 559000 B | NS | 204000 B | NS | 1590000 | NS |
| SULFIDE | UG/L | 4600 | NS | 3800 | 1300 B | 95000 | NS | 6100 | NS | 52000 | NS |
| TOTAL ORGANIC CARBON | UG/L | 300000 | NS | 63000 | 15000 | 43000 | NS | 6000 | NS | 7000 | NS |
| **Gases** | | | | | | | | | | | |
| ETHANE | UG/L | 68 | NS | 80 | 3.3 | 60 | NS | 7 | NS | 57 | NS |
| ETHENE | UG/L | 2000 | NS | 1100 | 8.2 | 530 | NS | 66 | NS | 3.6 | NS |
| METHANE | UG/L | 3000 | NS | 4300 | 320 | 2700 | NS | 1400 | NS | 3600 | NS |
| PROPANE | UG/L | 12 | NS | 1.7 | 0.91 | 5.4 | NS | 0.8 | NS | 3.8 | NS |
| **Total Volatiles** | | **301,100** | **6,072** | **9,819** | **1.6** | **7,036** | **7.9** | **12.3** | **32** | **11.8** | **11,160** |
| **Gene-Trac *Dehalococcoides* Assay** | | | | | | | | | | | |
| PERCENT DHC | | 0.0008-0.003% | NS | 0.7-2% | NA (1) | NS | NS | NS | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | 2 x $10^4$/liter | NS | 6 x $10^6$/liter | ND (2) | NS | NS | NS | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = estimated concentration
UJ = Not detected.  Reporting limit may not be accurate or precise.
B = Not detected substantially above the level reported in the lab or field blank.

# Table A-1
# Summary of D-Zone Analytical Results
# 2008
# DuPont Necco Park

| | | VH-105D | VH-123D | VH-136D | VH-136D | VH-137D | VH-139D | VH-145D | VH-147D | VH-148D | VH-149D | VH-156D | VH-165D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6/20/08 | 6/12/08 | 6/12/08 | 6/12/08 | 6/17/08 | 6/19/08 | 6/19/08 | 6/10/08 | 6/10/08 | 6/16/08 | 6/11/08 | 6/17/08 |
| **Analyte** | **Units** | FS | FS | DUP | FS | FS | FS | FS | FS | FS | FS | FS | FS |
| **Field Parameters** | | | | | | | | | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | GREY | CLEAR | NS | TAN | CLEAR | GREY | BLACK | CLEAR | YELLOW | CLEAR | BLACK | BLACK |
| ODOR (FIELD) | NS | STRONG | NONE | NS | NONE | SLIGHT | SLIGHT | MODERATE | NONE | NONE | NONE | SLIGHT | SLIGHT |
| PH (FIELD) | STD UNITS | 5.82 | 7.31 | NS | 7.07 | 6.55 | 7.47 | 6.29 | 7.15 | 10.21 | 7.4 | 7.15 | 7.49 |
| REDOX (FIELD) | MV | -29 | -432 | NS | -378 | -376 | -349 | -406 | -172 | -256 | -363 | -223 | -307 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 18200 | 3180 | NS | 1122 | 9510 | 4870 | 53200 | 2100 | 1089 | 2315 | 2120 | 1132 |
| TEMPERATURE (FIELD) | DEGREES C | 14.6 | 13.5 | NS | 13.5 | 12.8 | 13.8 | 17 | 13.8 | 12.5 | 16 | 16 | 12.6 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 11.81 | 7.22 | NS | 10.21 | 8.75 | 9.54 | 11.68 | 2.85 | 19 | 8.7 | 4.38 | 7.75 |
| **Volatile Organics** | | | | | | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | 76000 | <0.36 UJ | <4 UJ | <4.5 UJ | 950 J | 42 | <6 | <0.45 | <0.18 | <0.18 | <0.18 | <0.18 |
| 1,1,2-TRICHLOROETHANE | UG/L | 180000 | <0.54 | 13 J | 14 J | 10000 | 15 J | 56 | <0.68 | <0.27 | <0.27 | <0.27 | 1.7 |
| 1,1-DICHLOROETHENE | UG/L | 1800 J | <0.38 | 7.3 J | 7.8 J | 3000 | <6.3 | <6.3 | <0.48 | <0.19 | <0.19 | <0.19 | 0.32 J |
| 1,2-DICHLOROETHANE | UG/L | 11000 | <0.44 | 18 J | 21 J | <550 | <7.3 | <7.3 | <0.55 | <0.22 | <0.22 | <0.22 | 4 |
| CARBON TETRACHLORIDE | UG/L | 190000 | <0.26 | <2.9 | <3.2 | <320 | <4.3 | <4.3 | <0.32 | <0.13 | <0.13 | <0.13 | <0.13 |
| CHLOROFORM | UG/L | 96000 | <0.32 | 25 | 27 | 74000 | 57 | 29 J | <0.4 | <0.16 | <0.16 | <0.16 | 0.37 J |
| CIS-1,2 DICHLOROETHENE | UG/L | 8800 | 1.5 J | 460 | 500 | 11000 | 32 J | 530 | 92 | 1.4 | 0.88 J | 0.38 J | 1.7 |
| TETRACHLOROETHYLENE | UG/L | 12000 J | <0.58 UJ | <6.4 UJ | <7.2 UJ | 5300 J | 250 J | <9.7 UJ | <0.72 UJ | <0.29 | <0.29 | <0.29 UJ | <0.29 UJ |
| TRANS-1,2-DICHLOROETHENE | UG/L | 3300 J | <0.38 | 18 J | 18 J | 2800 | 29 J | 77 | 2.1 J | <0.19 | 0.25 J | 0.24 J | 2.6 |
| TRICHLOROETHENE | UG/L | 130000 | <0.34 | 78 | 84 | 70000 | 870 | <5.7 | <0.42 | <0.17 | <0.17 | <0.17 | <0.17 |
| VINYL CHLORIDE | UG/L | <1600 | 0.72 J | 320 | 340 | 1600 J | 38 | 970 | 78 | <0.22 | 3.2 | 1.3 | 18 |
| **Semivolatile Organics** | | | | | | | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | NS | <38 | 17 J | 22 J | NS | NS | <24 | <0.96 | <0.96 | <0.96 | <0.96 | 110 |
| 2,4,6-TRICHLOROPHENOL | UG/L | NS | <56 | <5.6 | 3.6 J | NS | NS | <35 | <1.4 | <1.4 | <1.4 | <1.4 | <5.6 |
| 3- AND 4- METHYLPHENOL | UG/L | NS | <0.75 | 3 J | 3 J | NS | NS | 13 J | <0.75 | 5.6 J | <0.75 | <0.75 | 6.8 J |
| HEXACHLOROBENZENE | UG/L | NS | <2.6 | <0.26 | <0.16 | NS | NS | <1.6 | <0.065 | <0.065 | <0.065 | <0.065 | <0.26 |
| HEXACHLOROBUTADIENE | UG/L | NS | <20 | <2 | <1.3 | NS | NS | <13 | <0.51 | <0.51 | <0.51 | <0.51 | <2 |
| HEXACHLOROETHANE | UG/L | NS | <23 | <2.3 | <1.4 | NS | NS | <14 | <0.58 | <0.58 | <0.58 | <0.58 | <2.3 |
| PENTACHLOROPHENOL | UG/L | NS | <19 | <1.9 | <1.2 | NS | NS | <12 | <0.48 | <0.48 | <0.48 | <0.48 | 2.3 J |
| PHENOL | UG/L | NS | 1200 | <3.8 | <2.4 | NS | NS | 89 J | <0.96 | <0.96 | <0.96 | <0.96 | 5.2 J |
| TIC01 | UG/L | NS | <NS J | 38 J | 34 J | NS | NS | 1700 J | <NS J | <NS J | 4.4 J | 0.41 J | |
| **Inorganics** | | | | | | | | | | | | | |
| BARIUM, DISSOLVED | UG/L | NS | 34 B | 200 | 200 | NS | NS | 670 | 47 B | 36 B | 45 B | 42 B | 24 B |
| IRON, DISSOLVED | UG/L | 18700 | NS | 140 | 120 | 310 | 1100 | NS | 730 | <81 | <81 | 1100 | <81 |
| MANGANESE, DISSOLVED | UG/L | 640 | NS | 210 | 220 | 510 | 270 | NS | 40 | 8 B | 28 | 69 | 31 |
| ALKALINITY, TOTAL | UG/L | 890000 | NS | 240000 B | 240000 B | 710000 B | 270000 B | NS | 240000 B | 24000 B | 53000 B | 430000 B | 59000 B |
| CHLORIDE | UG/L | 6020000 B | 193000 B | 256000 B | 258000 B | 1900000 B | 945000 B | 23500000 B | 33000 B | 61800 B | 313000 B | 193000 B | 336000 B |
| NITRATE/NITRITE NITROGEN | UG/L | <20 | NS | <20 R | <20 R | <20 | <20 | NS | <20 R | 1500 B | <20 R | <20 R | <20 |
| SULFATE | UG/L | 819000 B | NS | 331000 B | 65100 B | 1210000 B | 1440000 | NS | 1160000 | 431000 B | 942000 | 691000 | 12800 B |
| SULFIDE | UG/L | 3500 | NS | 16000 | 7700 | 7000 | 3800 J | NS | <380 | <380 | 6200 | 4400 | 640 B |
| TOTAL ORGANIC CARBON | UG/L | 1400000 | NS | 11000 | 10000 | 270000 | 3000 | NS | 1000 B | 4000 | 7000 | 3000 | 9000 |
| **Gases** | | | | | | | | | | | | | |
| ETHANE | UG/L | 5.8 | NS | 16 J | 12 J | 11 | 7 | NS | 0.28 B | 33 | 19 | 1.7 | 2.7 |
| ETHENE | UG/L | 260 | NS | 1400 | 1700 | 150 | 31 | NS | 3.3 | 2.8 | 52 | <0.057 | 200 |
| METHANE | UG/L | 1400 | NS | 1300 | 1500 | 1500 | 790 | NS | 140 | 380 | 3300 | 450 | 200 |
| PROPANE | UG/L | 1 | NS | 3.5 | 3.2 | 2.5 | 0.39 J | NS | 0.15 J | 13 | 0.74 | 0.31 J | 0.62 |
| **Total Volatiles** | | **708,900** | **2.22** | **939** | **1,012** | **178,650** | **1,333** | **1662** | **172** | **1.4** | **4.3** | **0.6** | **28.7** |
| **Gene-Trac *Dehalococcoides* Assay** | | | | | | | | | | | | | |
| PERCENT DHC | | 0.05 - 0.1% | NS | NS | NS | NA (1) | 0.002-0.005% | NS | NS | NS | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | 1 x 10 $^6$/liter | NS | NS | NS | ND (2) | 3 X 10$^4$/liter | NS | NS | NS | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = estimated concentration
UJ = Not detected. Reporting limit may not be accurate or precise.
B = Not detected substantially above the level reported in the lab or field blank.

# Table A-1
# Summary of E-Zone Analytical Results
# 2008
# DuPont Necco Park

| | **Sample ID** | VH-136E | VH-136E | VH-145E | VH-146E | VH-150E | VH-156E | VH-165E |
|---|---|---|---|---|---|---|---|---|
| | **Date** | 6/18/08 | 6/18/08 | 6/19/08 | 6/12/08 | 6/13/08 | 6/11/08 | 6/17/08 |
| **Analyte** | **Units** | FS | DUP | FS | FS | FS | FS | FS |
| **Field Parameters** | | | | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | CLEAR | NS | GREY | BLACK | CLEAR | BLACK | BLACK |
| ODOR (FIELD) | NS | NONE | NS | SLIGHT | MODERATE | MODERATE | SLIGHT | SLIGHT |
| PH (FIELD) | STD UNITS | 8.25 | NS | 7.47 | 6.94 | 6.33 | 7.72 | 8.2 |
| REDOX (FIELD) | MV | -385 | NS | -280 | -452 | -427 | -318 | -270 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 1393 | NS | 13380 | 5060 | 17700 | 1238 | 2760 |
| TEMPERATURE (FIELD) | DEGREES C | 13.4 | NS | 11.9 | 12.8 | 17.1 | 14.4 | 12 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 11.56 | NS | 10.73 | 7.47 | 8.45 | 35.9 | 14 |
| **Volatile Organics** | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | <0.18 | <0.18 | <30 | 240 J | <1.6 UJ | <0.18 | 1300 |
| 1,1,2-TRICHLOROETHANE | UG/L | <0.27 | <0.27 | <45 | 270 J | <2.5 | <0.27 | 1500 |
| 1,1-DICHLOROETHENE | UG/L | <0.19 | <0.19 | <32 | 190 J | <1.7 | <0.19 | 320 J |
| 1,2-DICHLOROETHANE | UG/L | 17 | 18 | <37 | 230 J | <2 | <0.22 | 340 J |
| CARBON TETRACHLORIDE | UG/L | <0.13 | <0.13 | <22 | <65 | <1.2 | <0.13 | 380 J |
| CHLOROFORM | UG/L | 1.5 | 1.5 | 110 J | <80 | <1.5 | <0.16 | 1400 |
| CIS-1,2 DICHLOROETHENE | UG/L | 0.89 J | 0.92 J | 4600 J | 11000 | 250 | 0.24 J | 17000 |
| TETRACHLOROETHYLENE | UG/L | <0.29 | <0.29 | 51 J | <140 UJ | <2.6 UJ | <0.29 UJ | 930 J |
| TRANS-1,2-DICHLOROETHENE | UG/L | 3.9 | 3.9 | 1100 | 430 J | 4.4 J | <0.19 | 530 J |
| TRICHLOROETHENE | UG/L | 2.1 | 2.1 | 86 J | 410 J | <1.5 | <0.17 | 5100 |
| VINYL CHLORIDE | UG/L | 1.9 | 1.9 | 4800 | 6400 J | 360 | 0.89 J | 5300 |
| **Semivolatile Organics** | | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | <0.96 | <0.96 | <1.9 | 360 | <48 | <0.96 | 1100 |
| 2,4,6-TRICHLOROPHENOL | UG/L | <1.4 | <1.4 | <2.8 | 59 J | <70 | <1.4 | 150 J |
| 3- AND 4- METHYLPHENOL | UG/L | <0.75 | <0.75 | <0.75 | 53 J | <0.75 | <0.75 | 47 J |
| HEXACHLOROBENZENE | UG/L | <0.065 | <0.065 | <0.13 | <0.81 | <3.2 | <0.065 | <2.6 |
| HEXACHLOROBUTADIENE | UG/L | <0.51 | <0.51 | <1 | 15 J | <26 | <0.51 | 91 J |
| HEXACHLOROETHANE | UG/L | <0.58 | <0.58 | <1.2 | <7.2 | <29 | <0.58 | <23 |
| PENTACHLOROPHENOL | UG/L | <0.48 | <0.48 | <0.96 | <6 | <24 | <0.48 | 67 J |
| PHENOL | UG/L | <0.96 | <0.96 | <1.9 | 82 J | 310 J | <0.96 | 56 J |
| TIC01 | UG/L | 4.3 J | 6.7 J | 200 J | 250 J | 500 J | 0.98 J | |
| **Inorganics** | | | | | | | | |
| BARIUM, DISSOLVED | UG/L | 150 J | 160 J | 49 B | 380 | 100 B | 33 B | 360 |
| IRON, DISSOLVED | UG/L | 120 | 110 | 10900 | <81 | NS | 1700 | NS |
| MANGANESE, DISSOLVED | UG/L | 190 | 190 | 970 | 130 | NS | 75 | NS |
| ALKALINITY, TOTAL | UG/L | 180000 B | 200000 B | 370000 B | 970000 | NS | 220000 B | NS |
| CHLORIDE | UG/L | 189000 B | 196000 B | 4050000 B | 1250000 | 6630000 | 205000 B | 1020000 B |
| NITRATE/NITRITE NITROGEN | UG/L | <20 | <20 | <20 | <20 R | NS | <20 R | NS |
| SULFATE | UG/L | 328000 B | 326000 B | 1040000 B | 394000 B | NS | 691000 | NS |
| SULFIDE | UG/L | 12000 J | 14000 J | 1400 B | 130000 | NS | 7000 | NS |
| TOTAL ORGANIC CARBON | UG/L | 5000 | 6000 | 28000 | 88000 | NS | 2000 | NS |
| **Gases** | | | | | | | | |
| ETHANE | UG/L | 13 | 12 | 75 | 41 | NS | 2.7 | NS |
| ETHENE | UG/L | 1100 | 1200 | 720 | 1500 | NS | <0.057 | NS |
| METHANE | UG/L | 1000 | 1100 | 5000 | 4300 | NS | 270 | NS |
| PROPANE | UG/L | 3.4 | 3.4 | 3.3 | 1.8 | NS | 0.5 | NS |
| **Total Volatiles** | | **27.3** | **28.3** | **10,747** | **19,170** | **614.4** | **1.13** | **34,100** |
| Gene-Trac ***Dehalococcoides*** **Assay** | | | | | | | | |
| PERCENT DHC | | NS | NS | NS | NS | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | NS | NS | NS | NS | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = estimated concentration
UJ = Not detected. Reporting limit may not be accurate or precise.
B = Not detected substantially above the level reported in the lab or field blanks.

# Table A-1
# Summary of F-Zone Analytical Results
# 2008
# DuPont Necco Park

| | **Sample ID** | VH-136F | VH-146F | VH-147F | VH-150F | VH-156F |
|---|---|---|---|---|---|---|
| | **Date** | 6/18/08 | 6/20/08 | 6/10/08 | 6/13/08 | 6/11/08 |
| **Analyte** | **Units** | FS | FS | FS | FS | FS |
| **Field Parameters** | | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | CLEAR | GREY | CLEAR | GREY | GREY |
| ODOR (FIELD) | NS | SLIGHT | SLIGHT | NONE | MODERATE | SLIGHT |
| PH (FIELD) | STD UNITS | 7.92 | 6.98 | 7.12 | 7.07 | 7.32 |
| REDOX (FIELD) | MV | -402 | -353 | -183 | -345 | -292 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 1890 | 10210 | 2970 | 28100 | 2290 |
| TEMPERATURE (FIELD) | DEGREES C | 13.5 | 14 | 13.4 | 16.4 | 13.7 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 13.94 | 9.48 | 14.6 | 3.17 | 8.56 |
| **Volatile Organics** | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | <0.6 | <90 | <0.18 | <5.1 UJ | <0.18 |
| 1,1,2-TRICHLOROETHANE | UG/L | 6.6 | 170 J | <0.27 | <7.7 | <0.27 |
| 1,1-DICHLOROETHENE | UG/L | 0.68 J | 490 J | <0.19 | <5.4 | <0.19 |
| 1,2-DICHLOROETHANE | UG/L | 24 | <110 | <0.22 | <6.3 | 1.4 |
| CARBON TETRACHLORIDE | UG/L | <0.43 | <65 | <0.13 | <3.7 | <0.13 |
| CHLOROFORM | UG/L | 9.4 | <80 | <0.16 | <4.6 | 0.25 J |
| CIS-1,2 DICHLOROETHENE | UG/L | 21 | 11000 | 0.79 J | 680 | 4.1 |
| TETRACHLOROETHYLENE | UG/L | <0.97 | <140 UJ | <0.29 | <8.3 UJ | <0.29 UJ |
| TRANS-1,2-DICHLOROETHENE | UG/L | 51 | 600 | <0.19 | <5.4 | 2 |
| TRICHLOROETHENE | UG/L | 6.4 | 230 J | <0.17 | <4.9 | 1.4 |
| VINYL CHLORIDE | UG/L | 120 | 3400 | 1.5 | 540 | 16 |
| **Semivolatile Organics** | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | 1.1 J | 88 J | <0.96 | <48 | 1.7 J |
| 2,4,6-TRICHLOROPHENOL | UG/L | <1.4 | 32 J | <1.4 | <70 | <1.4 |
| 3- AND 4- METHYLPHENOL | UG/L | 4.5 J | 47 J | <0.75 | 21 J | <0.75 |
| HEXACHLOROBENZENE | UG/L | <0.065 | <1.3 | <0.065 | <3.2 | <0.065 |
| HEXACHLOROBUTADIENE | UG/L | <0.51 | <10 | <0.51 | <26 | <0.51 |
| HEXACHLOROETHANE | UG/L | <0.58 | <12 | <0.58 | <29 | <0.58 |
| PENTACHLOROPHENOL | UG/L | <0.48 | <9.6 | <0.48 | <24 | <0.48 |
| PHENOL | UG/L | <0.96 | 250 | <0.96 | 270 J | <0.96 |
| TIC01 | UG/L | 80 J | 1400 J | <NS J | 390 J | 2.4 J |
| **Inorganics** | | | | | | |
| BARIUM, DISSOLVED | UG/L | 140 B | 69 B | 44 B | 130 J | 19 B |
| IRON, DISSOLVED | UG/L | NS | 270 | NS | 199000 | NS |
| MANGANESE, DISSOLVED | UG/L | NS | 1100 | NS | 2500 | NS |
| ALKALINITY, TOTAL | UG/L | NS | 670000 | NS | 460000 | NS |
| CHLORIDE | UG/L | 334000 B | 3350000 B | 149000 B | 12900000 B | 227000 B |
| NITRATE/NITRITE NITROGEN | UG/L | NS | <20 | NS | <20 R | NS |
| SULFATE | UG/L | NS | 889000 B | NS | 1110000 B | NS |
| SULFIDE | UG/L | NS | 5400 | NS | 21000 | NS |
| TOTAL ORGANIC CARBON | UG/L | NS | 80000 | NS | 210000 | NS |
| **Gases** | | | | | | |
| ETHANE | UG/L | NS | 70 | NS | 160 | NS |
| ETHENE | UG/L | NS | 260 | NS | 91 | NS |
| METHANE | UG/L | NS | 3100 | NS | 6100 | NS |
| PROPANE | UG/L | NS | 3.8 | NS | 1.6 | NS |
| **Total Volatiles** | | **239.1** | **15,890** | **2.3** | **1,220** | **25.2** |
| **Gene-Trac *Dehalococcoides* Assay** | | | | | | |
| PERCENT DHC | | NS | NS | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | NS | NS | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = estimated concentration

UJ = Not detected.  Reporting limit may not be accurate or precise.

B = Not detected substantially above the level reported in the lab or field blanks.

# Table A-1
# Summary of G-Zone Analytical Results
# 2008
# DuPont Necco Park

| Analyte | Units | VH-147G1<br>6/10/08<br>FS | VH-147G1<br>6/10/08<br>DUP | VH-147G2<br>6/10/08<br>FS | VH-147G3<br>6/10/08<br>FS |
|---|---|---|---|---|---|
| **Field Parameters** | | | | | |
| COLOR QUALITATIVE (FIELD) | NS | GREY | NS | GREY | GREY |
| ODOR (FIELD) | NS | SLIGHT | NS | NONE | NONE |
| PH (FIELD) | STD UNITS | 6.85 | NS | 7.42 | 6.72 |
| REDOX (FIELD) | MV | -270 | NS | -268 | -349 |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 5870 | NS | 5840 | 9590 |
| TEMPERATURE (FIELD) | DEGREES C | 14.4 | NS | 14.9 | 14.1 |
| TURBIDITY QUANTITATIVE (FIELD) | NTU | 7.39 | NS | 4.24 | 4.23 |
| **Volatile Organics** | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | 20 J | 22 J | <45 | 52 J |
| 1,1,2-TRICHLOROETHANE | UG/L | 14 J | 17 J | <68 | 42 J |
| 1,1-DICHLOROETHENE | UG/L | <4.8 | <4.8 | <48 | <27 |
| 1,2-DICHLOROETHANE | UG/L | 59 | 68 | 460 | 87 J |
| CARBON TETRACHLORIDE | UG/L | <3.2 | <3.2 | <32 | <19 |
| CHLOROFORM | UG/L | 12 J | 13 J | <40 | 56 J |
| CIS-1,2 DICHLOROETHENE | UG/L | 150 | 210 | 230 J | 570 |
| TETRACHLOROETHYLENE | UG/L | <7.2 UJ | <7.2 UJ | <72 UJ | <41 UJ |
| TRANS-1,2-DICHLOROETHENE | UG/L | 300 | 230 | 230 J | 410 |
| TRICHLOROETHENE | UG/L | 8.5 J | 8.2 J | <42 | <24 |
| VINYL CHLORIDE | UG/L | 790 J | 870 | 7300 | 5800 |
| **Semivolatile Organics** | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | 1 J | 1 J | 4.9 J | 1.1 J |
| 2,4,6-TRICHLOROPHENOL | UG/L | <1.4 | <1.4 | <1.4 | <1.4 |
| 3- AND 4- METHYLPHENOL | UG/L | <0.75 | <0.75 | <0.75 | <0.75 |
| HEXACHLOROBENZENE | UG/L | <0.065 | <0.065 | <0.065 | <0.065 |
| HEXACHLOROBUTADIENE | UG/L | <0.51 | <0.51 | <0.51 | <0.51 |
| HEXACHLOROETHANE | UG/L | <0.58 | <0.58 | <0.58 | <0.58 |
| PENTACHLOROPHENOL | UG/L | <0.48 | <0.48 | 0.5 J | 1.2 J |
| PHENOL | UG/L | <0.96 | <0.96 | <0.96 | <0.96 |
| TIC01 | UG/L | 20 J | 21 J | 180 J | 130 J |
| **Inorganics** | | | | | |
| BARIUM, DISSOLVED | UG/L | 46 B | 47 | 29 B | 38 B |
| IRON, DISSOLVED | UG/L | NS | NS | NS | NS |
| MANGANESE, DISSOLVED | UG/L | NS | NS | NS | NS |
| ALKALINITY, TOTAL | UG/L | NS | NS | NS | NS |
| CHLORIDE | UG/L | 1230000 | 1220000 | 1690000 | 2690000 |
| NITRATE/NITRITE NITROGEN | UG/L | NS | NS | NS | NS |
| SULFATE | UG/L | NS | NS | NS | NS |
| SULFIDE | UG/L | NS | NS | NS | NS |
| TOTAL ORGANIC CARBON | UG/L | NS | NS | NS | NS |
| **Gases** | | | | | |
| ETHANE | UG/L | NS | NS | NS | NS |
| ETHENE | UG/L | NS | NS | NS | NS |
| METHANE | UG/L | NS | NS | NS | NS |
| PROPANE | UG/L | NS | NS | NS | NS |
| **Total Volatiles** | | **1,354** | **1,438** | **8,220** | **7,017** |
| **Gene-Trac *Dehalococcoides* Assay** | | | | | |
| PERCENT DHC | | NS | NS | NS | NS |
| *DEHALOCOCCOIDES* ENUMERATION | | NS | NS | NS | NS |

< and ND = not detected at stated reporting limit.

(1)Not applicable- Dehalococcoides not detected

(2) Not detected. Quantiation limit is 4x 10 3 /liter

(3)Sample inhibited testing; may be false positive

(4) Blind sample duplicate submitted for this location

J = estimated concentration

UJ = Not detected. Reporting limit may not be accurate or precise.

B = Not detected substantially above the level reported in the lab or field blanks.

# Table A-2
# Summary of Analytical Results for Recovery Well Sampling
# DuPont Necco Park

| | | RW-4 | RW-4 | RW-5 | RW-8 | RW-9 | TBLK |
|---|---|---|---|---|---|---|---|
| | | 8/13/08 | 8/13/08 | 8/13/08 | 8/13/08 | 8/13/08 | 8/13/08 |
| **Analyte** | **Units** | DUPLICATE | FS | FS | FS | FS | TB |
| **Field Parameters** | | | | | | | |
| SPECIFIC CONDUCTANCE (FIELD) | UMHOS/CM | 9094 | 9094 | 29610 | 3885 | 4515 | NA |
| TEMPERATURE (FIELD) | DEGREES C | 17.7 | 17.7 | 17.4 | 13.7 | 13.5 | NA |
| COLOR QUALITATIVE (FIELD) | NS | clear | clear | white tint | clear | clear | NA |
| PH (FIELD) | STD UNITS | 7.04 | 7.04 | 6.24 | 7.75 | 7.66 | NA |
| REDOX (FIELD) | MV | -281 | -281 | -187 | -295 | -293 | NA |
| TURBIDITY QUALITATIVE (FIELD) | NTU | 14.5 | 14.5 | 38.8 | 3.97 | 5.19 | NA |
| DEPTH TO WATER FROM TOC | Feet | 33.26 | 33.26 | 18.23 | 31.98 | 20.93 | NA |
| ODOR (FIELD) | | strong | strong | strong | moderate | moderate | NA |
| **Volatile Organics** | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | 12000 J | 12000 J | 4000 J | 1300 J | 1500 J | <0.18 UJ |
| 1,1,2-TRICHLOROETHANE | UG/L | 500 | 500 | 1400 | 2500 | 2400 J | <0.27 |
| 1,1-DICHLOROETHENE | UG/L | <79 | <79 | 300 J | 240 J | 460 J | <0.19 |
| 1,2-DICHLOROETHANE | UG/L | <92 | <92 | 450 J | 240 J | 210 J | <0.22 |
| CARBON TETRACHLORIDE | UG/L | 2200 | 2600 | 1400 | 2900 | 1200 | <0.13 |
| CHLOROFORM | UG/L | 5500 | 5600 | 6700 | 9100 | 2700 | <0.16 |
| CIS-1,2 DICHLOROETHENE | UG/L | 830 | 890 | 13000 | 7300 | 13000 | <0.17 |
| METHYLENE CHLORIDE | UG/L | 790 B | 820 B | 2700 B | 2500 B | 6200 J | 0.74 J |
| TETRACHLOROETHYLENE | UG/L | 2100 | 2300 | 2400 | 3000 | 1300 | <0.29 |
| TRANS-1,2-DICHLOROETHENE | UG/L | 170 J | 160 J | 740 | 640 | 920 | <0.19 |
| TRICHLOROETHENE | UG/L | 4500 | 5000 | 8700 | 10000 | 7000 | <0.17 |
| VINYL CHLORIDE | UG/L | 390 J | 410 J | 4800 | 1500 | 3200 J | <0.22 |
| **Semivolatile Organics** | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | <240 | <240 | <24 | 520 | 180 | NS |
| 2,4,6-TRICHLOROPHENOL | UG/L | <350 | <350 | <35 | 300 | 48 J | NS |
| 3- AND 4- METHYLPHENOL | UG/L | <0.75 | <0.75 | 210 J | <0.75 | 19 J | NS |
| HEXACHLOROBENZENE | UG/L | <16 | <16 | <1.6 | <1.6 | <0.43 | NS |
| HEXACHLOROBUTADIENE | UG/L | 5500 | 5900 | 660 | 65 J | 12 J | NS |
| HEXACHLOROETHANE | UG/L | 1200 J | 1300 J | 470 J | 18 J | 4.7 J | NS |
| PENTACHLOROPHENOL | UG/L | <120 | <120 | 86 J | 1100 J | 45 J | NS |
| PHENOL | UG/L | <240 | <240 | 120 J | <24 | 61 J | NS |
| Tentatively Identified Compound 01 | UG/L | 500 J | 570 J | 1200 J | <NS J | 490 J | NS |
| **Inorganics** | | | | | | | |
| BARIUM, DISSOLVED | UG/L | 390 | 390 | 1080000 | 110 J | 200 | NS |
| CHLORIDE | UG/L | 3240000 | 3250000 | 16600000 | 771000 | 1190000 | NS |
| **Total Volatiles** | UG/L | 28,980 | 30,280 | 46,590 | 41,220 | 40,090 | 0.74 |

< and ND = not detected at stated reporting limit.
J - Estimated concentration
UJ - not detected. Reporting limit may not be accurate or precise.
B - not detected substantially above the level reported in the lab or field blanks.

# APPENDIX B

# RECOVERY WELL RW-10 REPLACEMENT

# 1.0 INTRODUCTION

As stated in all previous Necco Park Annual Reports submitted to the USEPA, the hydraulic efficiency of recovery well RW-10 has decreased since startup, thereby reducing the overall effectiveness of the HCS in the B/C-Zone throughout the western portion of the Site. Conventional rehabilitation methods to improve well efficiency had limited success. Steps were then taken to replace recovery well RW-10 with a well installed as a Blast-Fractured Bedrock Trench (BFBT) in the B-Zone as described in the March 14, 2008 *Recovery Well RW-10 Replacement Work Plan* (DuPont CRG 2008c). The Work Plan was approved by USEPA in April 2008.

## 1.1 Background

As described in the Work Plan, installation of a BFBT creates an interconnected zone of fractures in the shallow bedrock using controlled subsurface detonation of explosives. Groundwater elevations in the overburden and upper bedrock are lowered substantially during pumping from the BFBT by groundwater pumping from a single extraction well in each BFBT. Enhanced hydraulic control by such methods has proven successful at the nearby DuPont Niagara Plant. Hydraulic monitoring completed to date at Necco Park indicates similar results as discussed in Section 3.1.1 of this report.

# 2.0 IMPLEMENTATION

As described in the Work Plan, a new recovery well (RW-11) screened within a B-Zone BFBT and completed as a bedrock open-hole in the C-Zone was installed. Location of the BFBT and new recovery well RW-11 is shown in Figure B-1.

In accordance with the Blasting Plan prepared for the installation of the BFBT, the following steps were taken before blasting began:

- ☐ Coordination with the adjacent property owner
- ☐ Physical field mark-out of the BFBT blast holes and adjacent subsurface utilities
- ☐ Procurement of permits and notifications to local municipalities by the blasting subcontractor
- ☐ Pre-blast vibration monitoring to determine background conditions

Implementation was managed by DuPont CRG with project oversight provided by URS Diamond and design and blast vibration loss control support provided by Geomatrix Consultants, Inc. Nothnagle Enterprises conducted the blasting operations and Nothnagle Drilling conduct the drilling and recovery well installation necessary to complete the BFBT. DuPont selected Nothnagle and Geomatrix because of their experience with installing BFBTs at the DuPont Niagara Plant and other groundwater remediation sites. The work was completed in accordance with Heath and Safety Plan Addendum #5 prepared for the project (DuPont CRG June 2008). The work began on July 7th and completed on August 5, 2008 and included installation of the BFBT and the new recovery well.

The BFBT was constructed in accordance with the Blasting Plan provided in the Work Plan. The purpose of the Blasting Plan is to present in detail, procedures to be used to ensure that the blasting program is done safely and effectively. Elements of the Blasting Plan include a description of the proposed methods for BFBT construction, safety protocols including explosives storage, inventory, and control, blast warnings, blast monitoring, and requirements for permits, licensure, and insurance.

The BFBT was constructed along a 170-foot alignment as shown in Figure B-1. Using air-rotary drilling methods, boreholes along the alignment were installed at approximate 5-foot spacing to a depth of five to seven feet below the top of bedrock. Temporary steel casing in the overburden was installed at each boring. Overburden thickness along the trench alignment ranged from 12 to 14.5 feet. Borehole spacing of 3-feet was used in the area where the replacement recovery well was installed to create a highly fractured zone at this location.

Blasting began at the east end of the trench alignment, which is the farthest location from process structures. A 7.5-pound explosive charge was placed at the bottom of each borehole and filled to the surface with an angular stemming stone to direct the blast energy laterally and minimize upward blast forces. The temporary casings were removed before blasting. Heavy rope blast maps were placed over the loaded shot holes to limit the expulsion of material from the shot holes during detonation. The vibration monitoring results determined the number of holes shot for a particular sequence. A maximum of eight shot holes was detonated in a single shot sequence.

With the BFBT phase of the project complete, installation of recovery well RW-11 and BFBT overburden (PZ-A) and B-Zone (PZ-B) piezometers were installed at the locations in Figure A-1. The BFBT and replacement well was installed 6 feet north of well RW-10 allowing operation of the well using the existing equipment housed in the RW-10 well house. Boring logs and well construction diagrams are provided in Attachment A. As indicated on the soil log for well RW-11, rock cores were collected from the blasted bedrock and the bedrock below the BBFT. Core run # 1 helped determine the filter material for B-Zone well screen and run # 2 determined the depth of the C-Zone fracture.

As indicated on the well construction diagram for recovery well RW-11, a 200 slot (0.20-inch opening) well screen with glass bead backfill material was selected based on the brokeness of the blasted bedrock in which the well B-Zone portion of the well was installed. After installation, recovery well RW-11 and the BFBT piezometers were developed as described in the Work Plan. Following completion of well development, groundwater pumping tests to assess the hydraulic performance of the BFBT were completed. To evaluate chemical loading contribution from RW-11, groundwater samples for laboratory analysis were collected during the pumping tests. Results of the pumping tests and groundwater chemical analysis are discussed in Sections 3.1.1 and 3.1.2, respectively.

# 3.0 BFBT PERFORMANCE TESTING

Testing of RW-11 was conducted in four primary phases:

- ☐ Single day step test,
- ☐ Recovery period,
- ☐ Three day pump test and,
- ☐ Atmospheric recovery monitoring.

The objectives of the step-test were to evaluate the increase in conductivity of the bedrock across the length of the trench and to select a pumping rate for the 3-day test.

The objective of the 3-day pump was to determine the minimum area of influence exhibited by the new BFBT at the selected pumping rate.

The objectives of the recovery period were to collect sufficient data to evaluate and discern atmospheric influences from pumping influences on selected wells (137B, 150B and 150C).

The single day step-test was conducted on August 18, 2008, and RW-11 was pumped at an average rate of approximately 16-gallons per minute (gpm). Due to limitations of the pump in the well, increases in pumping rates were not available. After an overnight recovery period of no pumping the three day pump test was started on August 19, 2008, and run until August 21, 2008, when the pump in RW-11 was shut down. Due to limited periods of unplanned pump shut-downs, the pumping rate averaged at approximately 14-gpm. The recovery period was conducted until September 2, 2008.

**Summary of RW-11 Pump Test Schedule August-September 2008**

| Phase | Duration (HH:MM) | Start | Finish | Flow Rate |
|---|---|---|---|---|
| Step Test | 4:10 | 8/18<br>11:20 | 8/18<br>15:30 | 16 gpm |
| Recovery | 17:20 | 8/18<br>15:30 | 8/19<br>08:50 | 0 gpm |
| 3-Day Test | 55:00 | 8/19<br>08:50 | 8/21<br>15:50 | 14 gpm |
| Monitoring | 280:55 | 8/21<br>15:55 | 9/02<br>8:45 | 0 gpm |

## 3.1 Hydraulic Monitoring

Prior to the start of the test, seven In-Situ® dataloggers were installed in select wells (RW-11, PZ-A, PZ-B, 130B, 137B, 150B and 150C) to monitor static and pumping inducted water level responses. The dataloggers deployed in RW-11, PZ-A, PZ-B and 130B were removed on August 22, 2008. The dataloggers installed in 137B, 150B and

150C were used for long term atmospheric monitoring and were downloaded on September 2, 2008.

**Results**

Step Test

For the step test, nearly instantaneous and equal magnitude responses were observed in both trench piezometers (PZ-A and PZ-B), which indicates significantly increased hydraulic conductivity with good continuity throughout the length of the trench (Figure B2). Maximum drawdown in the pumping well was approximately 1.4 feet after 4 hours of pumping. Based on the step test results, the estimated maximum drawdown for the 3-day was determined to be approximately 2.5 feet.

Pumping Test

Pumping in RW-11 started at a rate of approximately 18 gpm. However, the rate fluctuated between 0 and 18 gpm during the test with an average of approximately 14 gpm.

After only 3-days of pumping, A-Zone responses of over 0.5-foot were observed in PZ-1A, D-11, 173A, 176A, 178A and 179A. Drawdown greater than 1-foot were recorded in B, B/C and C-Zone wells PZ-1B, 201B, 111B, D-14, D-10, BZTW-2, TRW-6, TRW-7, 138C and 137C (Table 1 and Figure B3).

Also, datalogger data provided indications of pumping response in 150B (Figure B4).

Discussion

A review of the pumping induced drawdowns indicates that, in general, the BFBT greatly enhances the area of influence in both the B-Zone and C-Zone in the vicinity of former recovery well RW-10. Measurable influence can be observed as far south as 150B and significant drawdowns were observed in wells 137C and 138C. With these results, after less then 60-hours of pumping, it is expected that the BFBT will provide enhanced control of the A-Zone, B-Zone and C-Zone groundwater relative to the control provided by RW-10 and will significantly enhance control in the area between RW-5 and RW-11.

### 3.1.1 Groundwater Chemistry Monitoring

On two separate occasions (during the first hour of pumping and one hour before pumping is terminated), groundwater samples were collected from RW-11 discharge. URS Diamond personnel conducted the sampling following the procedures of the Necco Park Site Sampling and Analysis Plan for the operation and maintenance of the HCS. Samples and associated quality assurance/quality control (QA/QC) samples were analyzed by TestAmerica located in North Canton, Ohio. Groundwater sample results are presented as Table B-1.

The samples were analyzed for TCL volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), target analyte list (TAL) metals, total cyanide, and water quality parameters (alkalinity, chloride, nitrate, sulfate, ferrous iron, chemical oxygen demand, and biological oxygen demand). A comparison of the RW-11 sample results to those from former recovery well RW-10 indicates no significant difference in the influent chemistry with one exception. The pH for the initial and final pumping test samples was 10.6 and 11.2 standard units, respectively. As discussed in Section 4.0, pH adjustment is conducted at the recovery well. Like the other recovery wells, groundwater samples will be collected at well RW-11 annually.

# 4.0 OPERATION AND MAINTENANCE

Following RW-10 well house and acid line modifications, replacement B/C-Zone recovery well RW-11 was put into operation on November 12th 2008. During 4Q08, RW-11 pumped at a rate of 15-18 gpm. The higher well yield required the installation of a 1-1/2 HP 25E8 Grundfos submersible pump. The uptime from startup to December 31st was 78.7 percent.

Groundwater samples collected during the pump test indicated the pH at RW-11 was between 10.6 and 11.2 (standard units). Because of these high pH values, 32% HCL is added to the well at the well pump, prior to mixing in the influent line with groundwater from wells RW-4 and RW-5. Acid is added to recover well RW-11 at rate of approximately 30-gallons per day. There have been a total of six pump changes (two in 2008 and 6 thus far in 2009) at RW-11 due to sediment and fouling since startup in November 2008.

# 5.0 DEVIATIONS FROM THE WORK PLAN

To increase the degree of bedrock fracturing at the new recovery well location, additional blast holes were completed at the western end of the BFBT. A total of thirty-seven blast holes were completed, five more than the thirty-two blast holes proposed in the Work Plan.

To minimize clogging of the screened portion of recovery well RW-11, ½-inch diameter clear glass beads were used in place of the washed fine gravel backfill described in the Work Plan.

Piezometers PZ-A and PZ-B, installed in the BFBT, were constructed of 2-inch diameter PVC casing in its place of the 4-inch material described in the Work Plan.

# Table B-1
# RW-11 Pump Test Results
# DuPont Necco Park

| | | | RW-11 | RW-11 | RW-11 | RW-11 | TBLK |
|---|---|---|---|---|---|---|---|
| | | Total (T)/ | 8/19/08 | 8/21/08 | 11/14/08 | 1/29/09 | 8/19/08 |
| **Analyte** | **Units** | **Diss. (D)** | FS | FS | | | TBLK |
| **Volatile Organics** | | | | | | | |
| 1,1,1-TRICHLOROETHANE | UG/L | T | <110 | <110 | | | <0.22 |
| 1,1,2,2-TETRACHLOROETHANE | UG/L | T | 1100 | 1400 | 1500 | 1300 | <0.18 UJ |
| 1,1,2-TRICHLOROETHANE | UG/L | T | 2300 | 2700 | 3130 | 2890 | <0.27 UJ |
| 1,1,2-TRICHLOROTRIFLUOROETHANE | UG/L | T | <140 | <140 | | | <0.28 |
| 1,1-DICHLOROETHANE | UG/L | T | <75 | <75 | | | <0.15 |
| 1,1-DICHLOROETHENE | UG/L | T | 800 | 650 | <36 | 639 | <0.19 |
| 1,2-DIBROMO-3-CHLOROPROPANE | UG/L | T | <340 | <340 | | | <0.67 |
| 1,2-DIBROMOETHANE (EDB) | UG/L | T | <120 | <120 | | | <0.24 |
| 1,2-DICHLOROBENZENE | UG/L | T | <65 | <65 | | | <0.13 |
| 1,2-DICHLOROETHANE | UG/L | T | <110 | <110 | <68 | <500 | <0.22 |
| 1,2-DICHLOROPROPANE | UG/L | T | <90 | <90 | | | <0.18 |
| 1,3-DICHLOROBENZENE | UG/L | T | <70 | <70 | | | <0.14 |
| 1,4-DICHLOROBENZENE | UG/L | T | <65 | <65 | | | <0.13 |
| 2-HEXANONE | UG/L | T | <200 | <200 | | | <0.41 |
| ACETONE | UG/L | T | 5100 | <550 | | | <1.1 |
| BENZENE | UG/L | T | <65 | <65 | | | <0.13 |
| BROMODICHLOROMETHANE | UG/L | T | <75 | <75 | | | <0.15 |
| BROMOFORM | UG/L | T | <320 | <320 | | | <0.64 |
| CARBON DISULFIDE | UG/L | T | 600 | <65 | | | <0.13 |
| CARBON TETRACHLORIDE | UG/L | T | 1500 | 1400 | 1370 | 1400 | <0.13 |
| CHLOROBENZENE | UG/L | T | <75 | <75 | | | <0.15 |
| CHLORODIBROMOMETHANE | UG/L | T | <90 | <90 | | | <0.18 |
| CHLOROFORM | UG/L | T | 14000 | 14000 | 13900 | 15400 | <0.16 |
| CIS-1,2 DICHLOROETHENE | UG/L | T | 3100 | 3300 | 3310 | 3140 | <0.17 |
| CIS-1,3-DICHLOROPROPENE | UG/L | T | <70 | <70 | | | <0.14 |
| CUMENE | UG/L | T | <65 | <65 | | | <0.13 |
| CYCLOHEXANE | UG/L | T | <60 | <60 | | | <0.12 |
| DICHLORODIFLUOROMETHANE | UG/L | T | <160 | <160 | | | <0.31 |
| ETHYL CHLORIDE | UG/L | T | <140 | <140 | | | <0.29 |
| ETHYLBENZENE | UG/L | T | <85 | <85 | | | <0.17 |
| METHYL ACETATE | UG/L | T | <190 | <190 | | | <0.38 |
| METHYL BROMIDE | UG/L | T | <200 | <200 | | | <0.41 |
| METHYL CHLORIDE | UG/L | T | <150 | <150 | | | <0.3 |
| METHYL ETHYL KETONE | UG/L | T | 5900 | <280 | | | <0.57 |
| METHYL ISOBUTYL KETONE | UG/L | T | <160 | <160 | | | <0.32 |
| METHYL TERTIARY BUTYL ETHER | UG/L | T | <85 | <85 | | | <0.17 |
| METHYLENE CHLORIDE | UG/L | T | 3800 | 3100 | 3270 | 2960 | <0.33 |
| STYRENE | UG/L | T | <55 | <55 | | | <0.11 |
| TETRACHLOROETHYLENE | UG/L | T | 5500 | 5700 | 5420 | 5770 | <0.29 |
| TOLUENE | UG/L | T | <65 | <65 | | | <0.13 |
| TRANS-1,2-DICHLOROETHENE | UG/L | T | <95 | <95 | 204 | <500 | <0.19 |
| TRANS-1,3-DICHLOROPROPENE | UG/L | T | <95 | <95 | | | <0.19 |
| TRICHLOROETHENE | UG/L | T | 15000 | 14000 | 13800 | 13900 | <0.17 |
| TRICHLOROFLUOROMETHANE | UG/L | T | <100 | <100 | | | <0.21 |
| VINYL CHLORIDE | UG/L | T | 680 | 1200 | 950 | 964 | <0.22 |
| XYLENES | UG/L | T | <140 | <140 | | | <0.28 |
| 1,2,4-TRICHLOROBENZENE | UG/L | T | <75 | <75 | | | <0.15 |
| METHYL CYCLOHEXANE | UG/L | T | <65 | <65 | | | <0.13 |
| **Total VOCs** | | | **59,380** | **47,450** | | | |

J - Estimated concentration.
R- Unusable result.  Analyte may or may not be present in the sample.
UJ - Not detected. Reporting limit may not be accurate or precise.
NS - not sampled.

# Table B-1
# RW-11 Pump Test Results
# DuPont Necco Park

| Analyte | Units | Total (T)/ Diss. (D) | RW-11 8/19/08 FS | RW-11 8/21/08 FS | RW-11 11/14/08 | RW-11 1/29/09 | TBLK 8/19/08 TBLK |
|---|---|---|---|---|---|---|---|
| **Semivolatile Organics** | | | | | | | |
| 2,4,5-TRICHLOROPHENOL | UG/L | T | <3.8 | <3 | | | NS |
| 2,4,6-TRICHLOROPHENOL | UG/L | T | <10 | <8 | | | NS |
| 2,4-DICHLOROPHENOL | UG/L | T | <10 | <8 | | | NS |
| 2,4-DIMETHYLPHENOL | UG/L | T | <10 | <8 | | | NS |
| 2,4-DINITROPHENOL | UG/L | T | <30 | <24 | | | NS |
| 2,4-DINITROTOLUENE | UG/L | T | <3.4 | <2.7 | | | NS |
| 2,6-DINITROTOLUENE | UG/L | T | <10 | <8 | | | NS |
| 2-CHLOROPHENOL | UG/L | T | <3.6 | <2.9 | | | NS |
| 2-METHYLNAPHTHALENE | UG/L | T | <1.2 | <1 | | | NS |
| 2-METHYLPHENOL (O-CRESOL) | UG/L | T | <10 | <8 | | | NS |
| 2-NITROANILINE | UG/L | T | <10 | <8 | | | NS |
| 2-NITROPHENOL | UG/L | T | <3.5 | <2.8 | | | NS |
| 3,3'-DICHLOROBENZIDINE | UG/L | T | <4.6 | <3.7 | | | NS |
| 3-NITROANILINE | UG/L | T | <3.5 | <2.8 | | | NS |
| 4,6-DINITRO-2-METHYLPHENOL | UG/L | T | <30 | <24 | | | NS |
| 4-BROMOPHENYL PHENYL ETHER | UG/L | T | <10 | <8 | | | NS |
| 4-CHLORO-3-METHYLPHENOL | UG/L | T | <10 | <8 | | | NS |
| 4-CHLOROANILINE | UG/L | T | <10 | <8 | | | NS |
| 4-CHLOROPHENYL PHENYL ETHER | UG/L | T | <3.8 | <3 | | | NS |
| 4-METHYLPHENOL (P-CRESOL) | UG/L | T | <10 | 180 | | | NS |
| 4-NITROANILINE | UG/L | T | <10 | <8 | | | NS |
| 4-NITROPHENOL | UG/L | T | <30 | <24 R | | | NS |
| ACENAPHTHENE | UG/L | T | <1.2 | <1 | | | NS |
| ACENAPHTHYLENE | UG/L | T | <1.2 | <1 | | | NS |
| ACETOPHENONE | UG/L | T | <4.2 | <3.4 | | | NS |
| ANTHRACENE | UG/L | T | <1.2 | <1 | | | NS |
| BENZALDEHYDE | UG/L | T | <4.9 | <3.9 | | | NS |
| BENZO(A)ANTHRACENE | UG/L | T | <1.2 | <1 | | | NS |
| BENZO(B)FLUORANTHENE | UG/L | T | <1.2 | <1 | | | NS |
| BENZO(G,H,I)PERYLENE | UG/L | T | <1.2 | <1 | | | NS |
| BENZO(K)FLUORANTHENE | UG/L | T | <1.2 | <1 | | | NS |
| BENZO[A]PYRENE | UG/L | T | <1.2 | <1 | | | NS |
| BIPHENYL | UG/L | T | <10 | <8 | | | NS |
| BIS(2-CHLORO-1-METHYLETHYL) ETHER | UG/L | T | <5 | <4 | | | NS |
| BIS(2-CHLOROETHOXY)METHANE | UG/L | T | <4 | <3.2 | | | NS |
| BIS(2-CHLOROETHYL)ETHER | UG/L | T | <1.2 | <1 | | | NS |
| BIS(2-ETHYLHEXYL)PHTHALATE | UG/L | T | <10 | <8 | | | NS |
| BUTYL BENZYL PHTHALATE | UG/L | T | <10 | <8 | | | NS |
| CAPROLACTAM | UG/L | T | <10 | <8 | | | NS |
| CARBAZOLE | UG/L | T | <3.5 | <2.8 | | | NS |
| CHRYSENE | UG/L | T | <1.2 | <1 | | | NS |
| DIBENZ(A,H)ANTHRACENE | UG/L | T | <1.2 | <1 | | | NS |
| DIBENZOFURAN | UG/L | T | <1.2 | <1 | | | NS |
| DIETHYL PHTHALATE | UG/L | T | <7.5 | <6 | | | NS |
| DIMETHYL PHTHALATE | UG/L | T | <3.6 | <2.9 | | | NS |
| DI-N-BUTYL PHTHALATE | UG/L | T | <8.4 | <6.7 | | | NS |
| FLUORANTHENE | UG/L | T | <1.2 | <1 | | | NS |
| FLUORENE | UG/L | T | <1.2 | <1 | | | NS |

J - Estimated concentration.
R- Unusable result. Analyte may or may not be present in the sample.
UJ - Not detected. Reporting limit may not be accurate or precise.
NS - not sampled.

# Table B-1
# RW-11 Pump Test Results
# DuPont Necco Park

| Analyte | Units | Total (T)/ Diss. (D) | RW-11 8/19/08 FS | RW-11 8/21/08 FS | RW-11 11/14/08 | RW-11 1/29/09 | TBLK 8/19/08 TBLK |
|---|---|---|---|---|---|---|---|
| **Semivolatile Organics (Continued)** | | | | | | | |
| HEXACHLOROBENZENE | UG/L | T | <1.2 | <1 | | | NS |
| HEXACHLOROBUTADIENE | UG/L | T | 350 | 320 | | | NS |
| HEXACHLOROCYCLOPENTADIENE | UG/L | T | <10 | <8 | | | NS |
| HEXACHLOROETHANE | UG/L | T | <10 | <8 | | | NS |
| INDENO (1,2,3-CD) PYRENE | UG/L | T | <1.2 | <1 | | | NS |
| ISOPHORONE | UG/L | T | <3.4 | <2.7 | | | NS |
| NAPHTHALENE | UG/L | T | <1.2 | <1 | | | NS |
| N-DIOCTYL PHTHALATE | UG/L | T | <10 | <8 | | | NS |
| NITROBENZENE | UG/L | T | <0.5 | <0.4 | | | NS |
| N-NITROSODI-N-PROPYLAMINE | UG/L | T | <10 | <8 R | | | NS |
| N-NITROSODIPHENYLAMINE | UG/L | T | <3.9 | <3.1 | | | NS |
| 2-CHLOROPNAPHTHALENE | UG/L | T | <1.2 | <1 | | | NS |
| PENTACHLOROPHENOL | UG/L | T | <30 | 320 | | | NS |
| PHENANTHRENE | UG/L | T | <1.2 | <1 | | | NS |
| PHENOL | UG/L | T | 230 | 260 | | | NS |
| PYRENE | UG/L | T | <1.2 | <1 | | | NS |
| ATRAZINE | UG/L | T | <4.2 | <3.4 | | | NS |

J - Estimated concentration.
R- Unusable result. Analyte may or may not be present in the sample.
UJ - Not detected. Reporting limit may not be accurate or precise.
NS - not sampled.

# Table B-1
# RW-11 Pump Test Results
# DuPont Necco Park

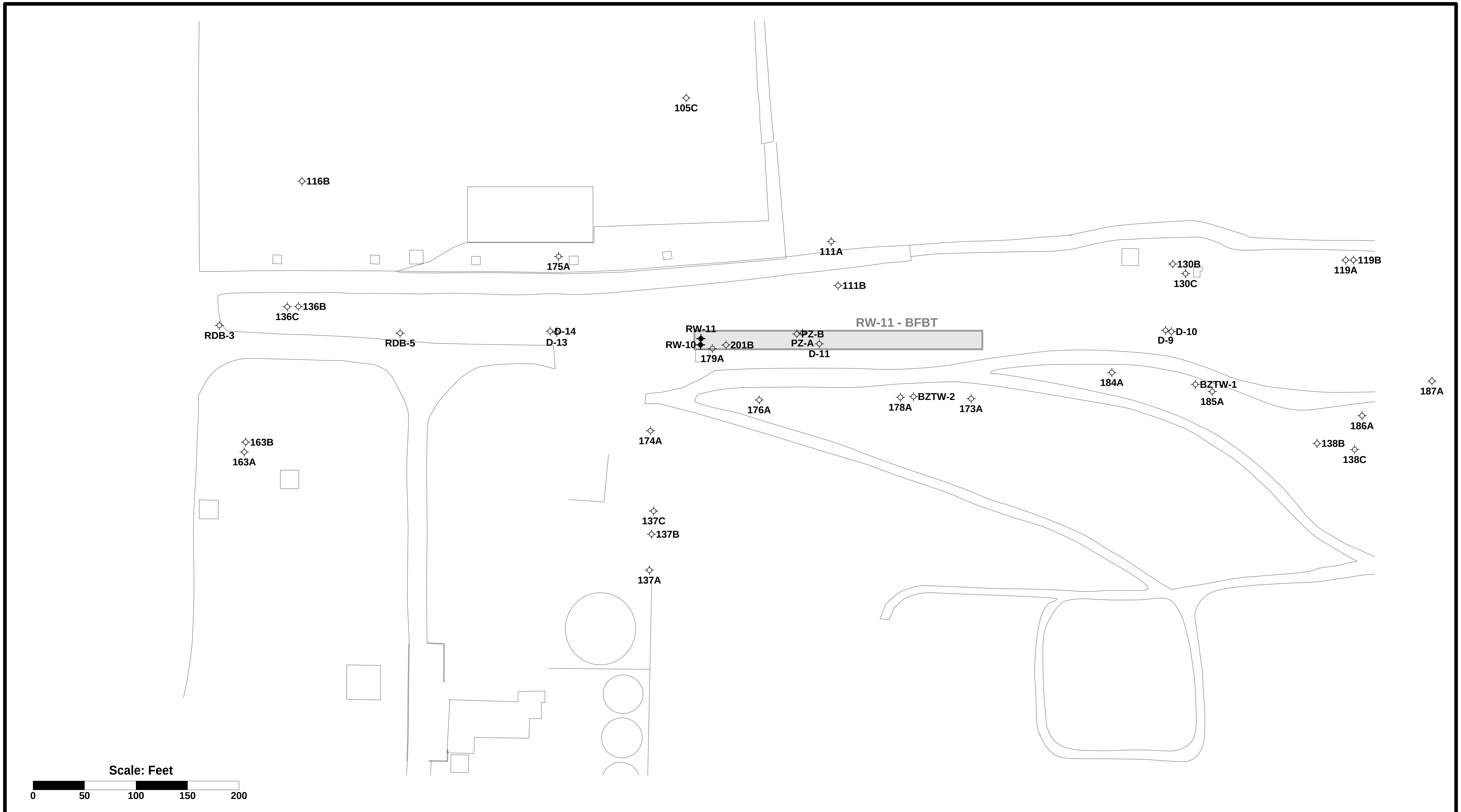
| Analyte | Units | Total (T)/ Diss. (D) | RW-11 8/19/08 FS | RW-11 8/21/08 FS | RW-11 11/14/08 | RW-11 1/29/09 | TBLK 8/19/08 TBLK |
|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | |
| ALUMINUM | UG/L | D | 1090 | <97 | | | NS |
| ALUMINUM | UG/L | T | <97 | <97 | | | NS |
| ANTIMONY | UG/L | D | <1.8 | <1.8 | | | NS |
| ANTIMONY | UG/L | T | <1.8 | <1.8 | | | NS |
| ARSENIC | UG/L | D | 15.8 | 11.7 | | | NS |
| ARSENIC | UG/L | T | 15.5 | <3.2 | | | NS |
| BARIUM | UG/L | D | 7190 | 9090 | | | NS |
| BARIUM | UG/L | T | 7380 | 8390 | | | NS |
| BERYLLIUM | UG/L | D | <0.46 | <0.46 | | | NS |
| BERYLLIUM | UG/L | T | <0.46 | <0.46 | | | NS |
| CADMIUM | UG/L | D | <0.66 | <0.66 | | | NS |
| CADMIUM | UG/L | T | <0.66 | <0.66 | | | NS |
| CALCIUM | UG/L | D | 789000 | 801000 | | | NS |
| CALCIUM | UG/L | T | 800000 | 767000 | | | NS |
| CHROMIUM | UG/L | D | <2.2 | <2.2 | | | NS |
| CHROMIUM | UG/L | T | <2.2 | <2.2 | | | NS |
| COBALT | UG/L | D | <1.7 | <1.7 | | | NS |
| COBALT | UG/L | T | <1.7 | <1.7 | | | NS |
| COPPER | UG/L | D | <4.5 | <4.5 | | | NS |
| COPPER | UG/L | T | <4.5 | <4.5 | | | NS |
| FERROUS IRON | UG/L | T | 1700 | 3100 | | | NS |
| IRON | UG/L | D | 11100 | 9250 | | | NS |
| IRON | UG/L | T | 11100 | 8710 | | | NS |
| LEAD | UG/L | D | <1.9 | <1.9 | | | NS |
| LEAD | UG/L | T | <1.9 | <1.9 | | | NS |
| MAGNESIUM | UG/L | D | 14600 | 16400 | | | NS |
| MAGNESIUM | UG/L | T | 15000 | 15500 | | | NS |
| MANGANESE | UG/L | D | 201 | 281 | | | NS |
| MANGANESE | UG/L | T | 205 | 267 | | | NS |
| MERCURY | UG/L | D | 0.23 | <0.12 | | | NS |
| MERCURY | UG/L | T | <0.12 | <0.12 | | | NS |
| NICKEL | UG/L | D | <3.2 | <3.2 | | | NS |
| NICKEL | UG/L | T | <3.2 | <3.2 | | | NS |
| POTASSIUM | UG/L | D | 59800 | 57400 | | | NS |
| POTASSIUM | UG/L | T | 61800 | 54600 | | | NS |
| SELENIUM | UG/L | D | 5.2 | <4.1 | | | NS |
| SELENIUM | UG/L | T | <4.1 | <4.1 | | | NS |
| SILVER | UG/L | D | <2.2 | <2.2 | | | NS |
| SILVER | UG/L | T | <2.2 | <2.2 | | | NS |

J - Estimated concentration.
R- Unusable result.  Analyte may or may not be present in the sample.
UJ - Not detected. Reporting limit may not be accurate or precise.
NS - not sampled.

# Table B-1
# RW-11 Pump Test Results
# DuPont Necco Park

| Analyte | Units | Total (T)/ Diss. (D) | RW-11 8/19/08 FS | RW-11 8/21/08 FS | RW-11 11/14/08 | RW-11 1/29/09 | TBLK 8/19/08 TBLK |
|---|---|---|---|---|---|---|---|
| **Inorganics (Continued)** | | | | | | | |
| SODIUM | UG/L | D | 682000 | 587000 | | | NS |
| SODIUM | UG/L | T | 697000 | 560000 | | | NS |
| THALLIUM | UG/L | D | <4.7 | <4.7 | | | NS |
| THALLIUM | UG/L | T | <4.7 | <4.7 | | | NS |
| VANADIUM | UG/L | D | <0.64 | <0.64 | | | NS |
| VANADIUM | UG/L | T | <0.64 | <0.64 | | | NS |
| ZINC | UG/L | D | 44.5 | 60 | | | NS |
| ZINC | UG/L | T | 44.7 | 58.6 | | | NS |
| ALKALINITY, BICARB. AS CACO3 AT PH 4.5 | UG/L | T | 668000 | 758000 J | | | NS |
| BIOCHEMICAL OXYGEN DEMAND (BOD) - 5 D | UG/L | T | 620000 | 540000 | | | NS |
| CHEMICAL OXYGEN DEMAND (COD) | UG/L | T | 1910000 J | 1410000 J | | | NS |
| CHLORIDE | UG/L | T | 2200000 | 1980000 | | | NS |
| CYANIDE | UG/L | T | 175000 | 870 | | | NS |
| NITRATE | UG/L | T | <23 | 500 | | | NS |
| PH | STD UNITS | T | 10.6 | 11.2 | | | NS |
| SULFATE | UG/L | T | 107000 | 97000 | | | NS |

J - Estimated concentration.
R- Unusable result.  Analyte may or may not be present in the sample.
UJ - Not detected. Reporting limit may not be accurate or precise.
NS - not sampled.



**Corporate Remediation Group**

*An Alliance between*
*DuPont and URS Diamond*

**Buffalo Avenue & 26th Street**
**Niagara Falls, NY 14302**

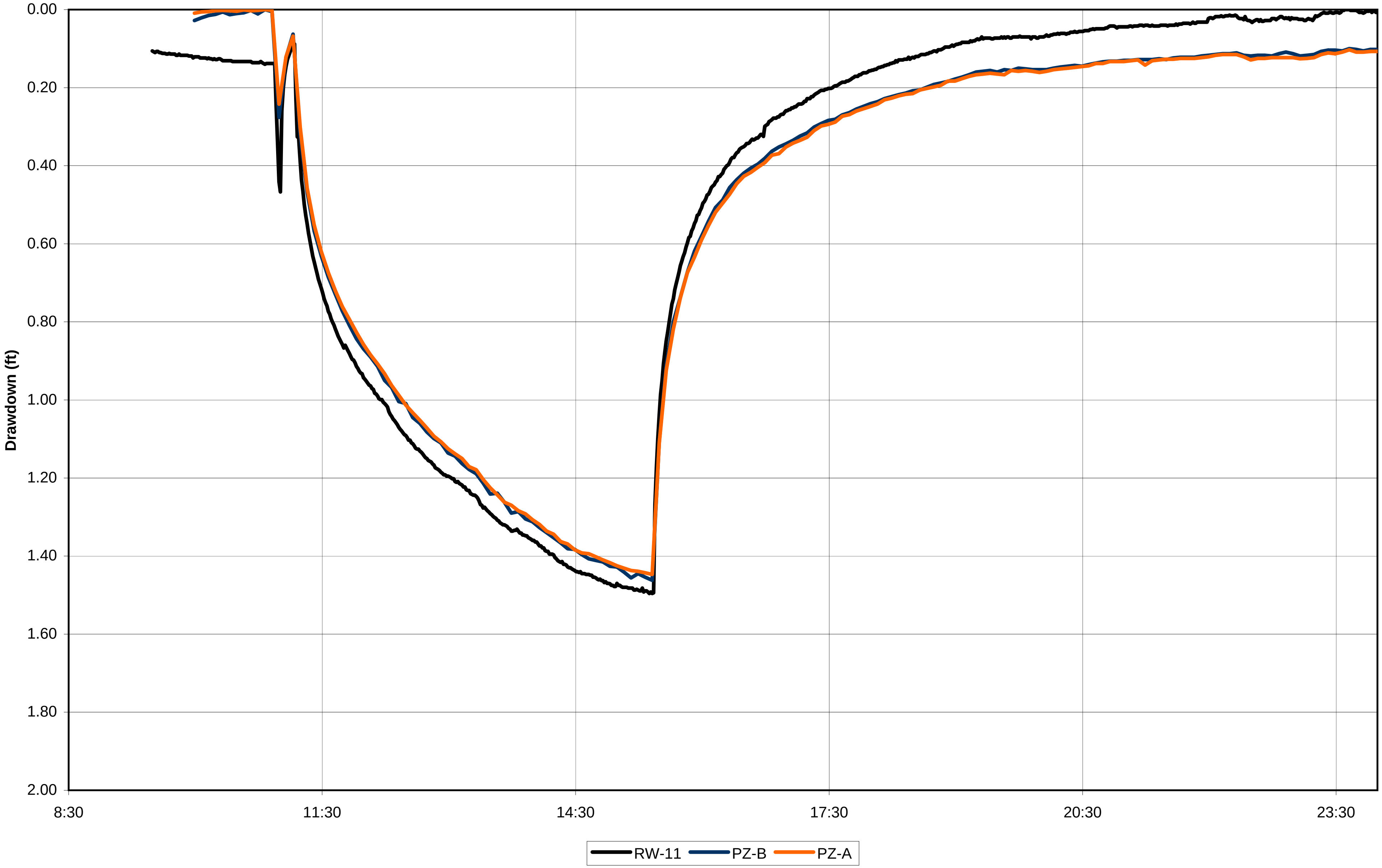
## LEGEND

| | | | |
|---|---|---|---|
| 3B | Well ID | | Potentiometric Contour |
| ✧ | Monitoring Well | ▭ | Structure |
| ◆ | Pumping Well | | Road |
| ▭ | Blast Fractured Bedrock Trench | | |

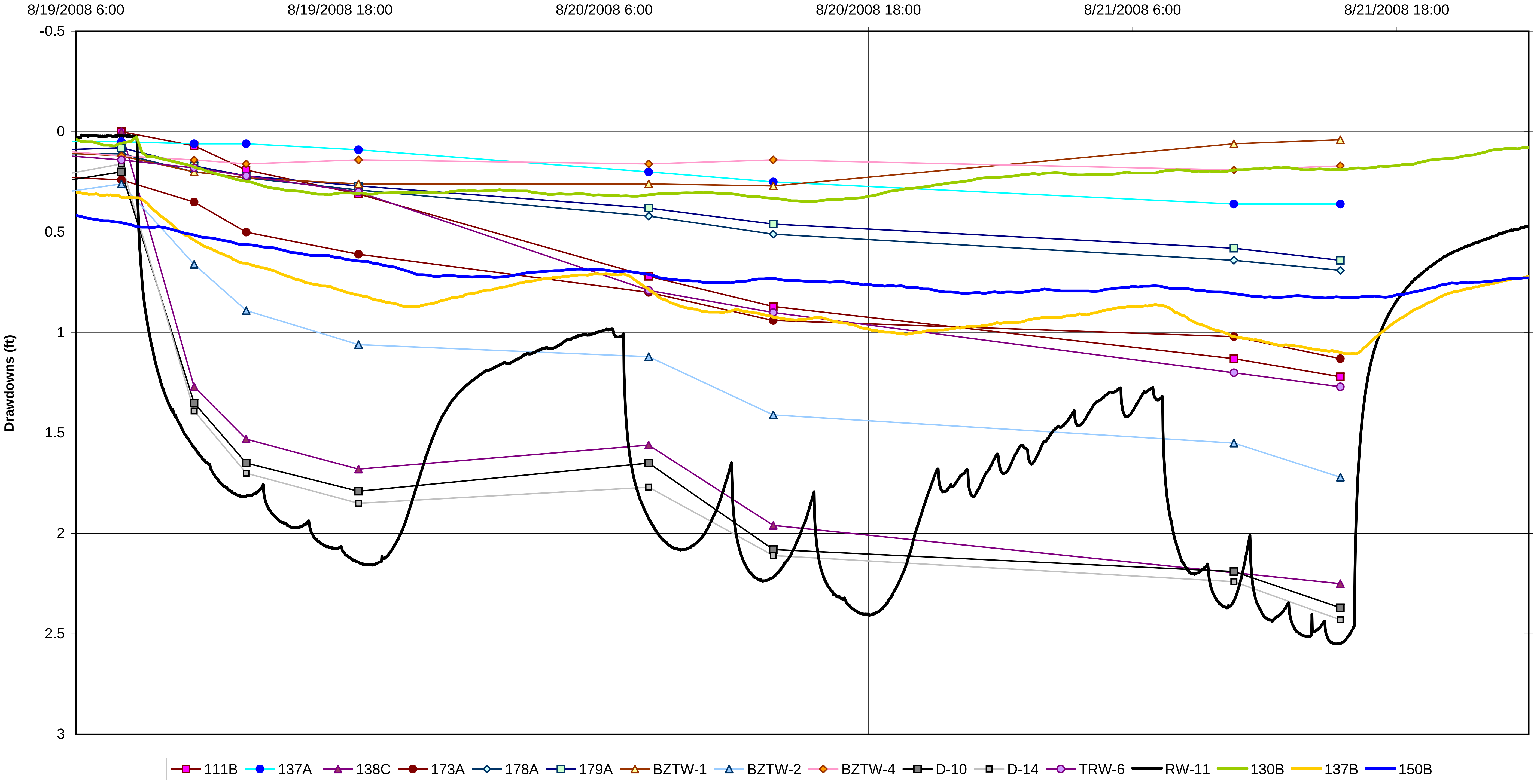
# Figure B1
# General Plan View of RW-11
# DuPont Necco Park

Necco Park/General Surfer Grid Files and Data/20072Q Data Packet/2007-05-02 A to F Zones w-SA Lines.srf

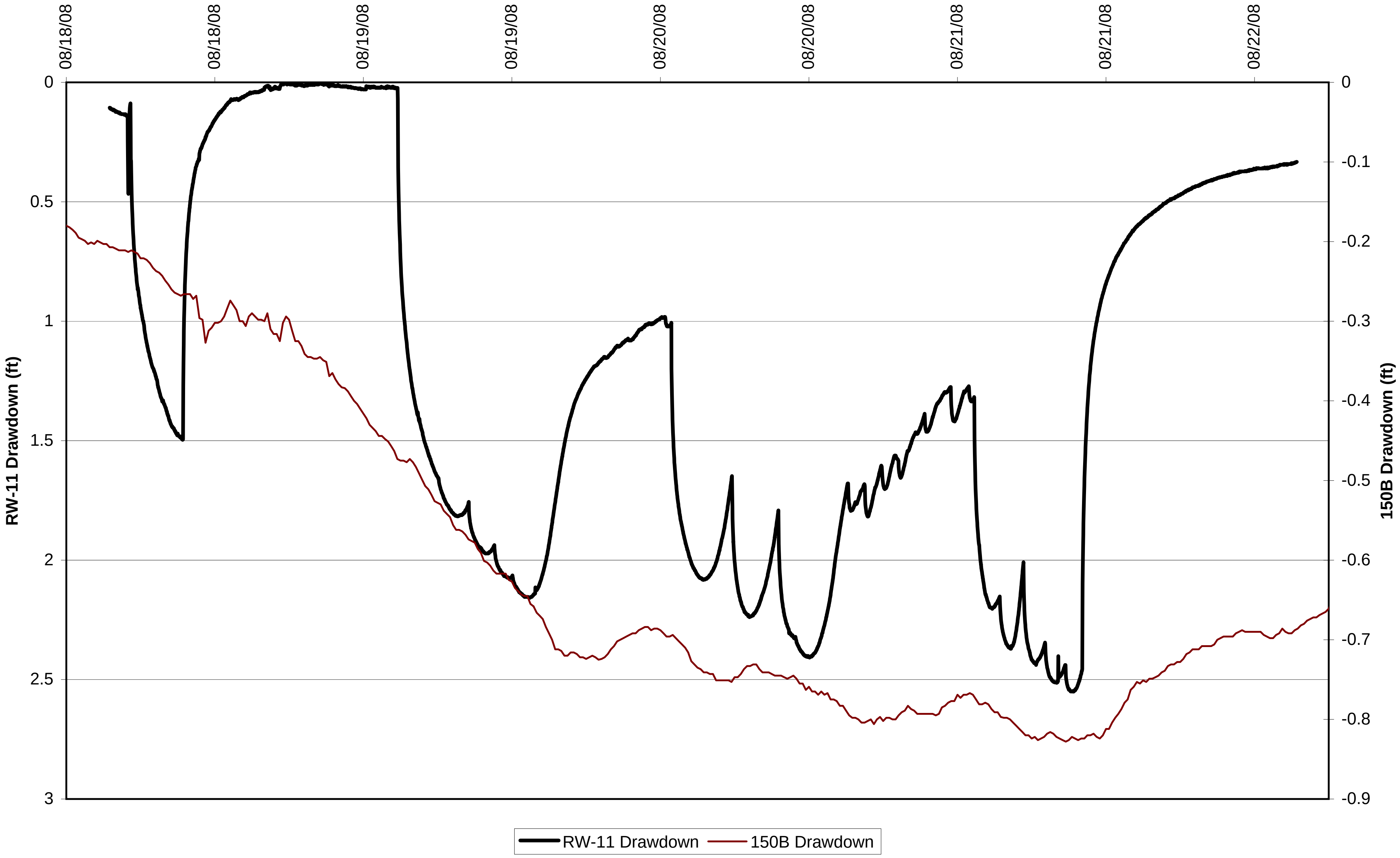
# Figure B2
## Step Test Drawdowns
## RW-11 Pump Test
## DuPont Necco Park: 18 August 2008



## Figure B3
## Selected Datalogger and Manual Water Level Drawdowns
## RW-11: 3-Day Pump Test
## DuPont Necco Park: August 2008



## Figure B4
## 150B Water Level Response
## RW-11: 3-Day Pump Test
## DuPont Necco Park: August 2008



*URS Diamond*

# TEST BORING LOG

**BORING NO.:** RW-11

**PROJECT:** **Necco Park, Routine Maintence & Well Replacement**

**SHEET:** 1 of 1

**CLIENT:** **DuPont CRG**

**JOB NO.:** 18985651

**BORING CONTRACTOR:** **Nothnagle Drilling Co.**

**BORING LOCATION:** N: 1127951.03/E: 1037212.59

**GROUND ELEVATION:** 577.42

**DATE STARTED:** 07/25/08

**DATE FINISHED:** 08/04/08

**DRILLER:** Steve Lorante

**GEOLOGIST:** Scott McCabe

**REVIEWED BY:** Dan Sheldon

**GROUNDWATER:**

| DATE | TIME | LEVEL | TYPE |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

| | CAS. | SAMPLER | CORE | TUBE |
|---|---|---|---|---|
| **TYPE** | 12 1/4" | | NX | |
| **DIA.** | HSA | | 2.0" ID | |
| **WT.** | - | | - | |
| **FALL** | - | | - | |

*** POCKET PENETROMETER READING**

| DEPTH FEET | SAMPLE: STRATA | NO. | TYPE | BLOWS PER 6" | REC% RQD% | DESCRIPTION: COLOR | CONSIST HARD | MATERIAL DESCRIPTION | USCS | REMARKS: PID | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5<br>10 | | | | | | | | See 179A boring log for lithologic description. | | | Auger refusal @ 12.0' |
| 15<br>20 | ▦ | Core Run #1 | NX | | 58%<br>14% | Drk Brwn/<br>Drk Grn Brwn | Hard/<br>Med. Hard | Lockport Group<br>fine to medium grained dolostone. 1/8-1/2" diameter vugs, some with calcite broken to very broken 4"-1/2" pieces. Void 19-20'bgs, broken coral 12-15'bgs | | | core #1 took 12.0 min. water losses at 12-15', 17', & 19-20' |
| 25<br>30 | ▦ | Core Run #2 | NX | | 87%<br>75% | Drk Brwn/<br>Drk Grey | | pitting and vugs 1/4-3/4" diameter with some calcite filling,. Very broken 21-21.3', 21.6-22', 22.4-22.5' (weath. fractures),23.4', 23.6'bgs. solid 23.6-28.5'bgs. Fine styolitic partings throughout core, trace coral.<br>Broken to massive.<br>C-Zone 22.5' | | | core #2 took 7.0 min. unable to determine water loss, no return |
| 35 | | | | | | | | Boring completed at 30.0' bgs | | | |

**Comments:** Boring advanced with truck-mounted CME-85 drill rig using 12 1/4" ID HSA to 12.0'. Reamed with Roller Bit 20.0' to 30.0'. NX core 12.0'-30.0'.

**PROJECT NO.** 18985651

**BORING NO.** RW-11

## DRILLING SUMMARY

Geologist:
Scott McCabe

Drilling Company:
Nothnagle Drilling Co.

Driller:
Steve Lorante

Rig Make/Model:
CME-85

Date:
7/25-8/4/08

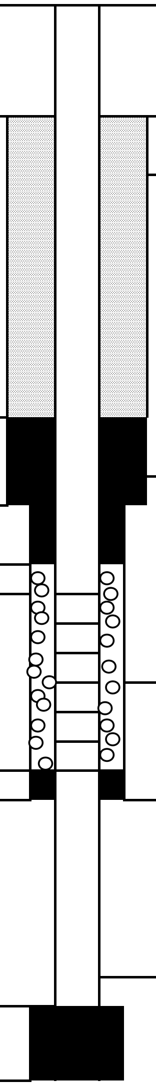
## GEOLOGIC LOG

| Depth(ft.) | Description* |
|---|---|
| 0.0-12.0' | See 179A boring log for lithologic description |
| 12.0-30.0' | Lockport Group Dark brown/dark grey fine to medium grained dolostone. Numerous vugs and pitting. Some calcite deposits in vugs. Broken to very broken grading to massive. Trace coral throughout core. Fine styolitic partings from 20-30'bgs |
| | End of boring at 30.0' bgs. |

**Top of Casing Elevation** 578.78

**Ground Elevation** 577.42

Depth in Feet Below Grade



Stick-up Protective Casing and Lockable Cap

Ground Level

16 AUGERHOLE

Top of Seal 10

Carbon Steel Riser
10.0 inch dia.
15.4 feet length

Top of Bedrock Blasted Zone 12.0

Top of Glass Beads 13

Top of Screen 14

Stainless 304 Steel Screen
10.0 inch dia.
5.0 feet length

Top of Seal/Bottom of screen 19

Top of Compentent Bedrock 20.0

20 Bottom Rock Socket

9 7/8" Diameter OPEN ROCK HOLE

Bottom of Open Rock Hole 28

Bottom of Borehole 30.0

## WELL DESIGN

**Not to Scale**

*CASING MATERIAL*

Surface: 10-inch steel stick-up

Well: 10-inch ID carbon steel

Monitor: Screened/open rock hole

*SCREEN MATERIAL*

Type: Screened (B-Zone)

Type: Open Rock Hole (C-Zone)

Slot Size: 200 Slot

*FILTER MATERIAL*

Type: Glass Beads Setting: 13-19'

*SEAL MATERIAL*

Type: Bentonite Chips Setting: 28-30'
10-13'

*COMMENTS:*

*ROCK CORING*

Cored Interval: 12.0-30.0'

Core Diameter: 3"

Rock Hole Diameter: 9 7/8"

*LEGEND*

▨ Cement/Bentonite Grout
■ Bentonite Seal
○ 1/2" Diameter Glass Beads

**Client:** **DuPont CRG**

**Location:** **Necco Park**

**Project No.:** **18985651**

**URS Diamond**

**BEDROCK MONITORING WELL CONSTRUCTION DETAILS**

**Well Number:** **RW-11**

## DRILLING SUMMARY

**Geologist:**
Scott McCabe

**Drilling Company:**
Nothnagle Drilling Co.

**Driller:**
Steve Lorante

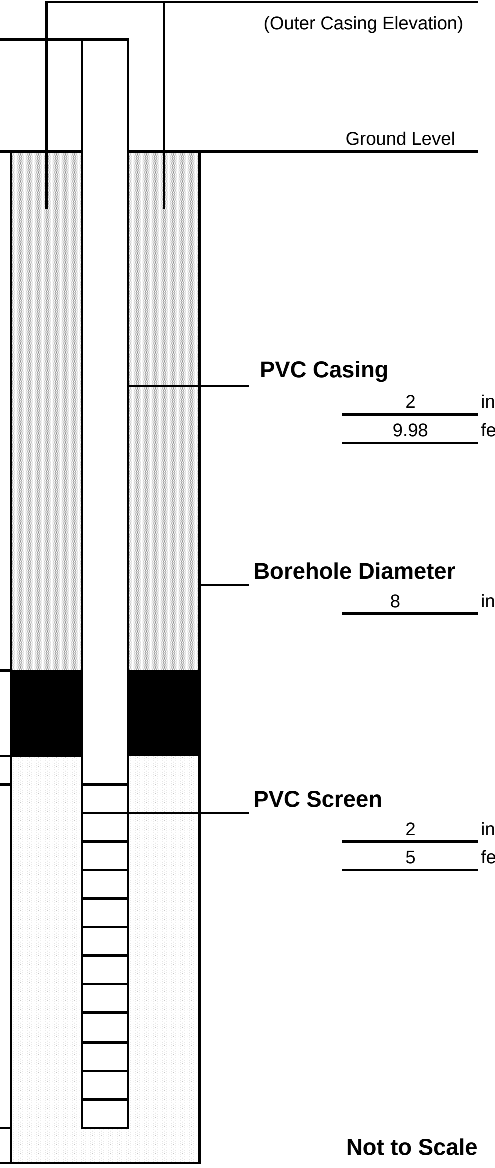
**Rig Make/Model:**
CME-85

**Date:**
7/30/2008

## GEOLOGIC LOG

| Depth(ft.) | Description |
|---|---|
| 0.0-0.2' | Coarse Gravel |
| 0.2-4.0' | Silty Clay, trace to some fine to coarse sand (FILL) |
| 4.0-7.0' | Slag, with gravel and some fine sand (FILL) |
| 7.0-13.5' | CLAY, trace to some silt grading to trace rounded gravel and fine to med. sand |
| 13.5' | Refusal, top of rock<br>* Overburden description based on BZTW-3 log. |

## WELL DESIGN



579.53 Locking Protective Casing (Outer Casing Elevation)

**Top of Casing Elevation** 579.06 (Measuring Pt.)

**Ground Elevation** 577.08 Ground Level

Depth in Feet Below Grade

**PVC Casing**
2 inch dia.
9.98 feet length

**Borehole Diameter**
8 inch dia.

**Top of Seal** 2

**Top of Sand Pack** 6

**Top of Screen** 8

**PVC Screen**
2 inch dia.
5 feet length

**Bottom of Screen/ Top of Seal** 13

**Bottom of Borehole** 13.5
(Top of Bedrock)

**Not to Scale**

### *CASING MATERIAL*

**Surface:** Steel protective cover (Stick Up)

**Monitor:** PVC

### *SCREEN MATERIAL*

**Type:** Schedule 40 PVC

**Slot Size:** 0.020"

### *FILTER MATERIAL*

**Type:** #2 NSF Silica Sand
**Setting:** 13.5-6.0'

### *SEAL MATERIAL*

**Type 1:** 3/8" Bentonite Chips
**Setting:** 6.0-2.0'

***COMMENTS:***

### *LEGEND*

▨ Cement Grout
■ Bentonite Seal
□ Sand Pack

**Client: DuPont CRG**

**Location:** **Necco Park**

**Project No.: 18985651**

***URS Diamond***

**OVERBURDEN PIEZOMETER CONSTRUCTION DETAILS**

**Well Number:** **PZ- A**

RW-11 and Piezo Boring Logs.xls/PZ-A

## DRILLING SUMMARY

**Geologist:**
Scott McCabe

**Drilling Company:**
Nothnagle Drilling Co.

**Driller:**
Steve Lorante

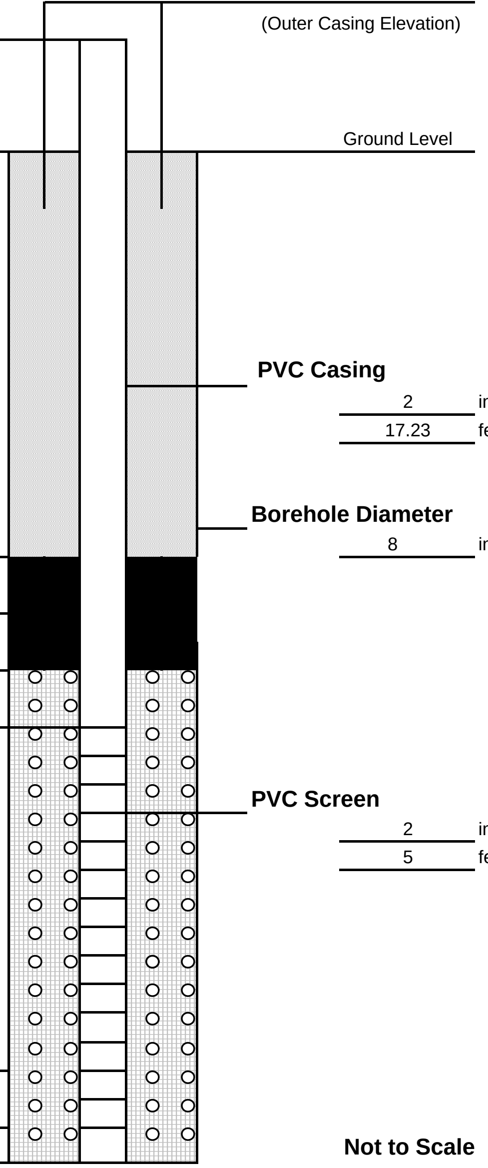
**Rig Make/Model:**
CME-85

**Date:**
7/30/2008

## GEOLOGIC LOG

| Depth(ft.) | Description |
|---|---|
| 0.0-0.2' | Coarse Gravel |
| 0.2-4.0' | Silty Clay, trace to some fine to coarse sand (FILL) |
| 4.0-7.0' | Slag, with gravel and some fine sand (FILL) |
| 7.0-13.5' | CLAY, trace to some silt grading to trace rounded gravel and fine to med. sand |
| 14.0-20.0' | Lockport Group<br>Oak Orchard Member<br>thick bedded, fine to medium grained, dolostone |
|  | End of boring at 20.0' bgs<br>* Overburden description based on BZTW-3 log. |

## WELL DESIGN



579.65 Locking Protective Casing
(Outer Casing Elevation)

**Top of Casing Elevation** 579.47
(Measuring Pt.)

**Ground Elevation** 577.24

Ground Level

Depth in Feet Below Grade

**PVC Casing**
2 inch dia.
17.23 feet length

**Borehole Diameter**
8 inch dia.

**Top of Seal** 12.5

**Top of Bedrock Blasted Zone** 14

**Top of Gravel** 14.5

**Top of Screen** 15

**PVC Screen**
2 inch dia.
5 feet length

**Top of Competent Bedrock** 19

**Bottom of Screen/ Top of Seal** 20

**Bottom of Borehole** 20

**Not to Scale**

| ***CASING MATERIAL*** | | ***SCREEN MATERIAL*** | | ***FILTER MATERIAL*** |
|---|---|---|---|---|
| **Surface:** | Steel protective cover (Stick Up) | **Type:** | Schedule 40 PVC | **Type:** 3/8" Gravel<br>**Setting:** 20.0-14.5' |
| | | | | ***SEAL MATERIAL*** |
| **Monitor:** | PVC | **Slot Size:** | 0.020" | **Type 1:** 3/8" Bentonite Chips<br>**Setting:** 14.5-12.5' |

***COMMENTS:***

***LEGEND***

▨ Cement Grout

■ Bentonite Seal

○ 3/8" Gravel

**Client: DuPont CRG**

**Location:** **Necco Park**

**Project No.: 18985651**

***URS Diamond***

**BEDROCK PIEZOMETER CONSTRUCTION DETAILS**

**Well Number:** **PZ- B**

# APPENDIX C

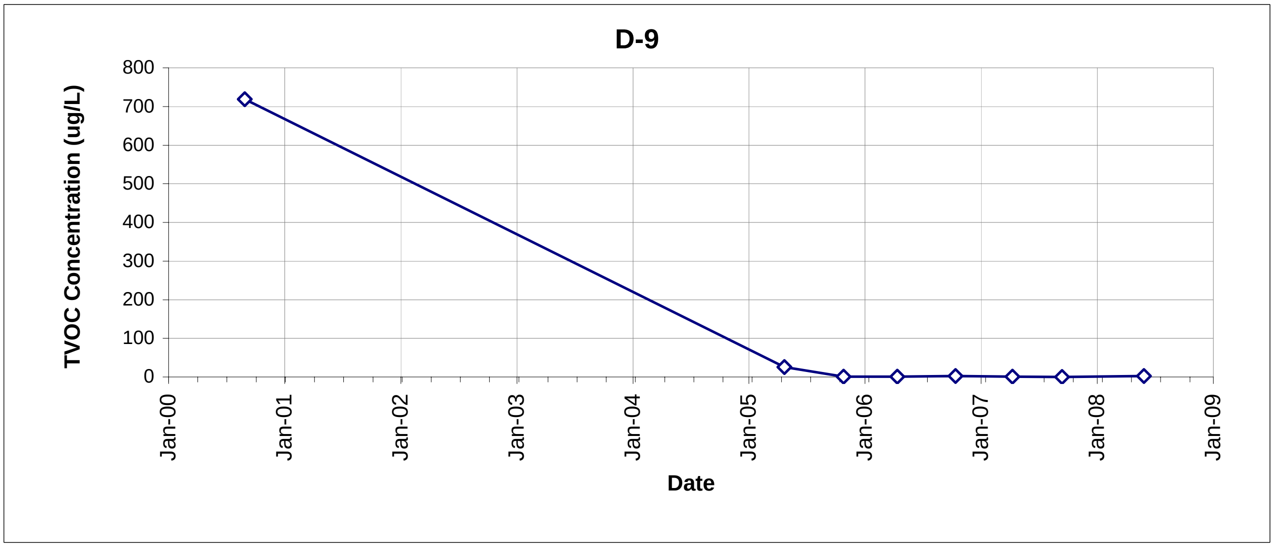
# DATA VALIDATION SUMMARY LABORATORY REPORTS

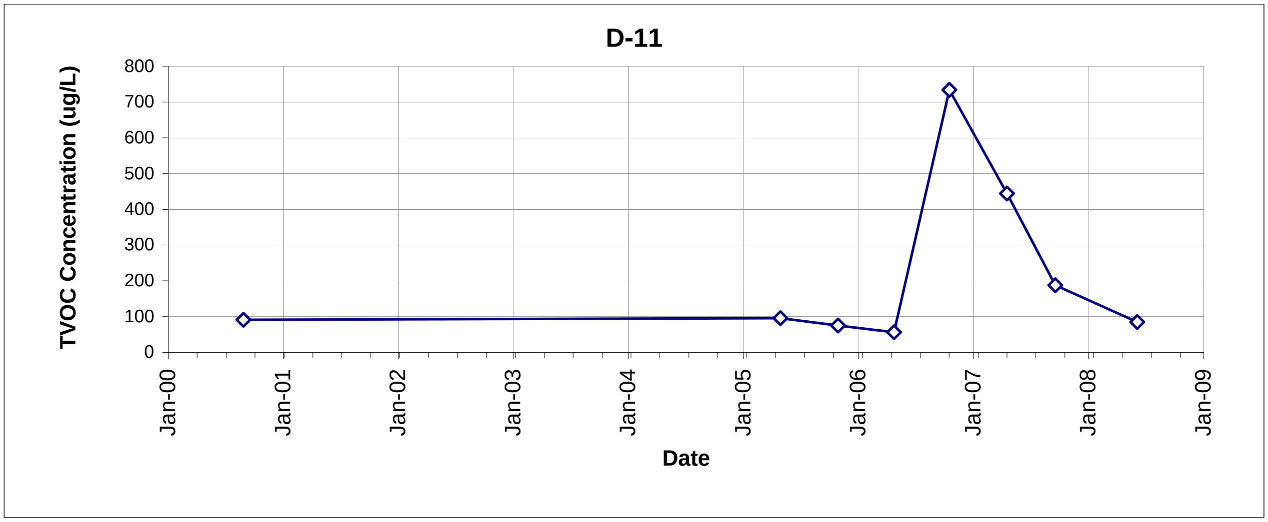
**- Provided on CD only - no Hardcopy attached -**

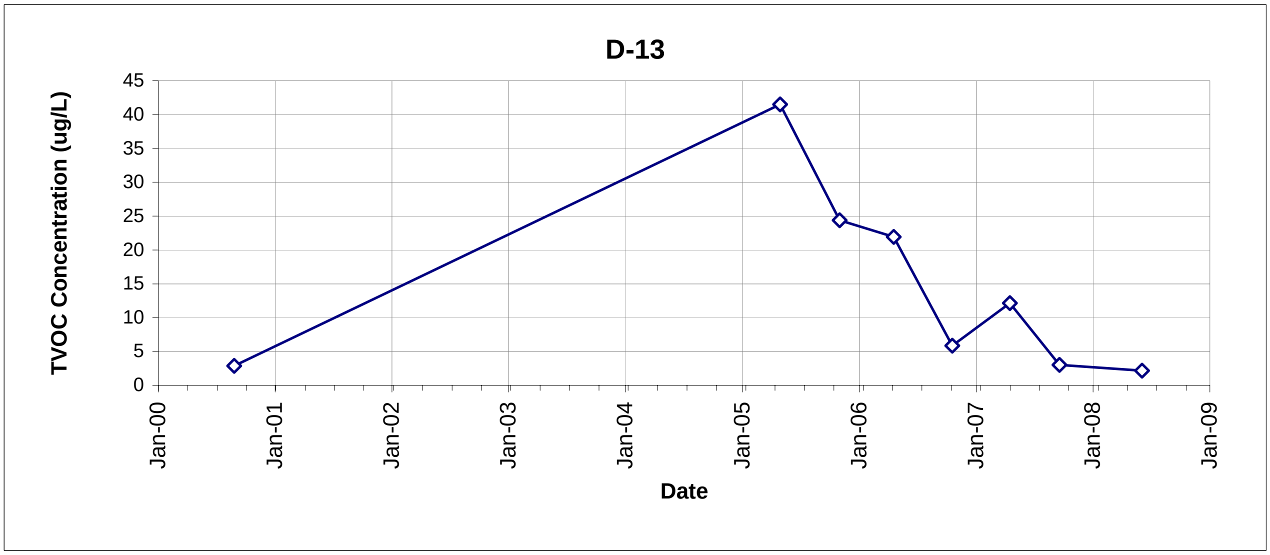
# APPENDIX D

# TVOC TREND PLOTS

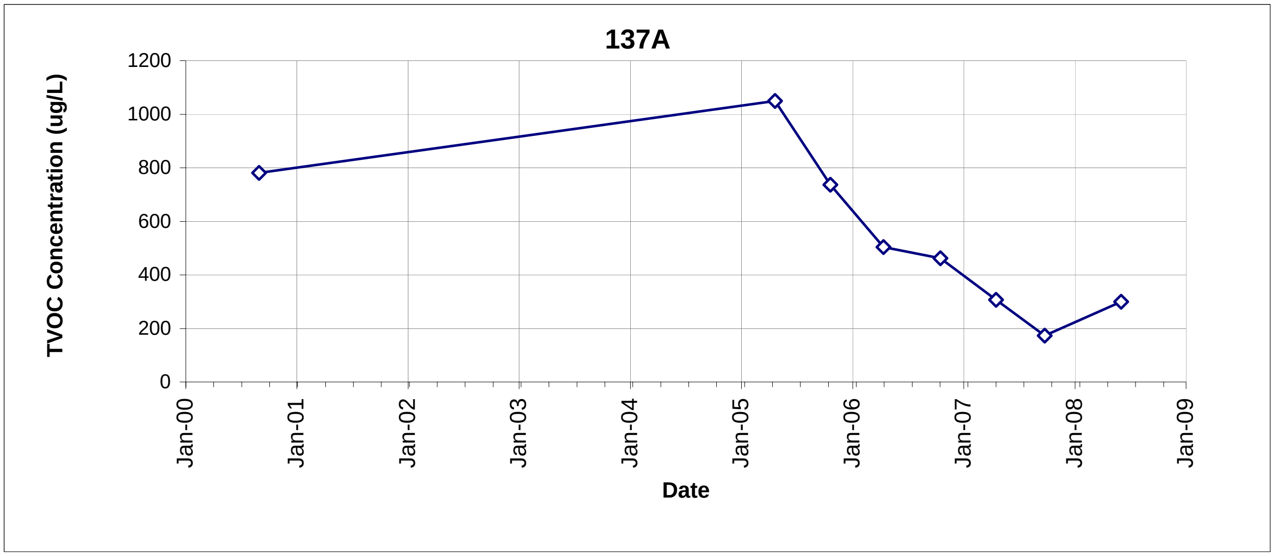
# Appendix D: TVOC Concentration Trend Plots
## A-Zone Wells
## Necco Park

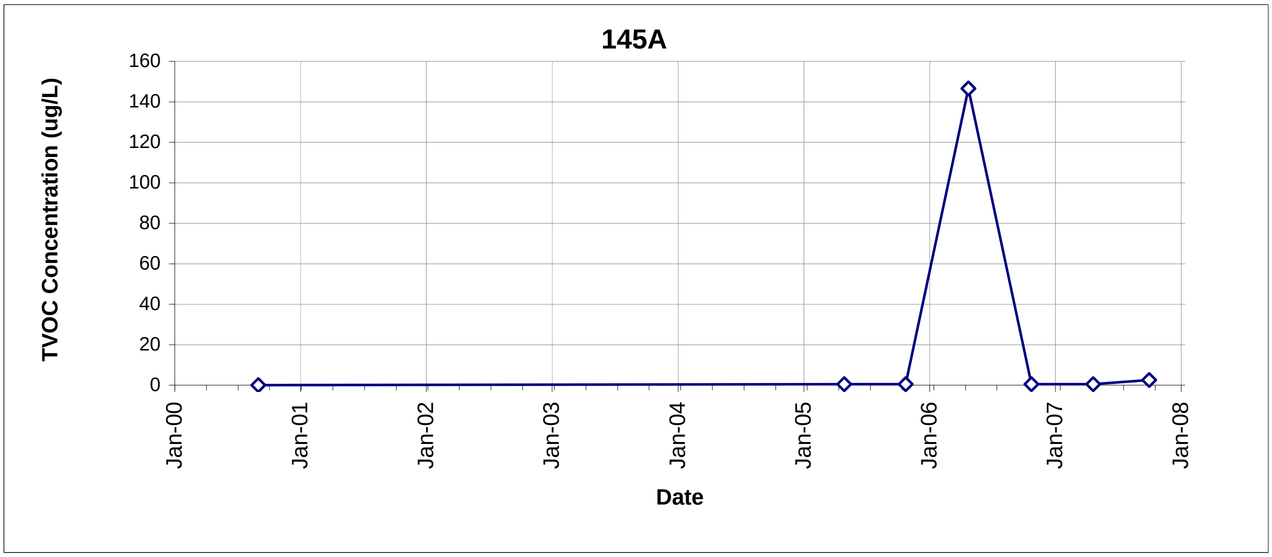


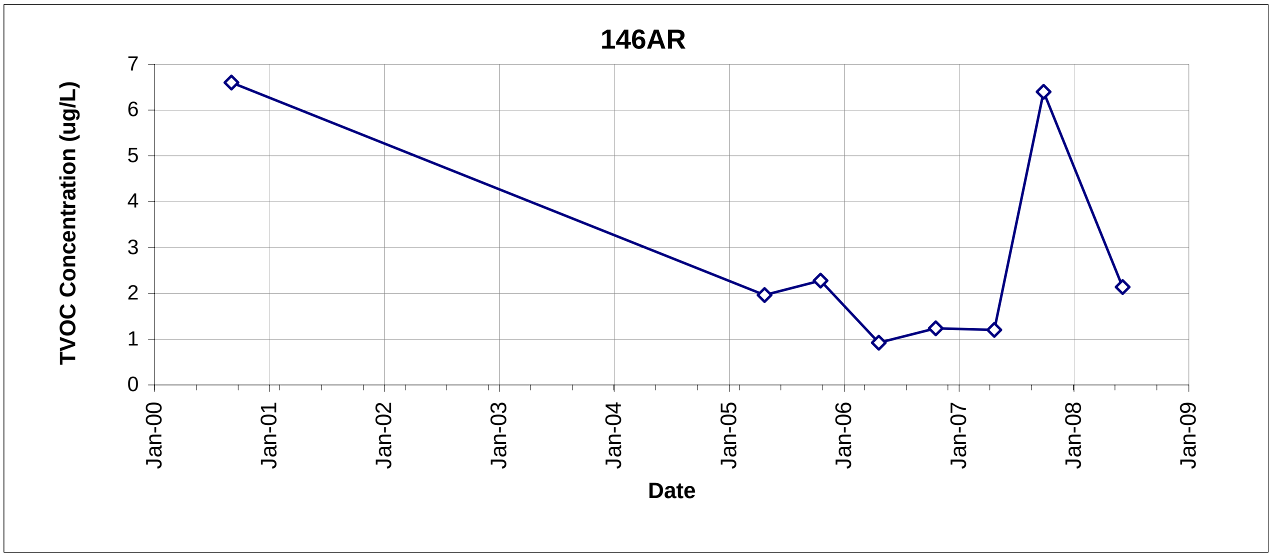




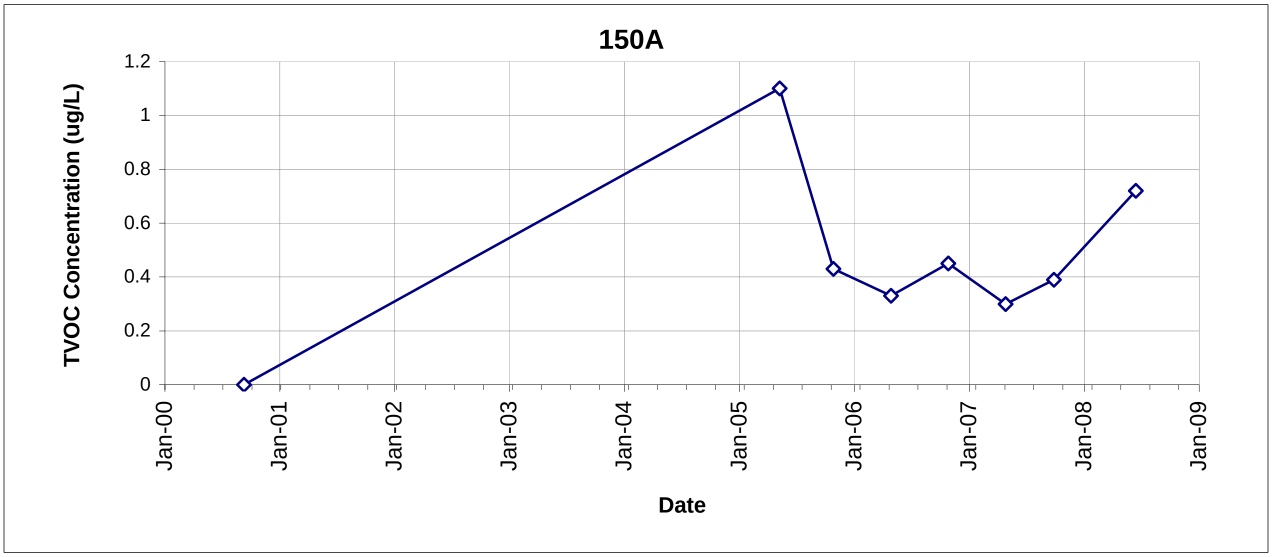
# Appendix D: TVOC Concentration Trend Plots
## A-Zone Wells
## Necco Park



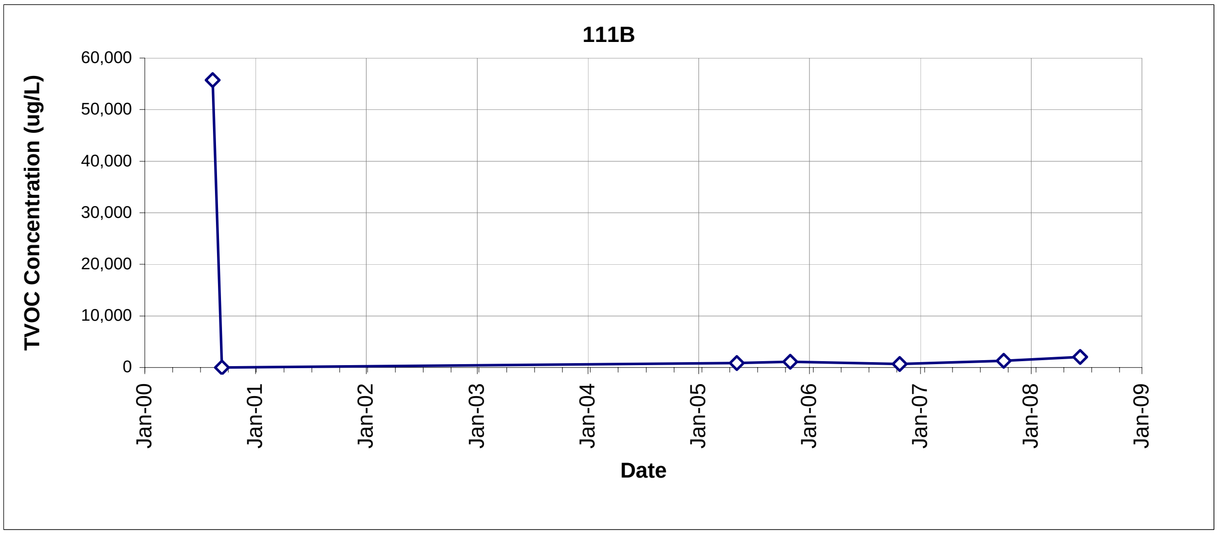


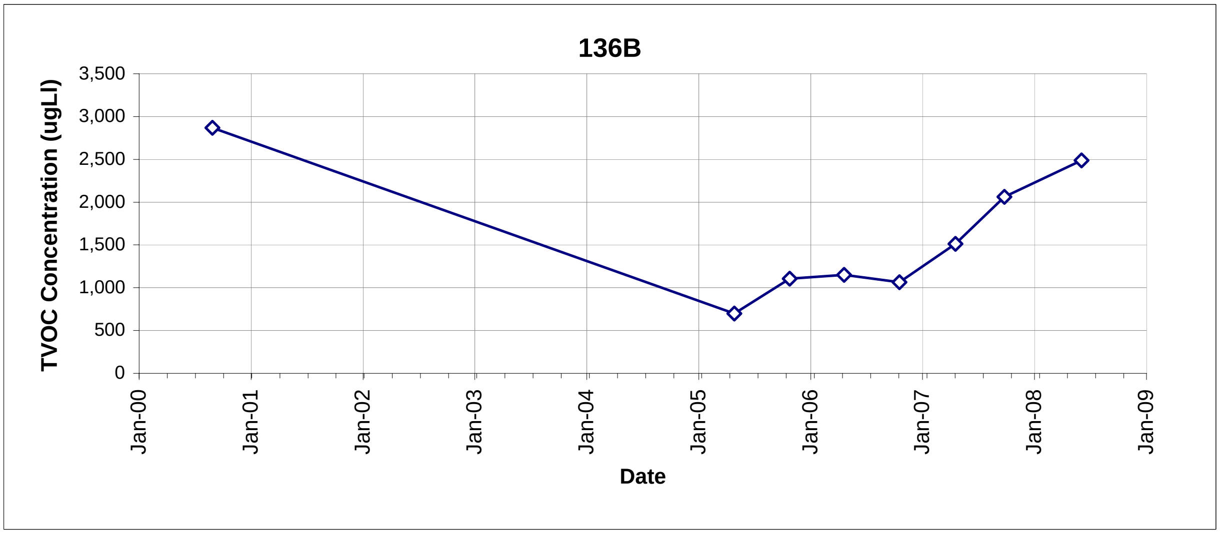


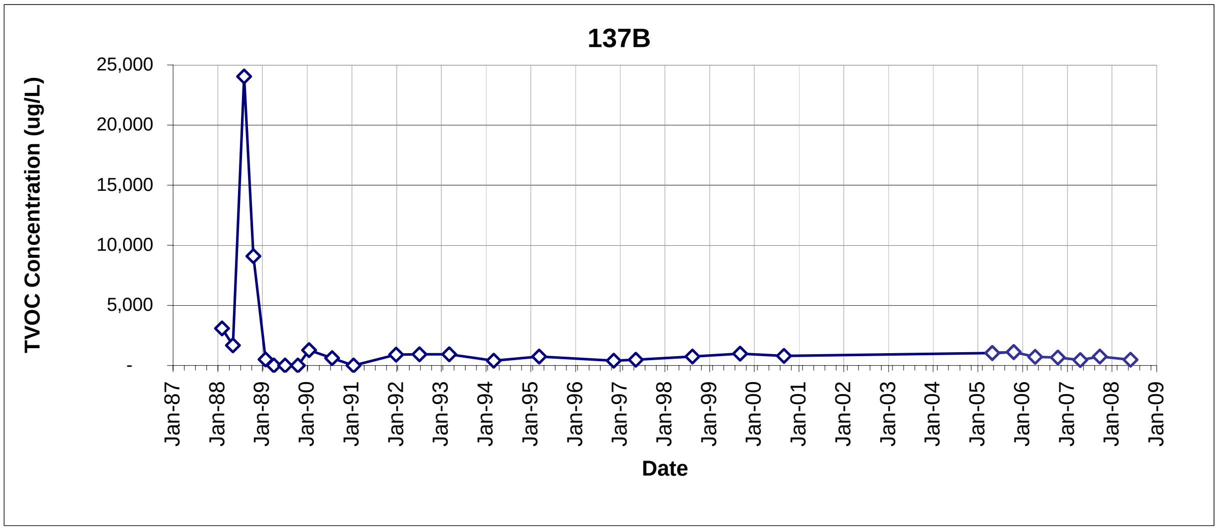
# Appendix D: TVOC Concentration Trend Plots
## A-Zone Wells
## Necco Park



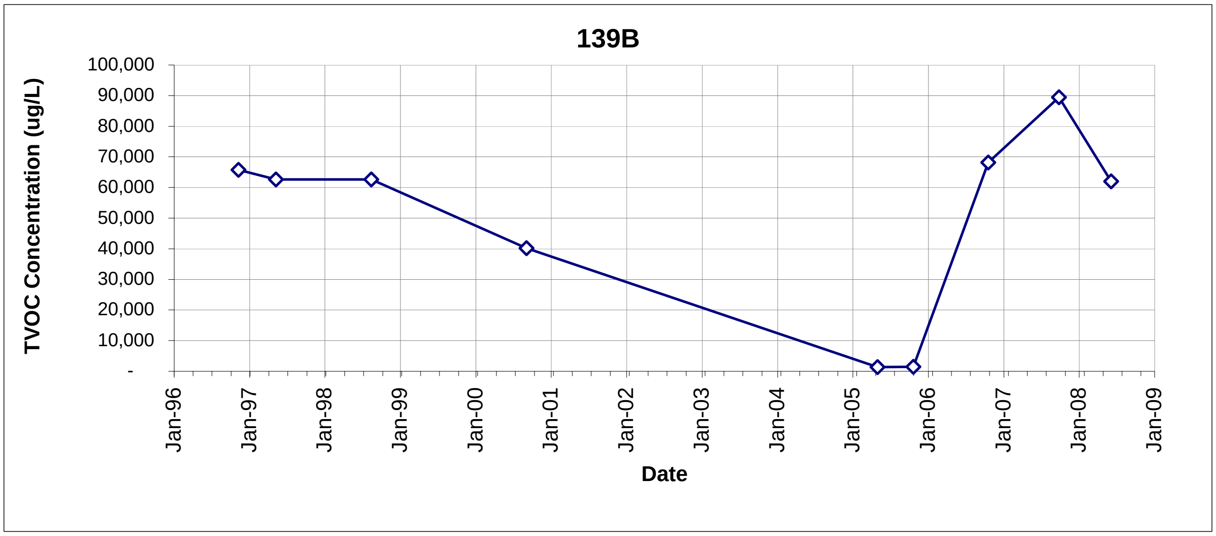
# Appendix D: TVOC Concentration Trend Plots
## B-Zone Wells
## Necco Park

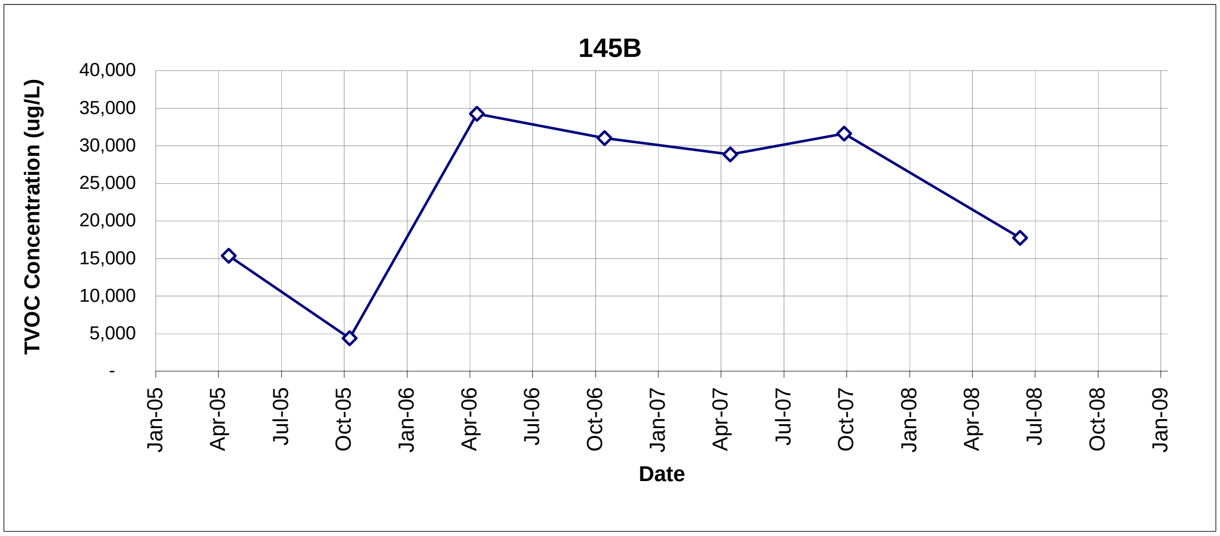


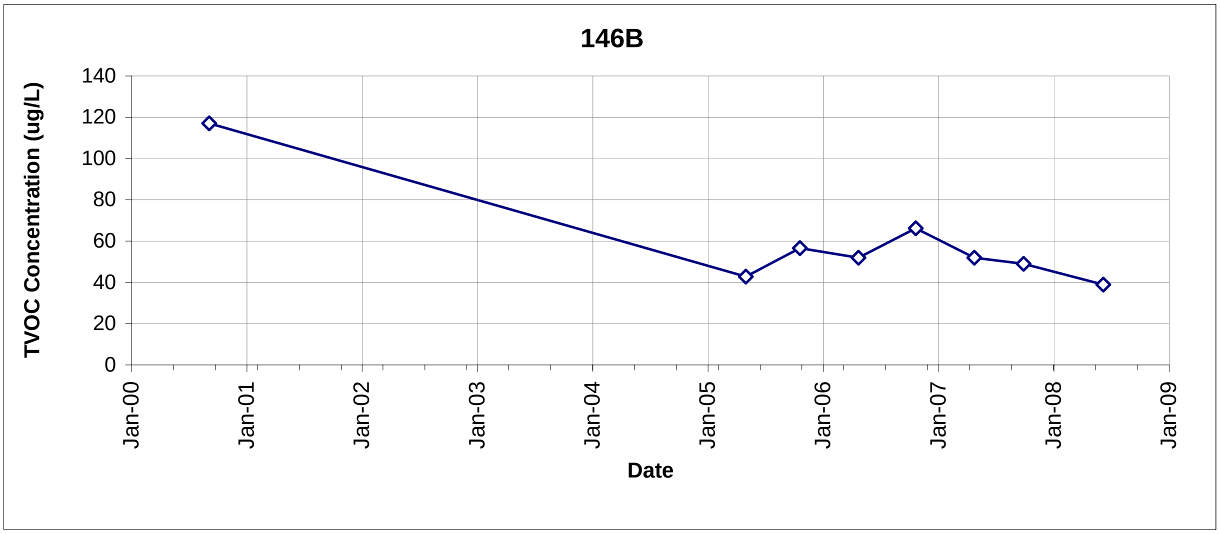




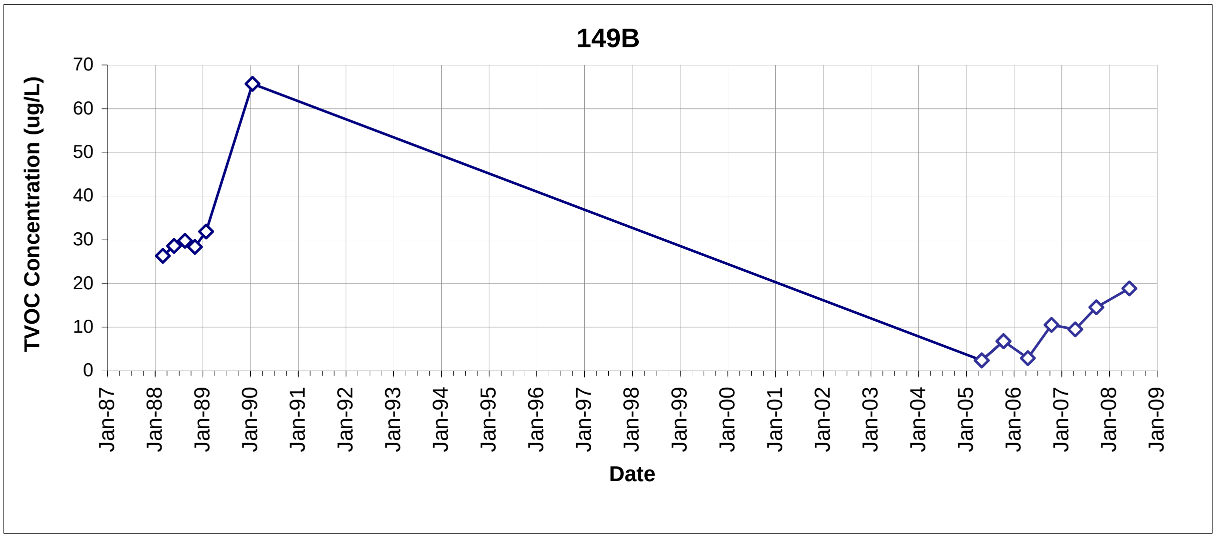
# Appendix D: TVOC Concentration Trend Plots
## B-Zone Wells
## Necco Park

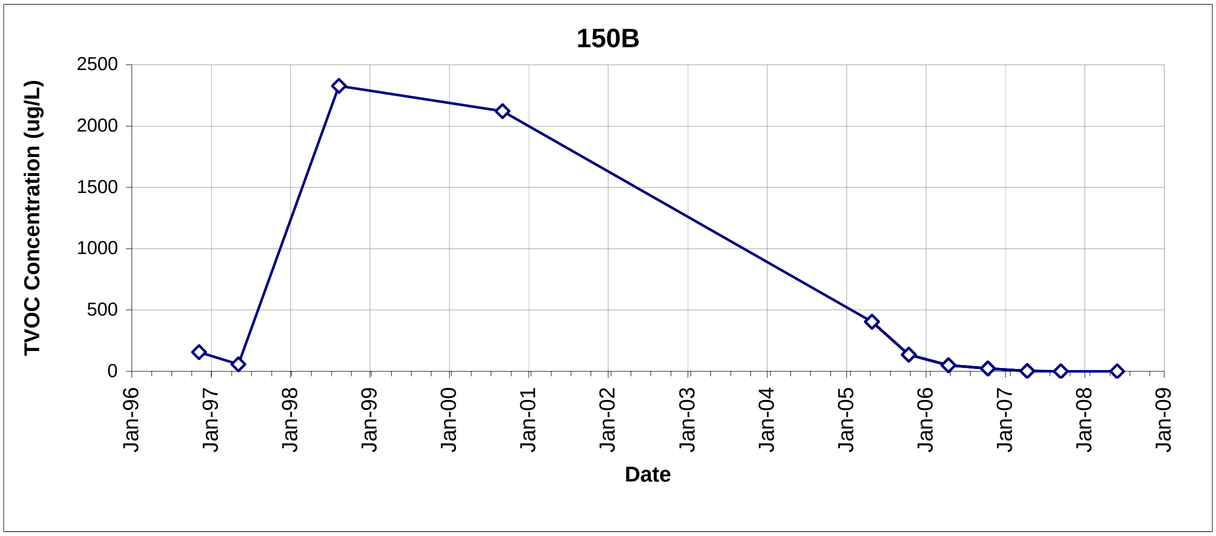


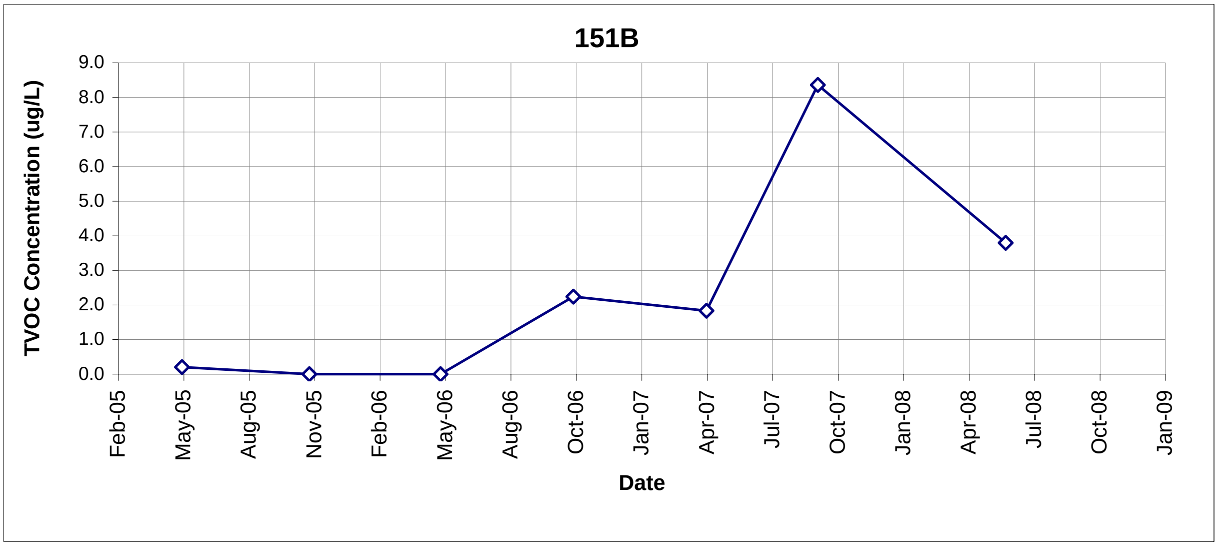




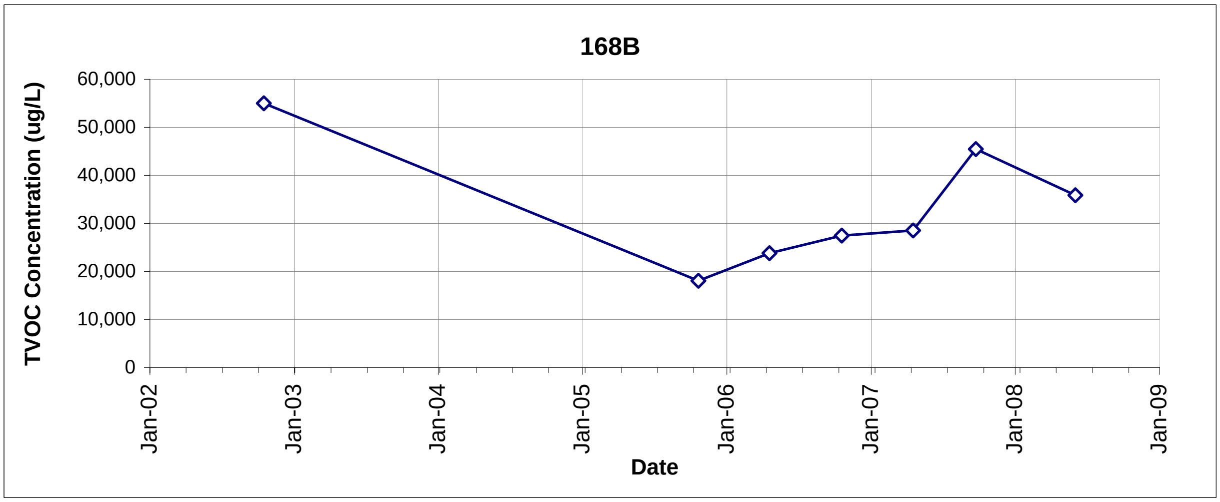
# Appendix D: TVOC Concentration Trend Plots
# B-Zone Wells
# Necco Park

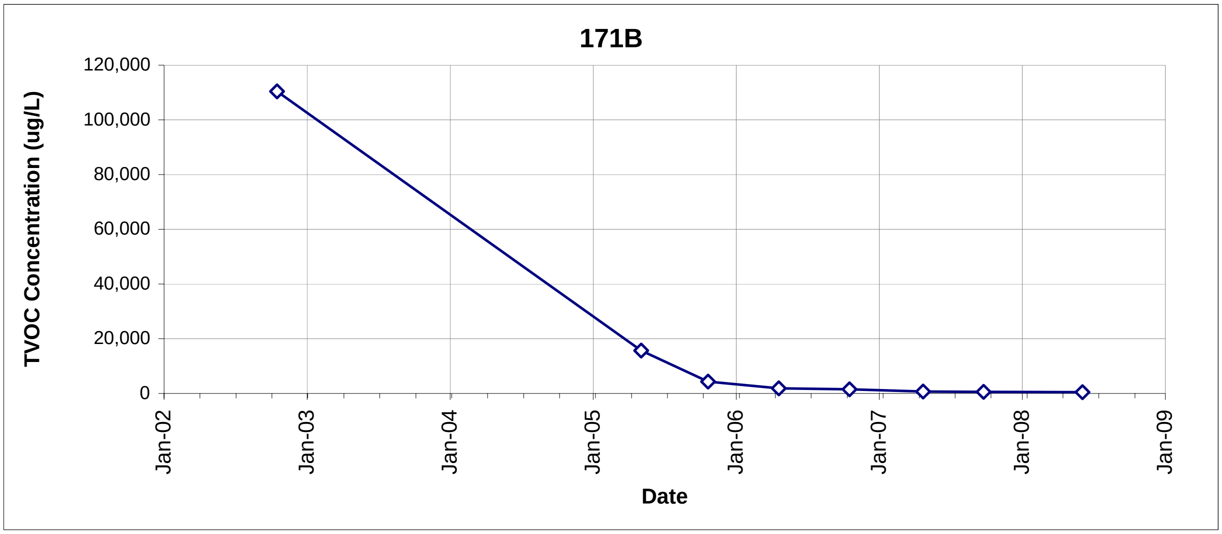


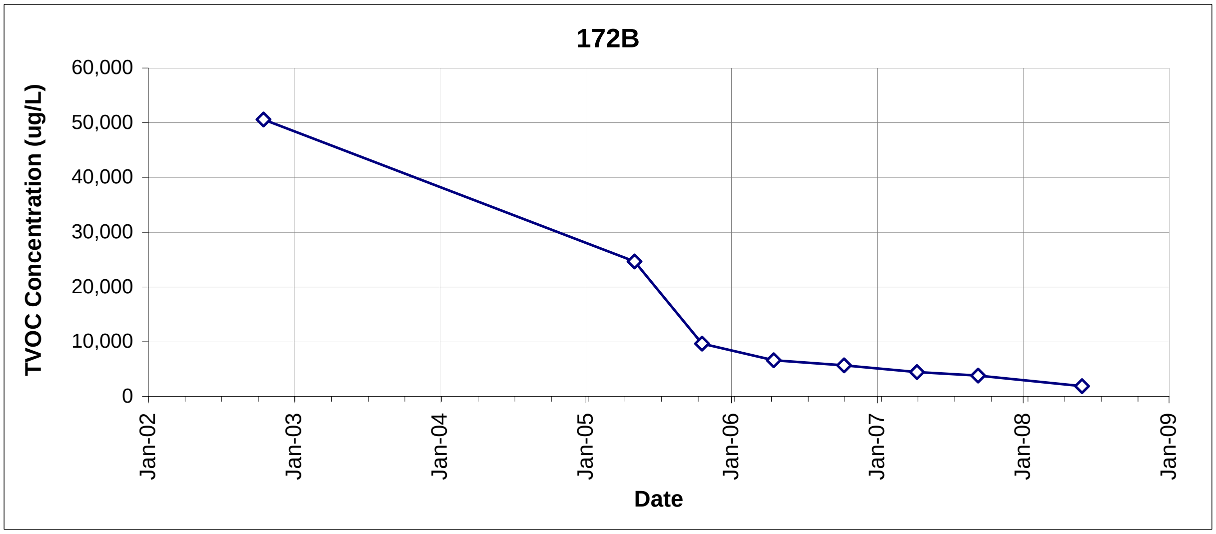




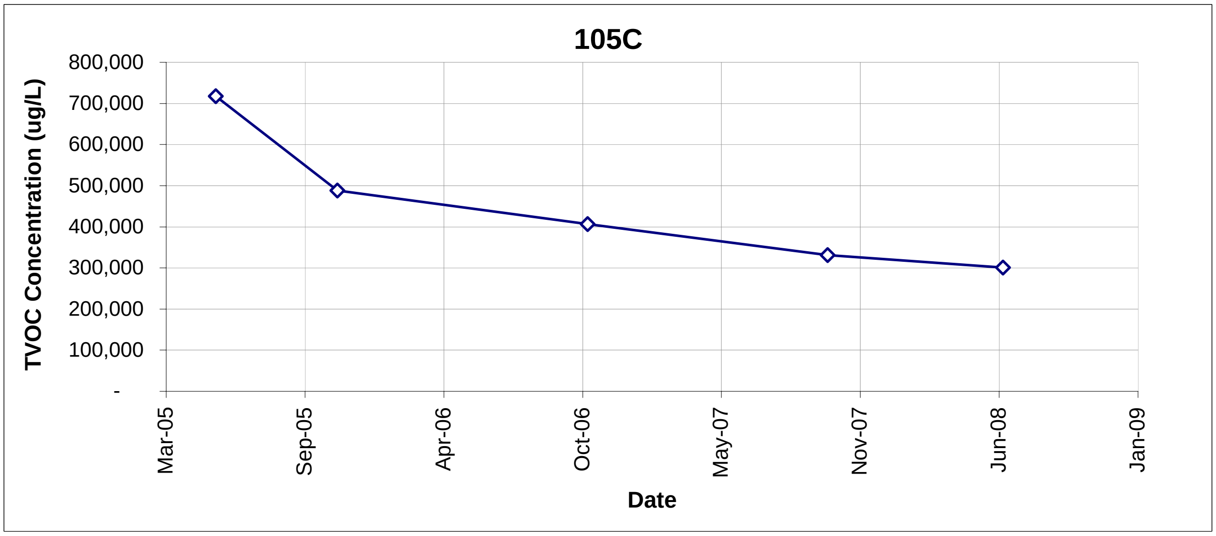
# Appendix D: TVOC Concentration Trend Plots
## B-Zone Wells
## Necco Park

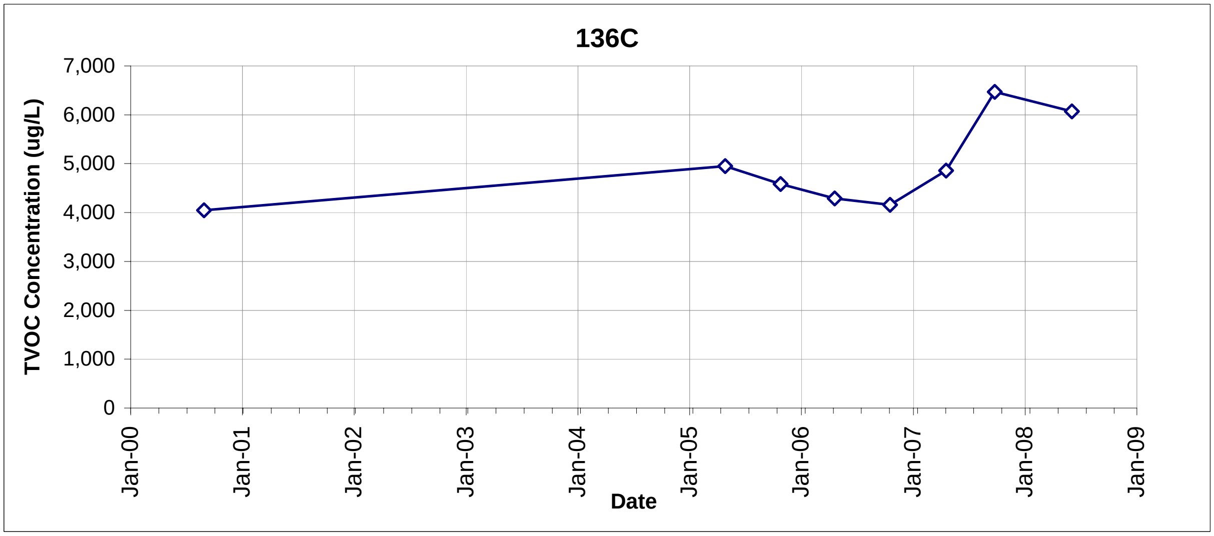


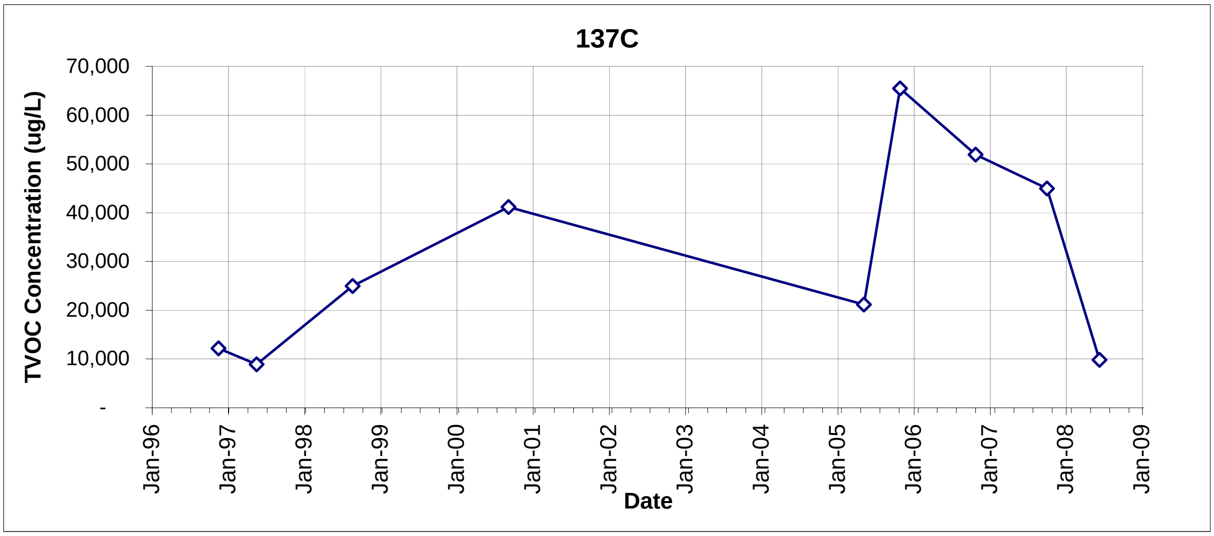




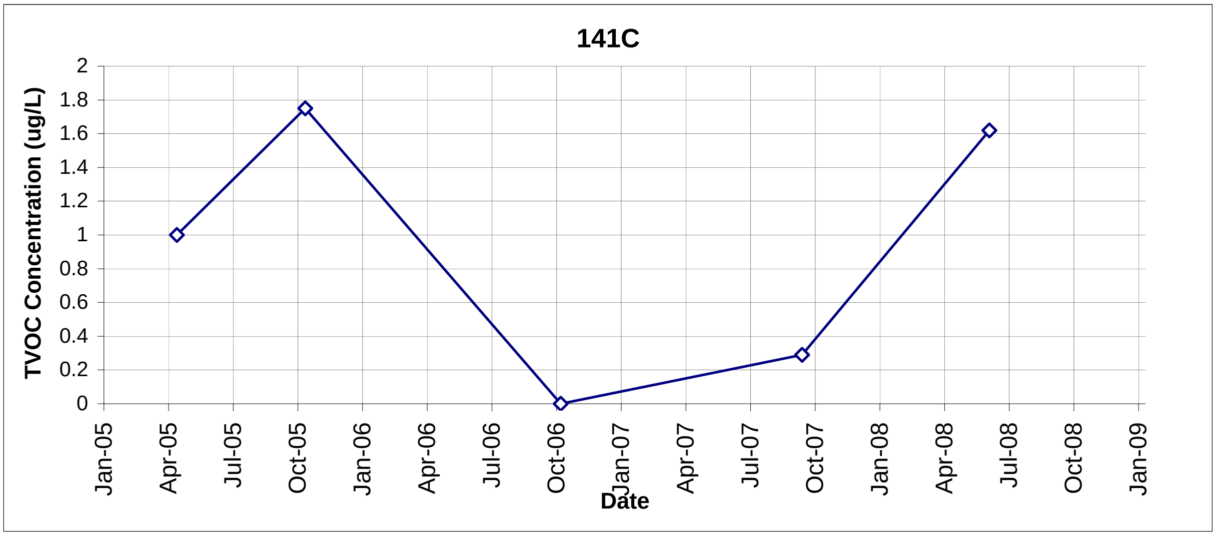
# Appendix D: TVOC Concentration Trend Plots
## C-Zone Wells
## Necco Park

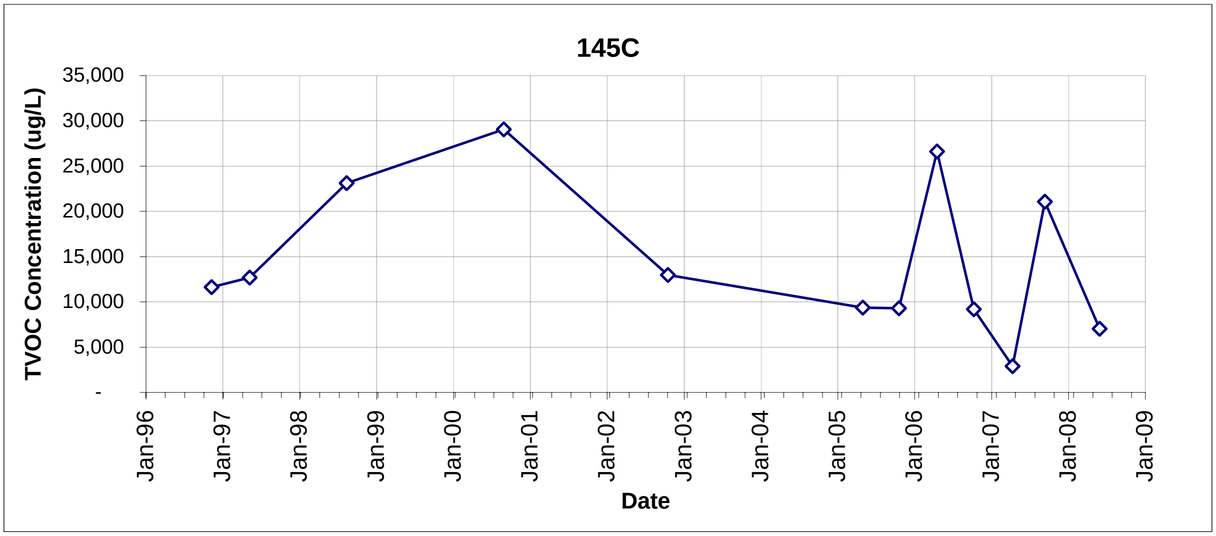


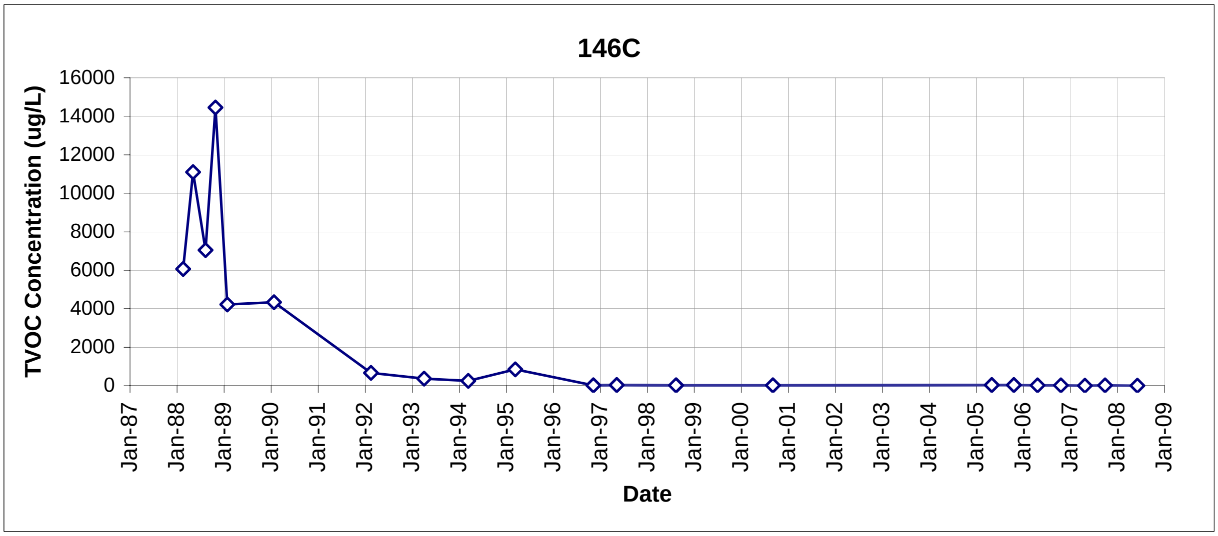




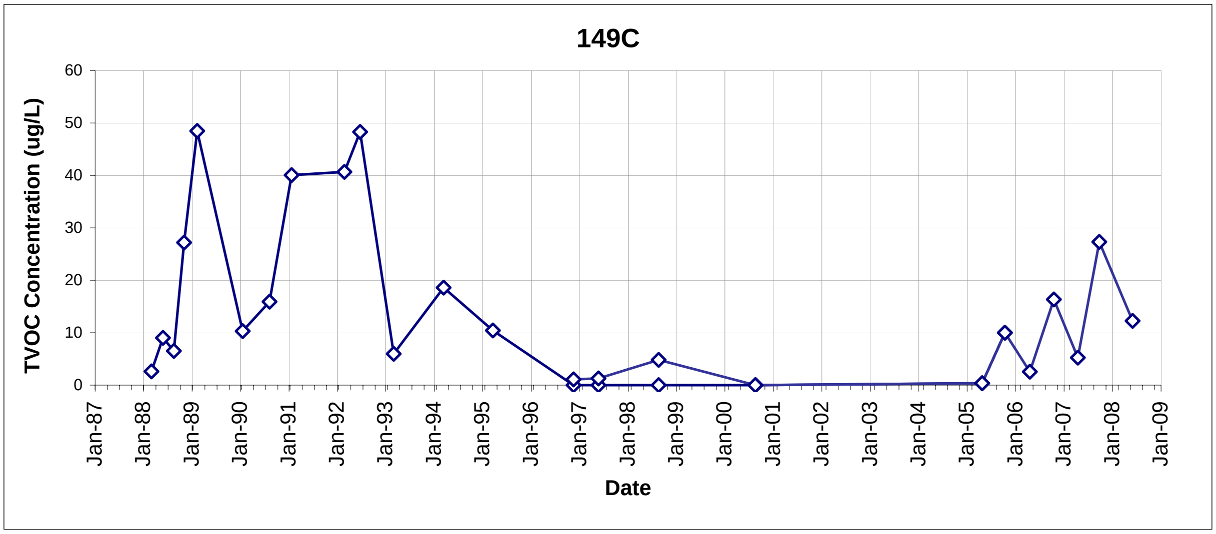
## Appendix D: TVOC Concentration Trend Plots
## C-Zone Wells
## Necco Park

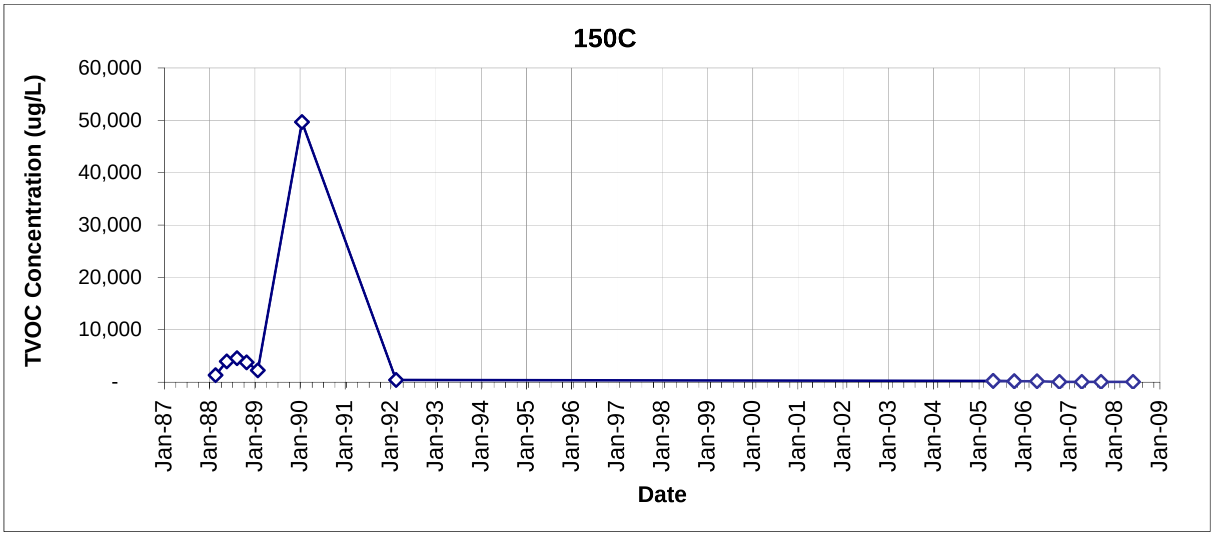


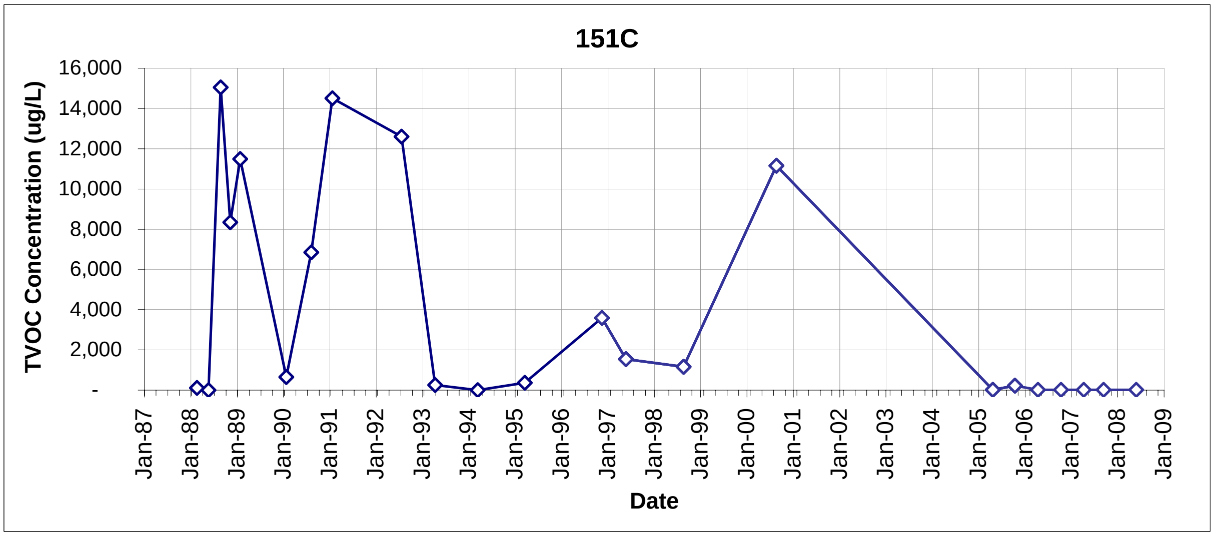




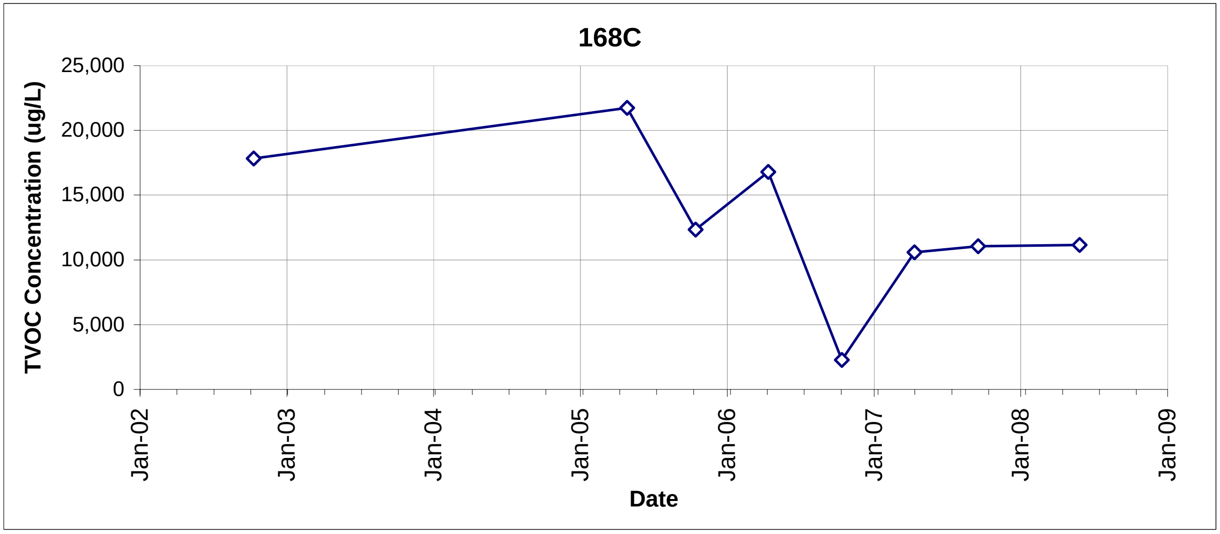
# Appendix D: TVOC Concentration Trend Plots
## C-Zone Wells
## Necco Park



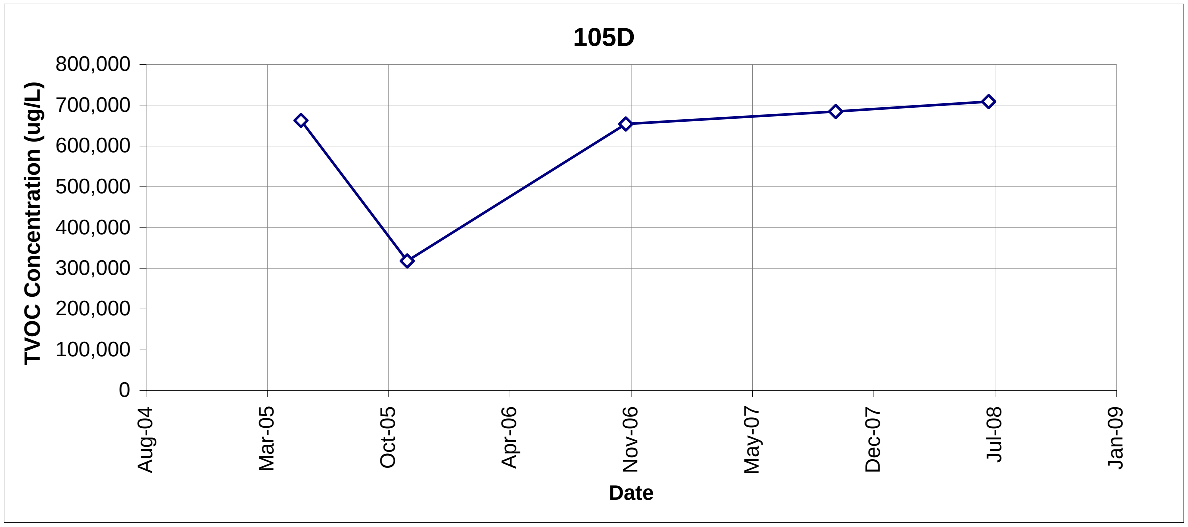


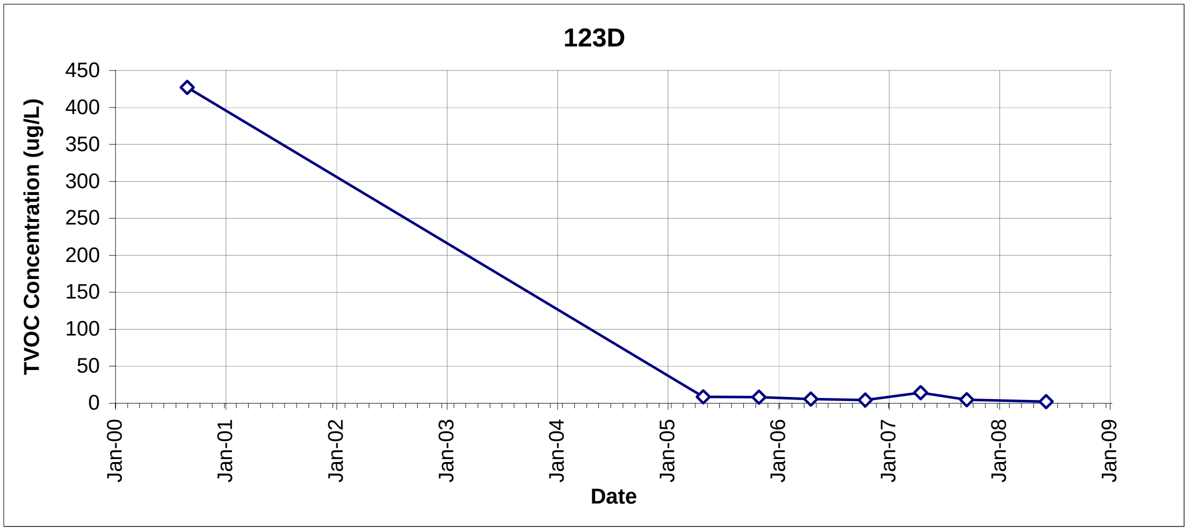


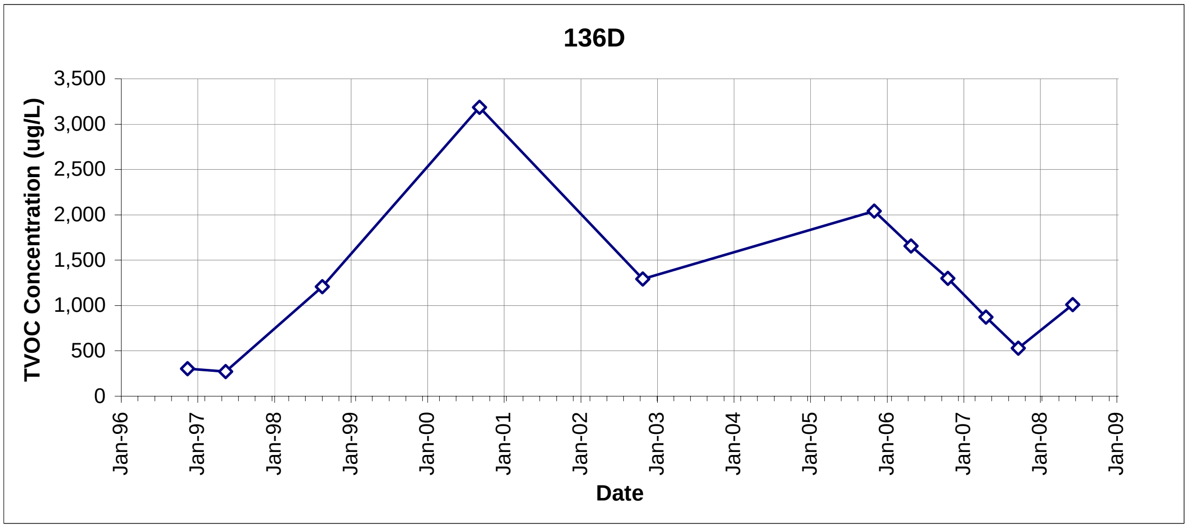
# Appendix D: TVOC Concentration Trend Plots
## C-Zone Wells
## Necco Park



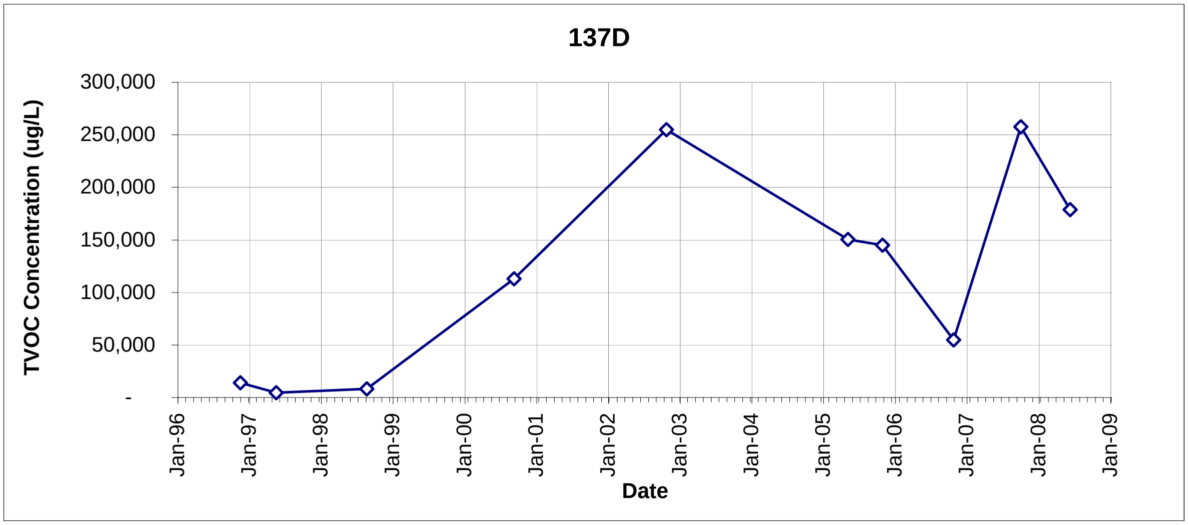
# Appendix D: TVOC Concentration Trend Plots
## D-Zone Wells
## Necco Park

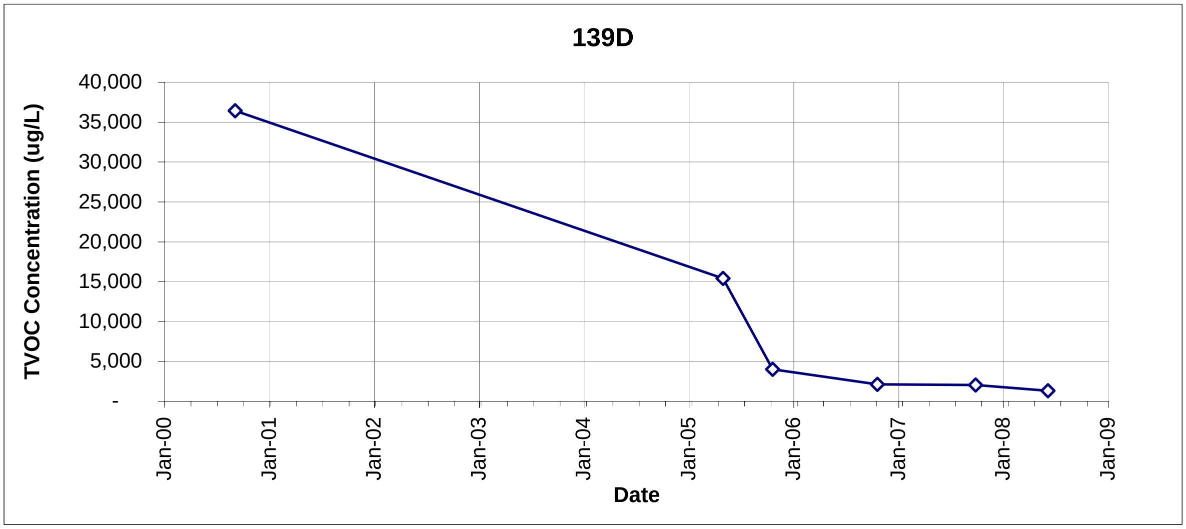


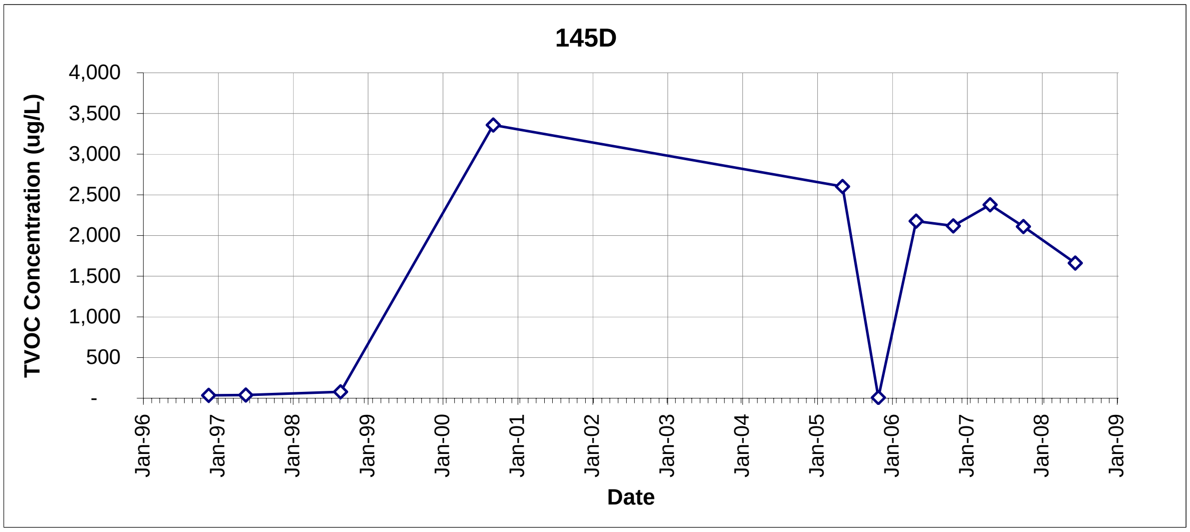




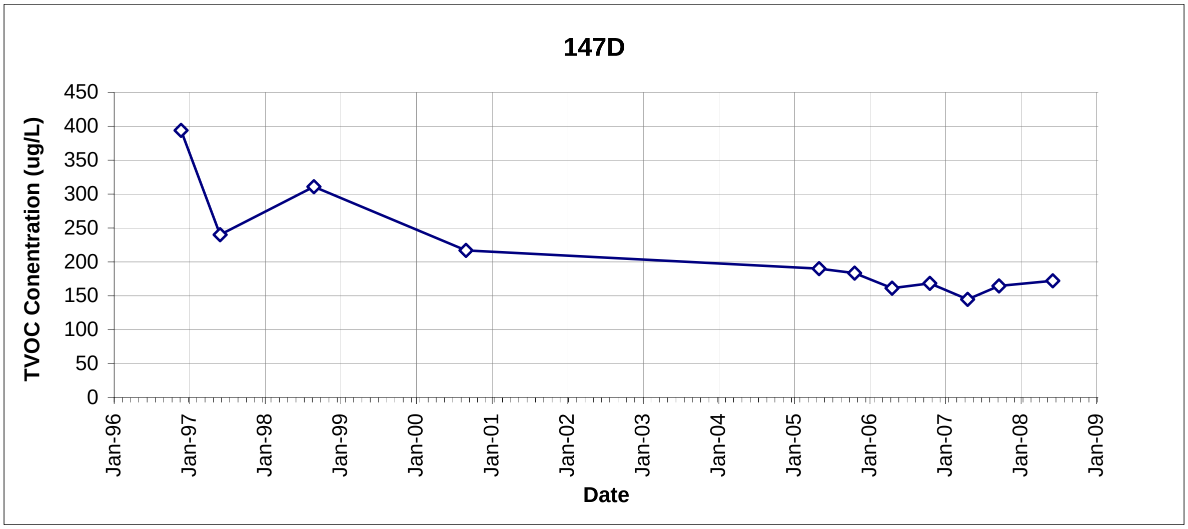
# Appendix D: TVOC Concentration Trend Plots
## D-Zone Wells
## Necco Park

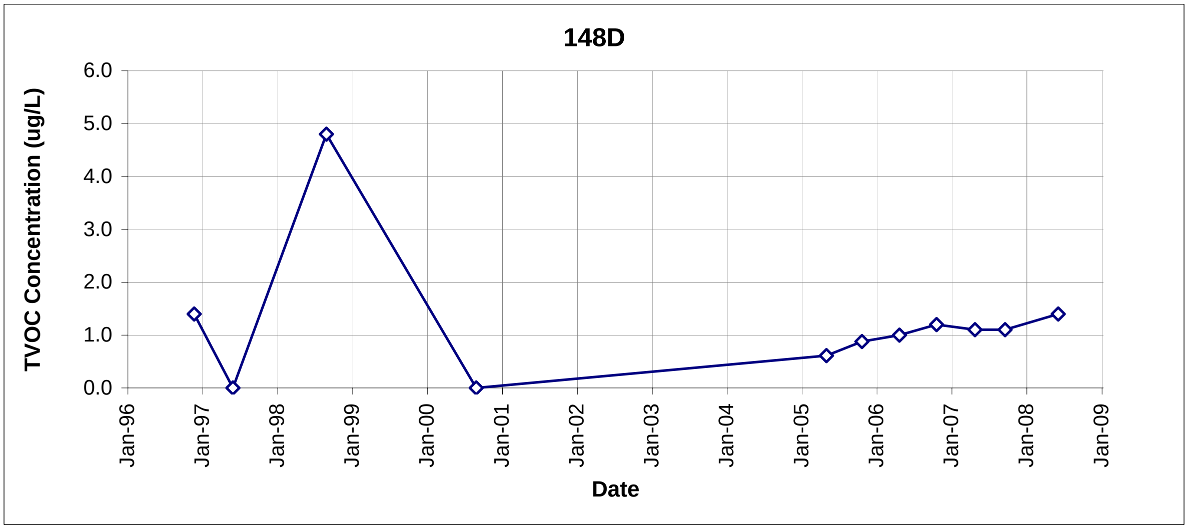


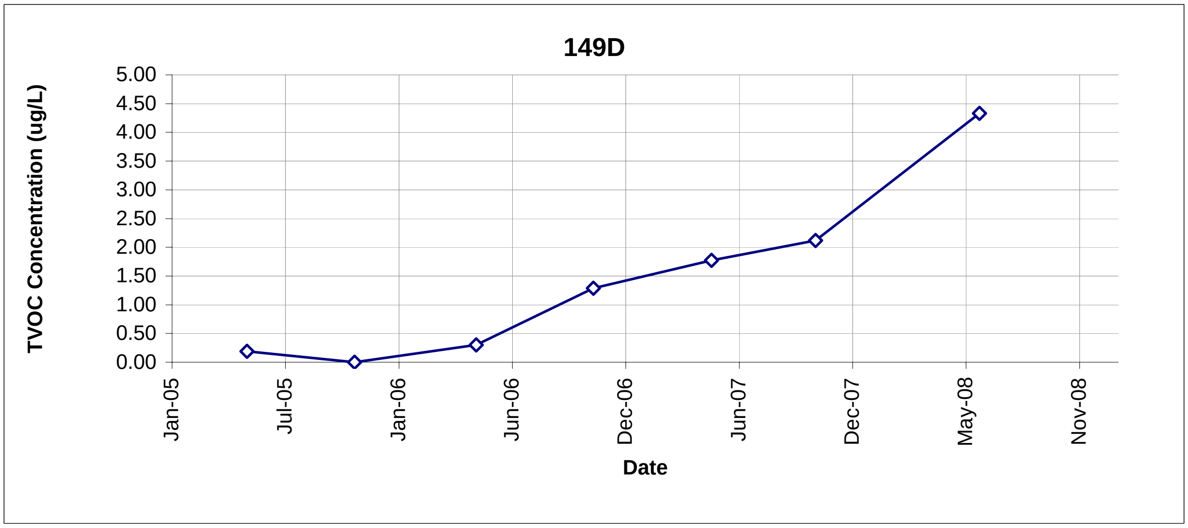




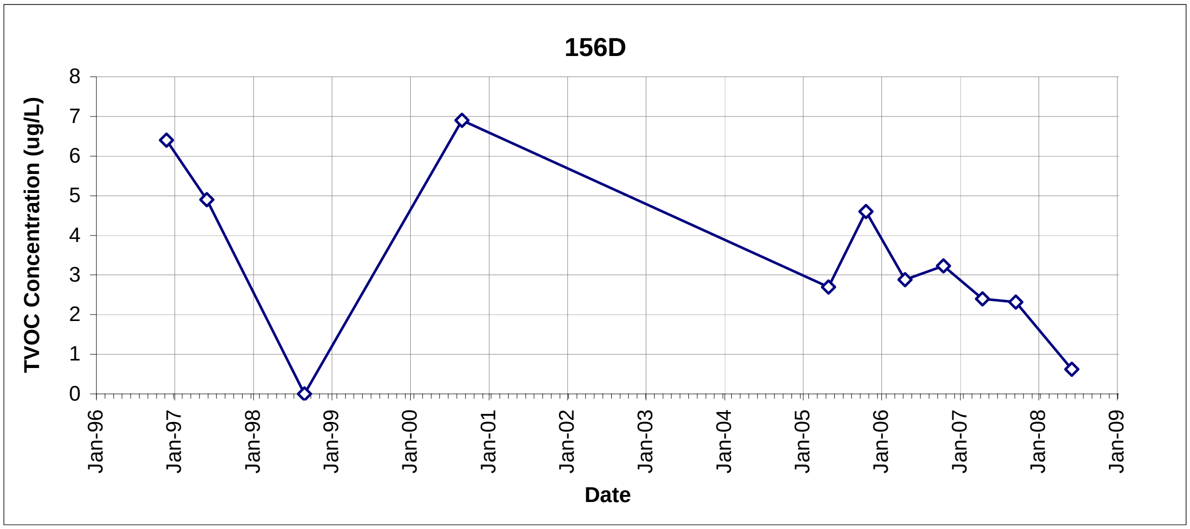
# Appendix D: TVOC Concentration Trend Plots
## D-Zone Wells
## Necco Park

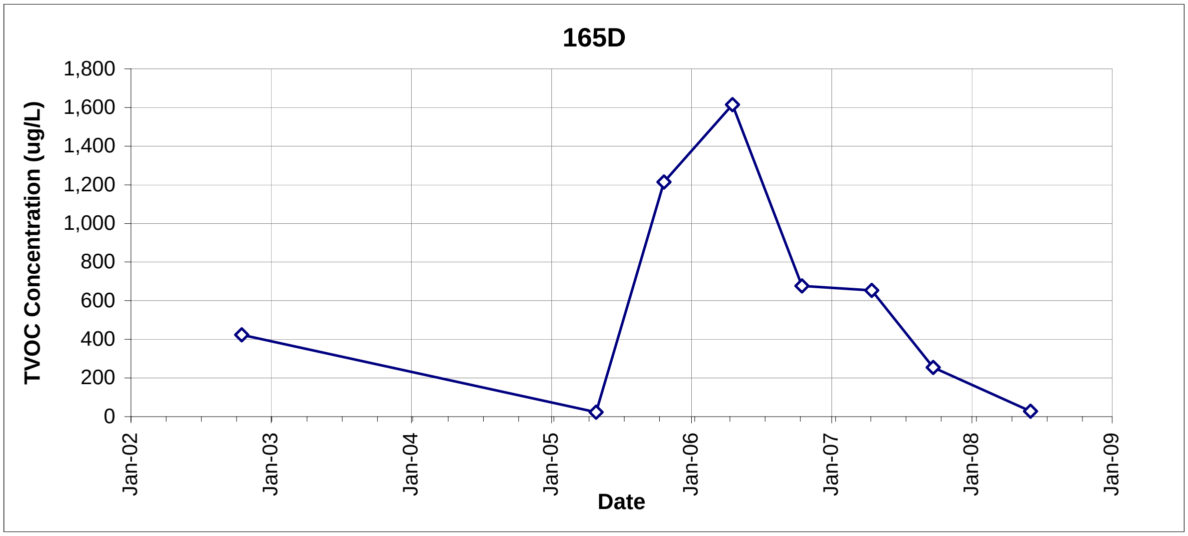




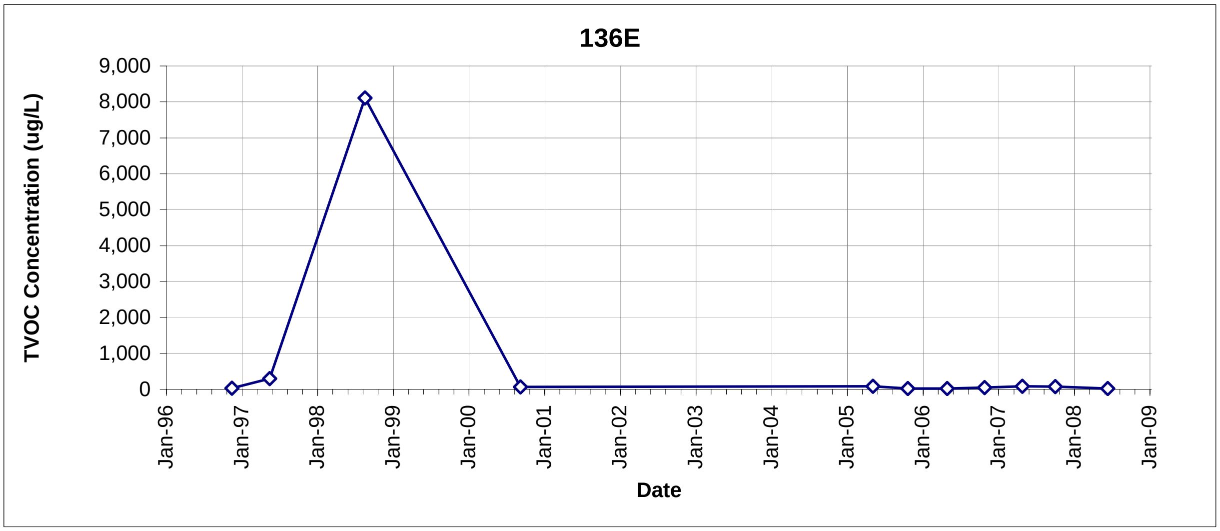


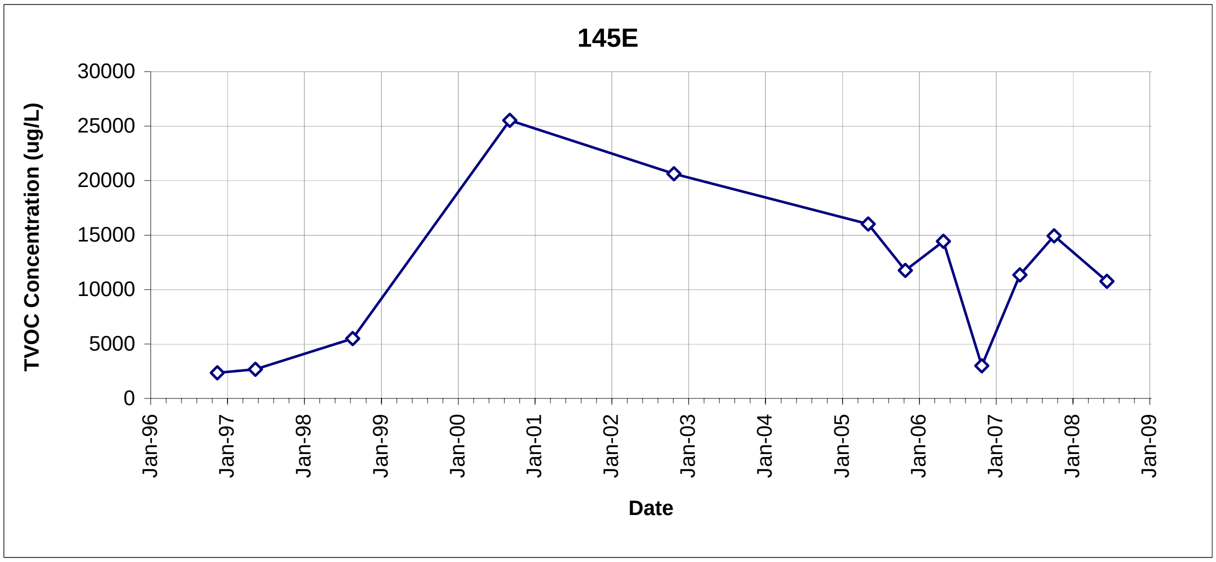
# Appendix D: TVOC Concentration Trend Plots
## D-Zone Wells
## Necco Park

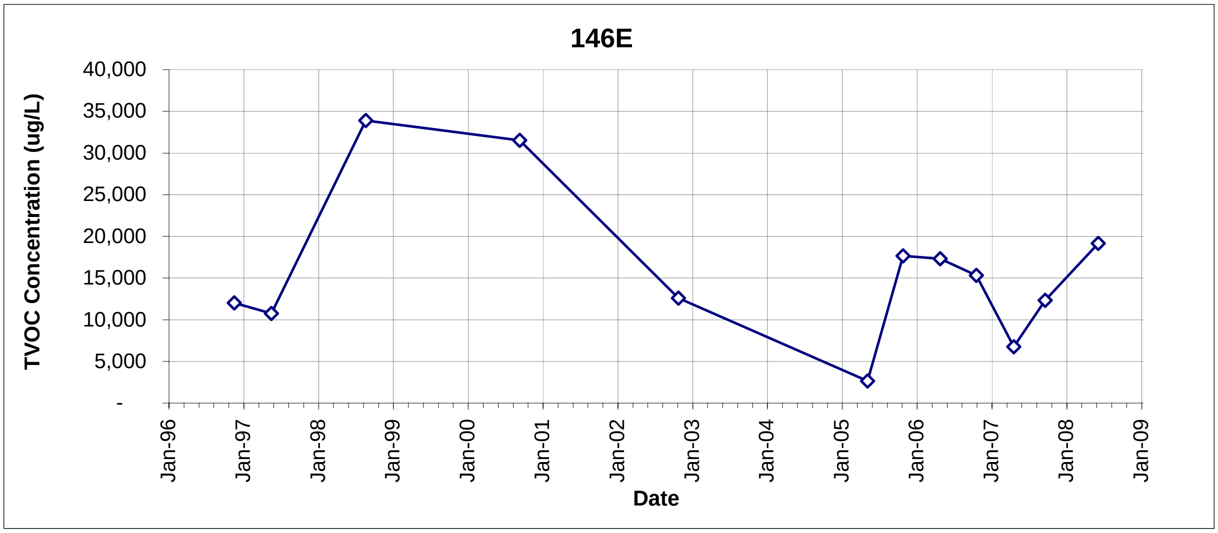




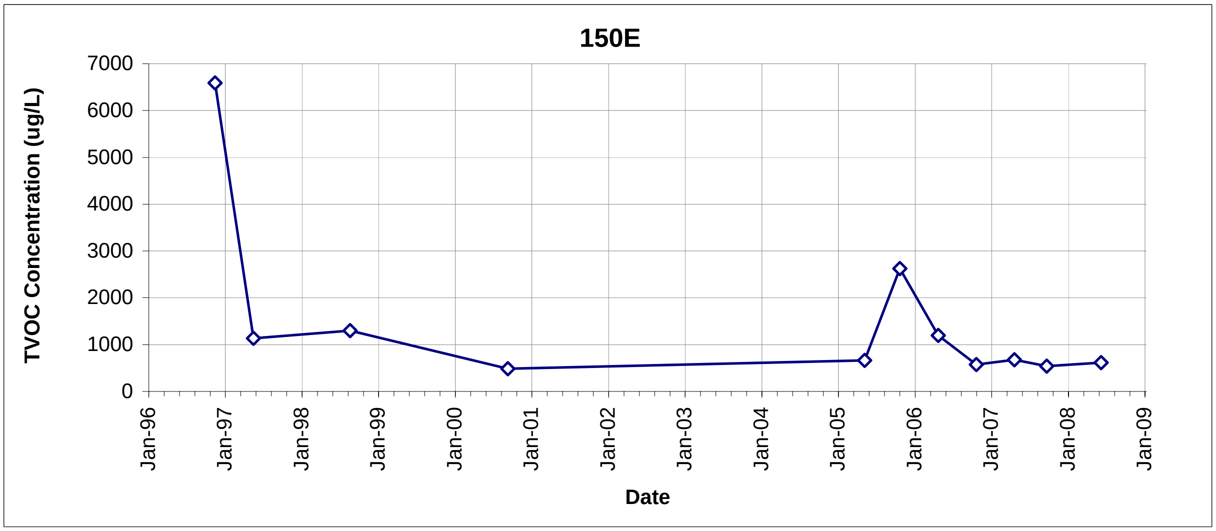
# Appendix D: TVOC Concentration Trend Plots
## E-Zone Wells
## Necco Park

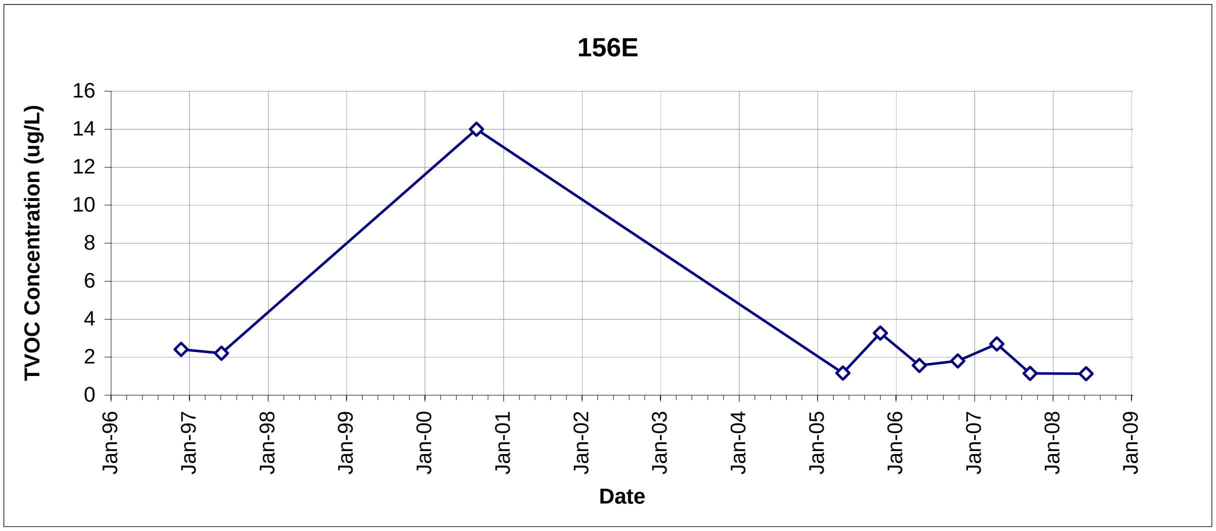


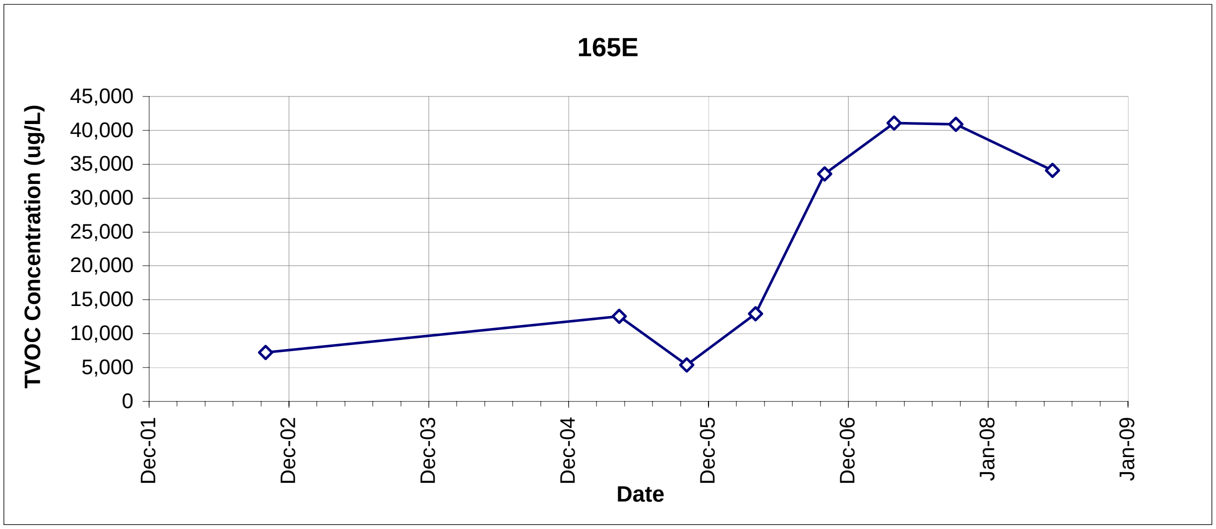




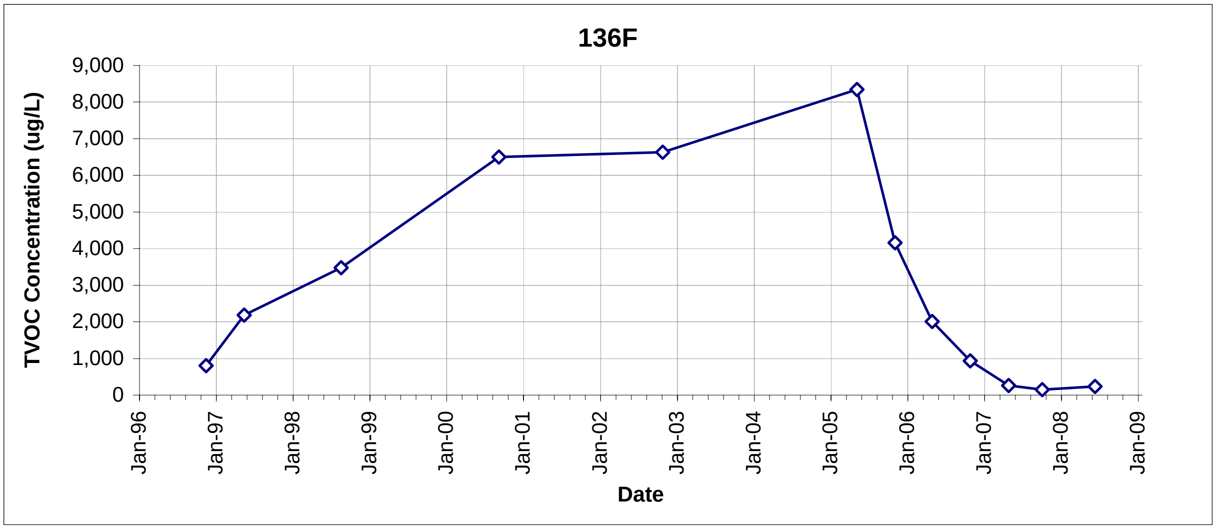
# Appendix D: TVOC Concentration Trend Plots
# E-Zone Wells
# Necco Park

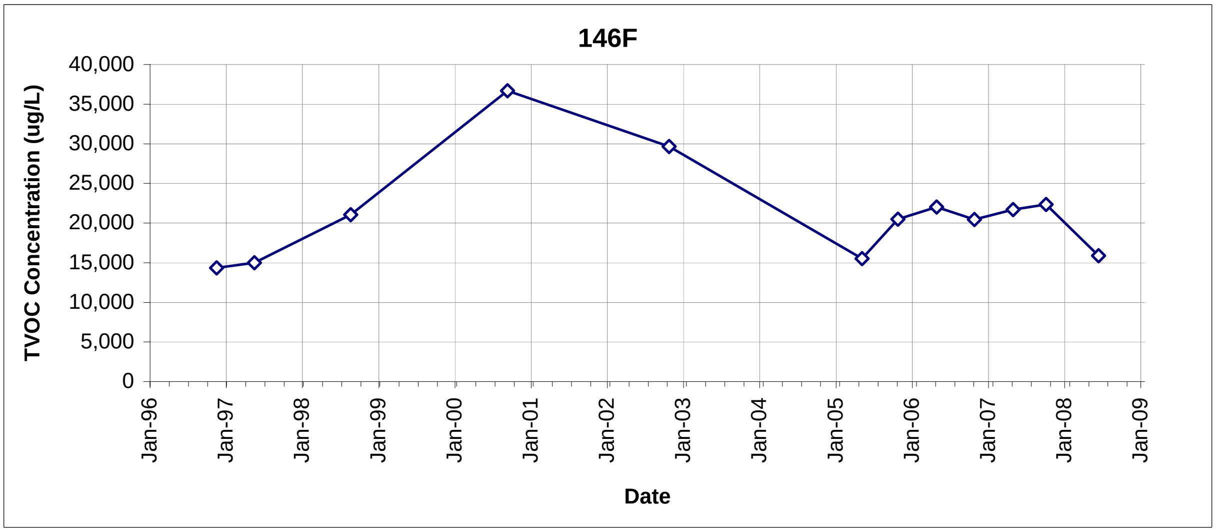


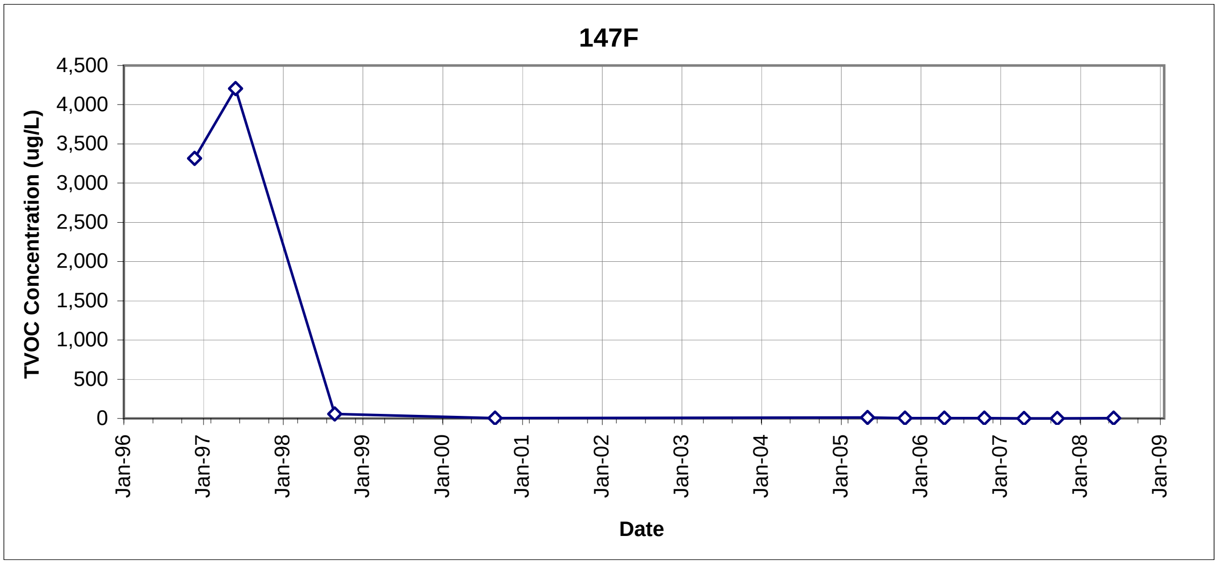




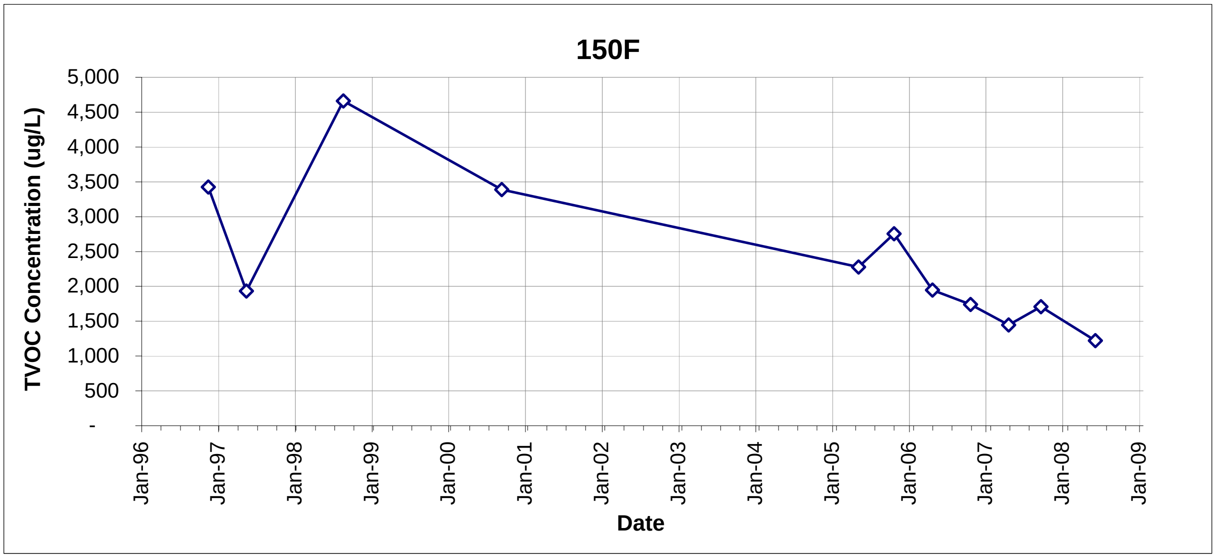
# Appendix D: TVOC Concentration Trend Plots
## F-Zone Wells
## Necco Park

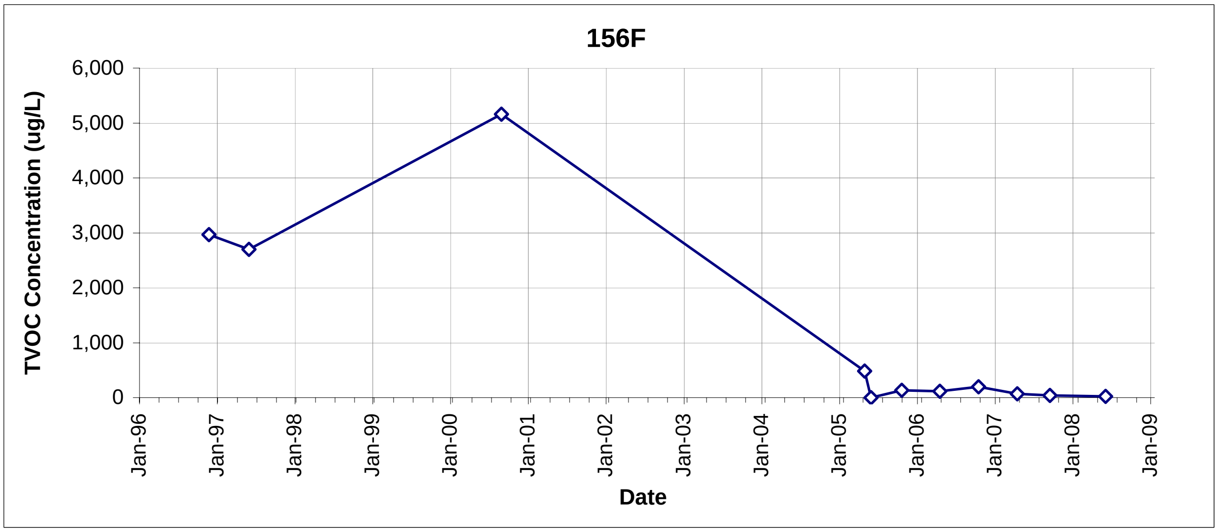




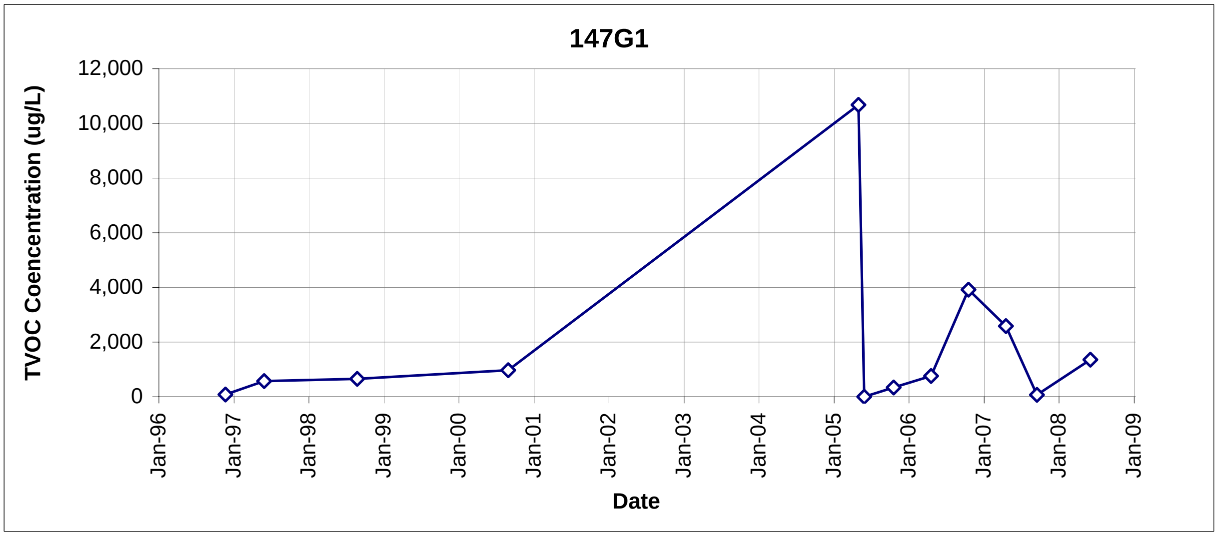


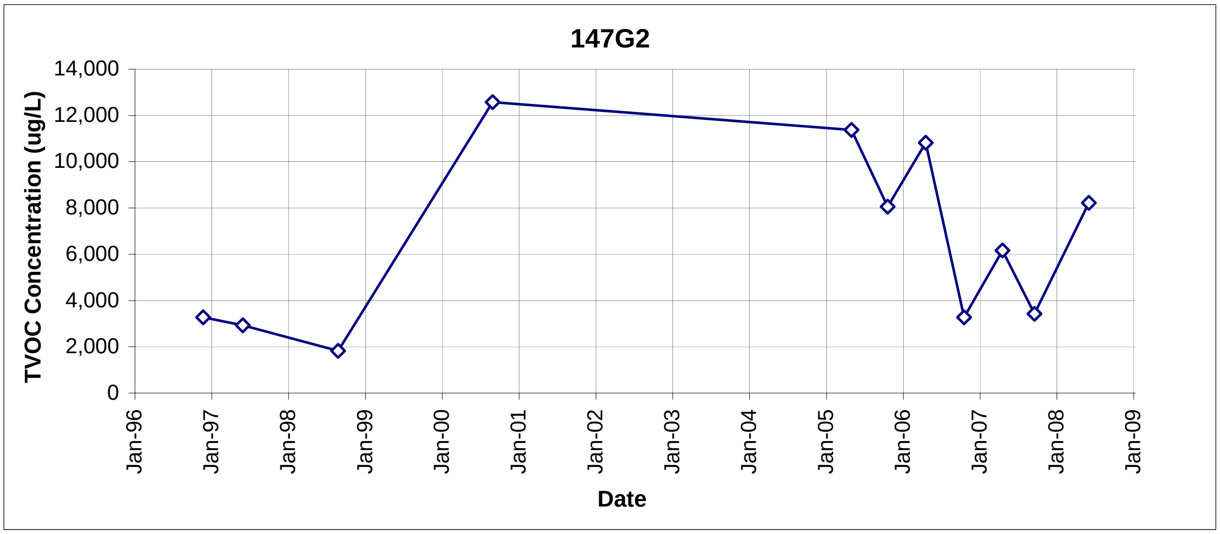
# Appendix D: TVOC Concentration Trend Plots
## F-Zone Wells
## Necco Park

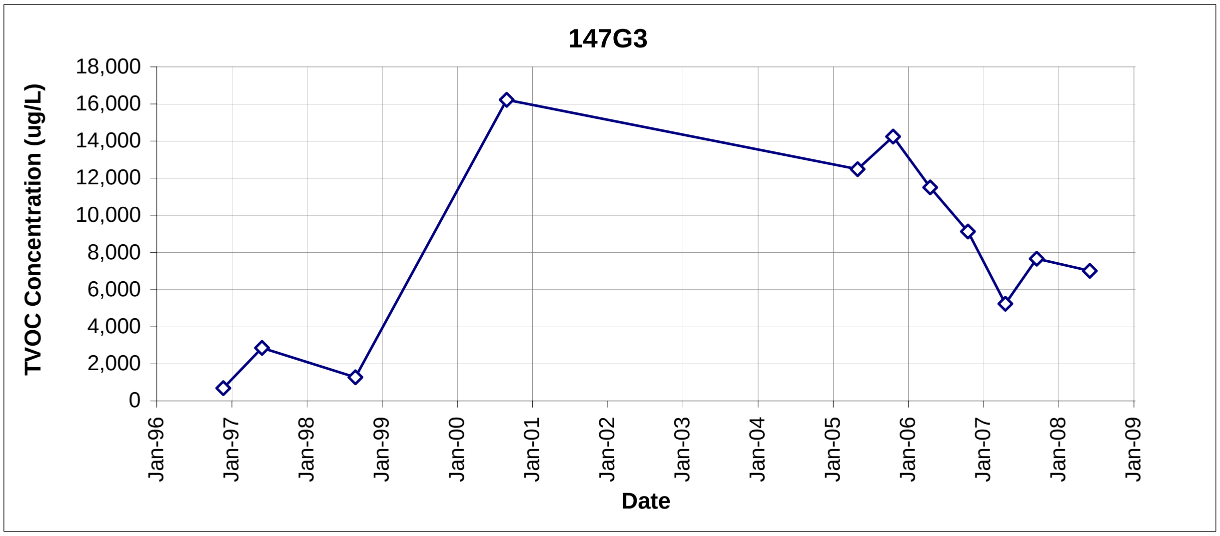




# Appendix D: TVOC Concentration Trend Plots
## G-Zone Wells
## Necco Park







# APPENDIX E

# CHLORINATED ETHENES & ETHENE

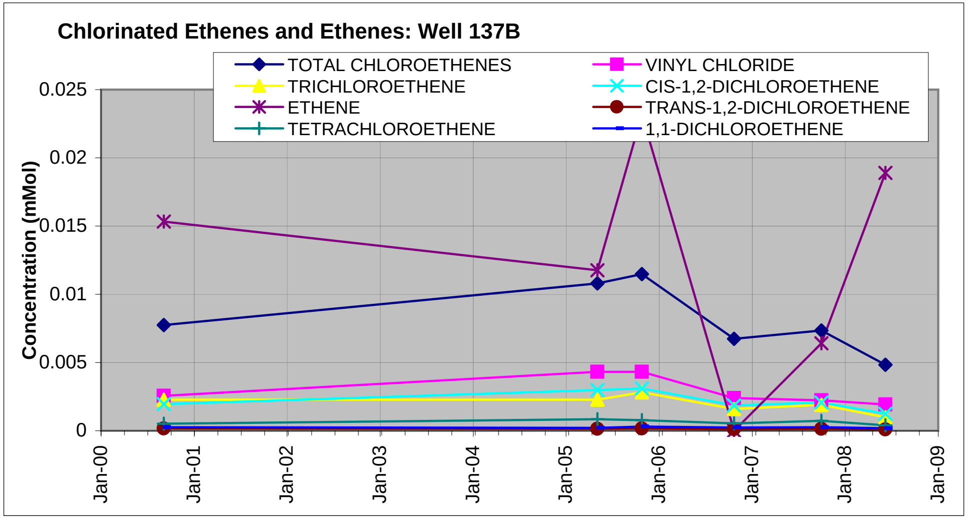
# Appendix E: Chlorinated Ethenes and Ethene
# B/C - Zone Wells
# DuPont Necco Park

## WELL 137B

**Monitoring Well Summary**

- Source area
- Decrease of Chlorinated Ethenes 2005-2008
- Mostly TCE, cDCE, VC
- No DHEs were detected in 2008
- Moderate Ethene Production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | 65 |
| TCE | 130 |
| Cis- 1,2 DCE | 120 |
| VC | 120 |
| Trans-1,2 DCE | 9.4 |
| 1,1-DCE | 19 |
| **TOTAL** | **463** |

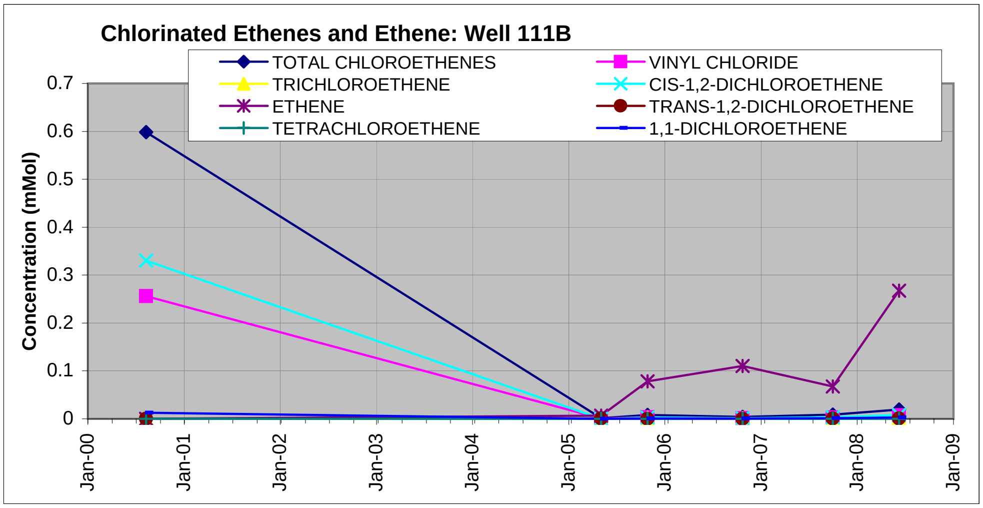


## WELL 111B

**Monitoring Well Summary**

- Source area
- Slight increase in Total Chlorinated Ethenes 2005-2008
- Mostly cDCE, VC
- Moderate increase in 1,1- DCE from 2005-2008
- Good Ethene production
- Strong DHE signal

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <36 |
| TCE | 110 |
| Cis- 1,2 DCE | 810 |
| VC | 470 |
| Trans-1,2 DCE | 37 |
| 1,1-DCE | 230 |
| **TOTAL** | **1657** |

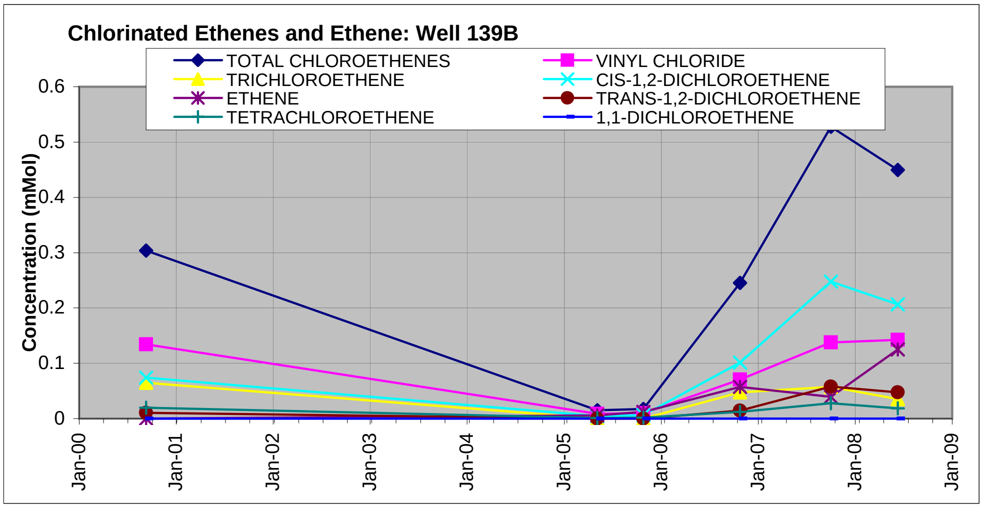


## WELL 139B

**Monitoring Well Summary**

- Source area
- NAPL observed in 1992
- Increase in Total Chlorinated Ethenes 2005-2008
- Mostly cDCE, VC, TCE, tDCE, PCE
- Good Ethene production
- Exceeds 1% Pure Phase Solubility Criteria (PCE)

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | 3,100 |
| TCE | 4,600 |
| Cis- 1,2 DCE | 20,000 |
| VC | 8,900 |
| Trans-1,2 DCE | 4,600 |
| 1,1-DCE | <130 |
| **TOTAL** | **41,200** |



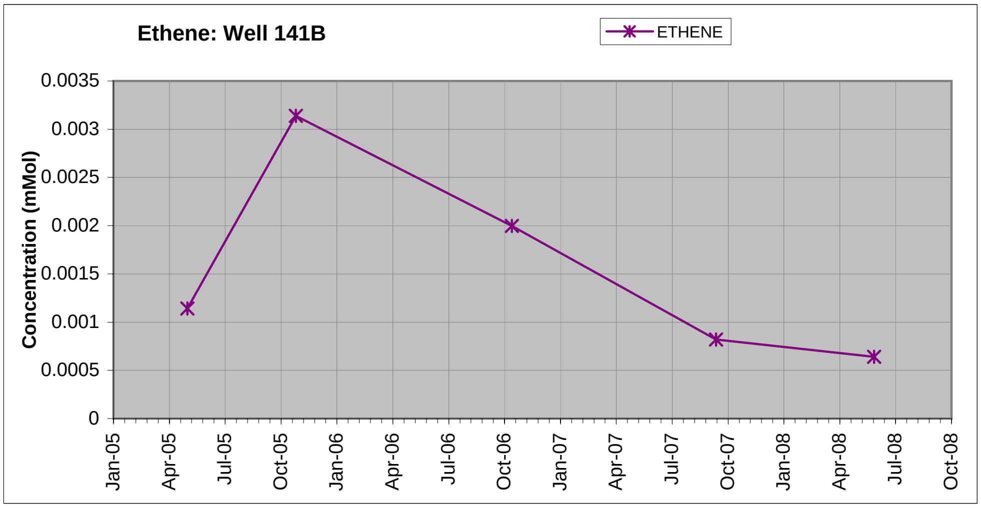
# Appendix E: Chlorinated Ethenes and Ethene
# B/C - Zone Wells
# DuPont Necco Park

## WELL 141B

**Monitoring Well Summary**

- Upgradient Well
- Clean: No Chlorinated Ethenes detected
- No DHEs were detected in 2008
- Moderate Ethene production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <3.6 UJ |
| TCE | <2.1 |
| Cis- 1,2 DCE | <2.1 |
| VC | <2.8 |
| Trans-1,2 DCE | <2.4 |
| 1,1-DCE | <2.4 |
| **TOTAL** | **0** |

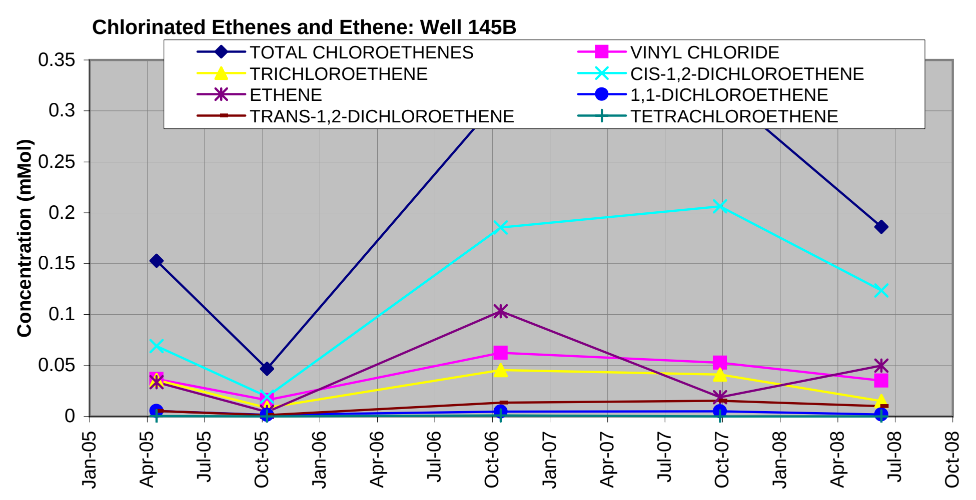


## WELL 145B

**Monitoring Well Summary**

- Down gradient Well
- Slight increase in Total Chlorinated Ethenes 2005-2008
- Mostly TCE, cDCE, VC
- Not sampled for DHE in 2008
- Good Ethene production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <120 UJ |
| TCE | 2,000 |
| Cis- 1,2 DCE | 12,000 |
| VC | 2,200 |
| Trans-1,2 DCE | 960 |
| 1,1-DCE | 190 |
| **TOTAL** | **17,350** |

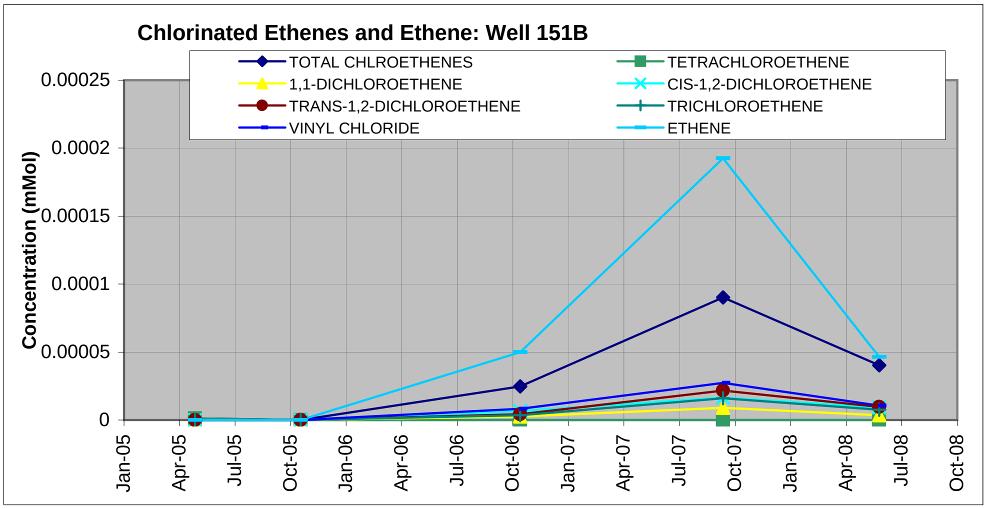


## WELL 151B

**Monitoring Well Summary**

- Far downgradient well
- Slight decrease in Total Chlorinated Ethenes 2005-2008
- Mostly low conc. of VC, TCE, tDCE,cDCE
- Not sampled for DHE in 2008
- Weak Ethene production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 UJ |
| TCE | 0.98 |
| Cis- 1,2 DCE | 0.88 |
| VC | 0.66 |
| Trans-1,2 DCE | 0.93 |
| 1,1-DCE | 0.35 |
| **TOTAL** | **3.8** |



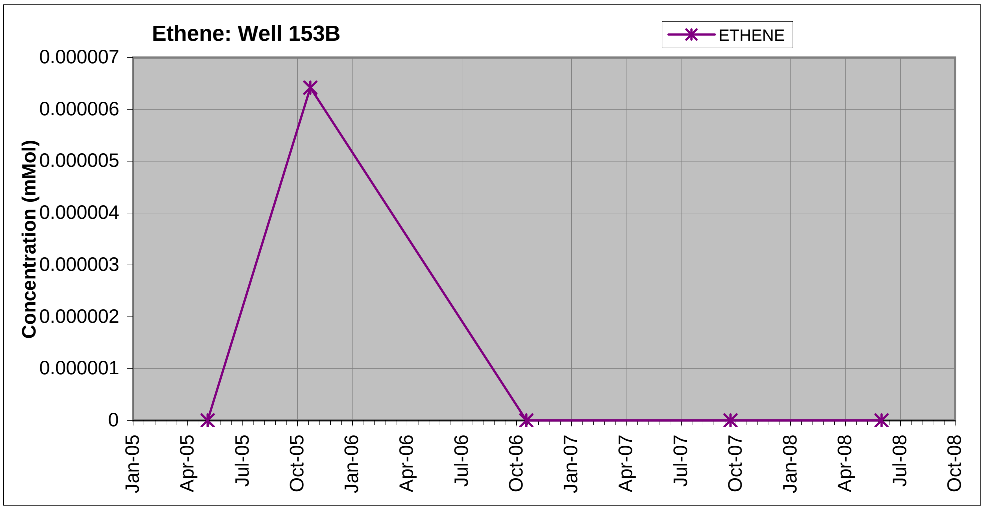
# Appendix E: Chlorinated Ethenes and Ethene
## B/C - Zone Wells
## DuPont Necco Park

## WELL 153B

**Monitoring Well Summary**

- East side gradient well
- Clean: No Chlorinated Ethenes detected
- No DHEs were detected in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 UJ |
| TCE | <0.17 |
| Cis- 1,2 DCE | <0.17 |
| VC | <0.22 |
| Trans-1,2 DCE | <0.19 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **0** |

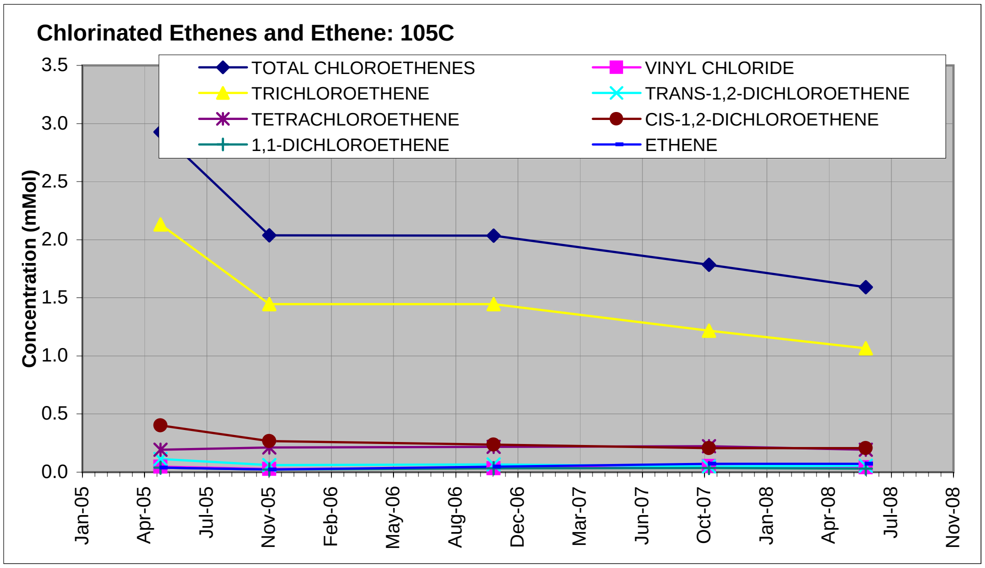


## WELL 105C

**Monitoring Well Summary**

- Source area
- DNAPL observed in 1992
- Exceeds effective solubility and 1% absolute solubility for: PCE, TCE, CF
- Slight decrease Total Chlorinated Ethenes 2005-2008
- Moderate DHE signal
- Good Ethene production
- High Chloroform: 82,000 ppb

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | 32,000 |
| TCE | 140,000 |
| Cis- 1,2 DCE | 20,000 |
| VC | 2,600 |
| Trans-1,2 DCE | 5,300 |
| 1,1-DCE | 3,000 |
| **TOTAL** | **202,900** |



# Appendix E: Chlorinated Ethenes and Ethene
# C/D - Zone Wells
# Necco Park

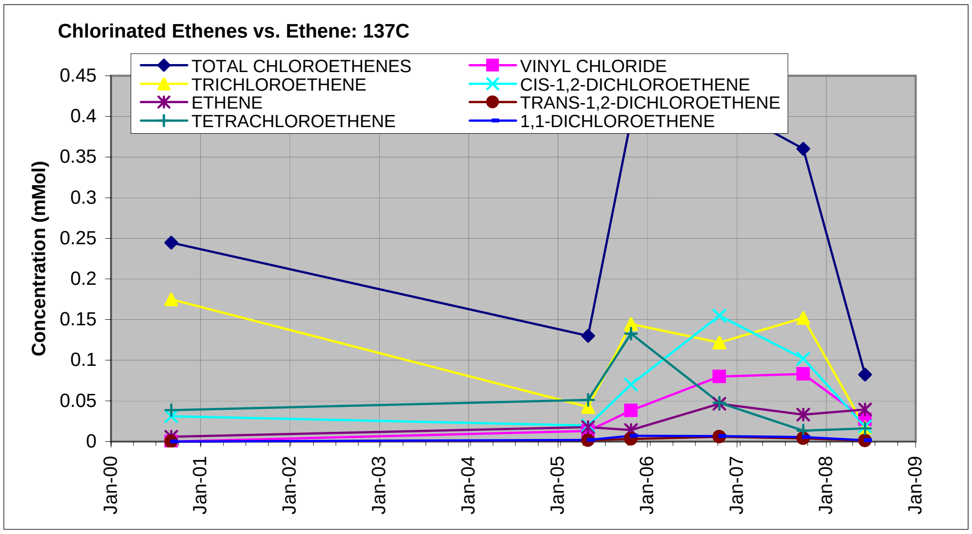
## WELL: 137C

**Monitoring Well Summary**

- Source area

- Exceeds 1% Pure Phase Solubility (PCE, TCE)
- Decreasing Total chlorinated Ethenes 2005-2008
- Good Ethene production
- Moderate/Strong DHE signal

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | 2,700 |
| TCE | 2,300 |
| Cis- 1,2 DCE | 1,800 |
| VC | 1,700 |
| Trans-1,2 DCE | 120 |
| 1,1-DCE | 140 |
| **TOTAL** | **8,760** |

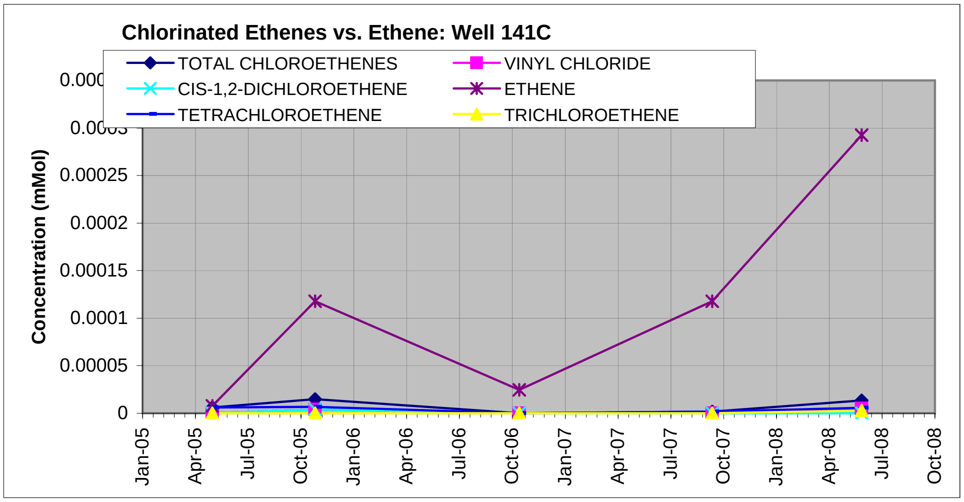


## WELL: 141C

**Monitoring Well Summary**

- Upgradient
- Low conc. of VC, TCE, PCE
- Weak ethene production
- Flat Total Chlorinated Ethenes 2005-2008
- No DHEs were detected in 2008

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | 0.96 |
| TCE | 0.34 |
| Cis- 1,2 DCE | <0.17 |
| VC | 0.32 |
| Trans-1,2 DCE | <0.19 |
| 1,1-DCE | <019 |
| **TOTAL** | **2** |

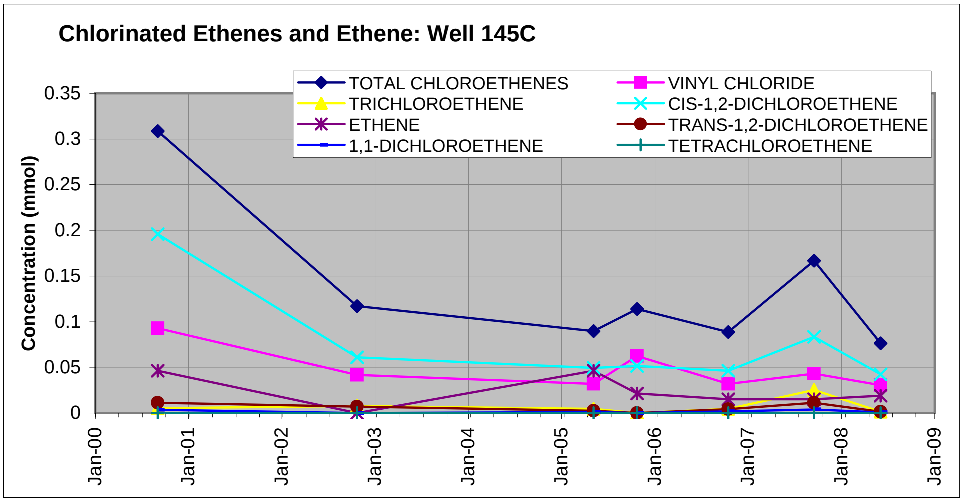


## WELL: 145C

**Monitoring Well Summary**

- Downgradient
- Near Source Boundary
- Flat Total Chlorinated Ethenes 2005-2008
- Mostly cDCE and VC
- Moderate ethene production
- Not sampled for DHE in 2008

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | <58 UJ |
| TCE | 180 |
| Cis- 1,2 DCE | 4,100 |
| VC | 1,900 |
| Trans-1,2 DCE | 150 |
| 1,1-DCE | 82 |
| **TOTAL** | **6,412** |



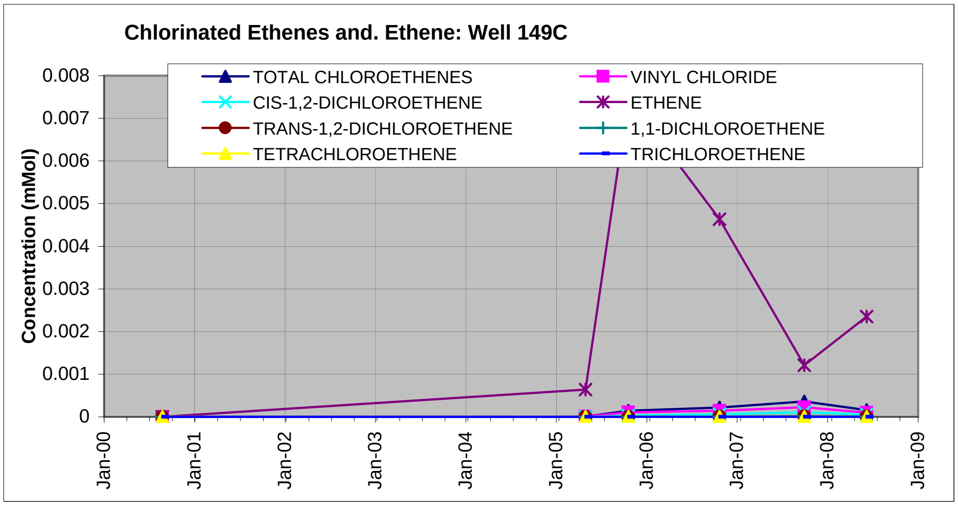
# Appendix E: Chlorinated Ethenes and Ethene
# C/D - Zone Wells
# Necco Park

## WELL: 149C

**Monitoring Well Summary**

- Downgradient
- Flat Total Chlorinated Ethenes 2005-2008
- Mostly cDCE, VC
- Weak ethene production
- Not sampled for DHE in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 5.2 |
| VC | 6 |
| Trans-1,2 DCE | 0.62 |
| 1,1-DCE | 0.43 |
| **TOTAL** | **12.25** |

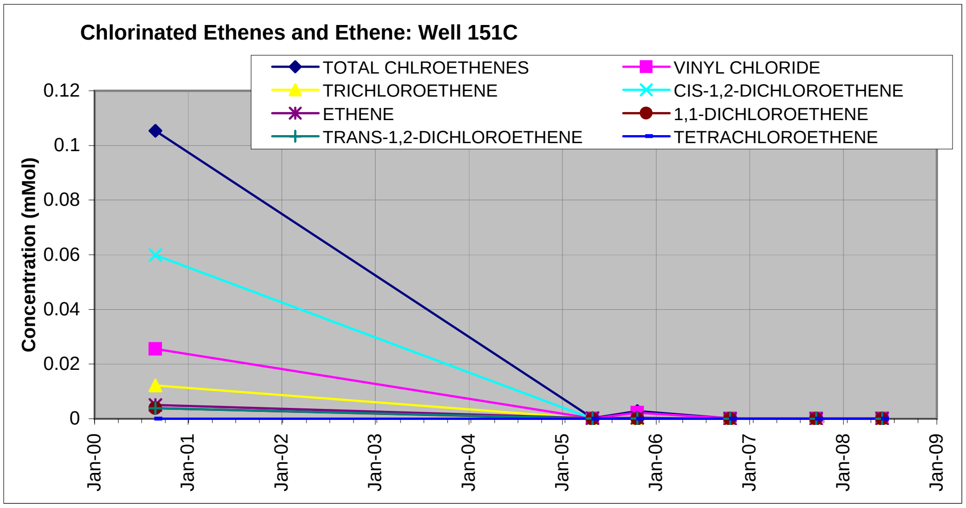


## WELL: 151C

**Monitoring Well Summary**

- Far downgradient
- Declining Total Chlorinated Ethenes 2005-2008
- Mostly tDCE, VC
- Not sampled for DHE in 2008
- Weak ethene production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 1.9 |
| VC | 7.8 |
| Trans-1,2 DCE | 2.1 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **11.8** |

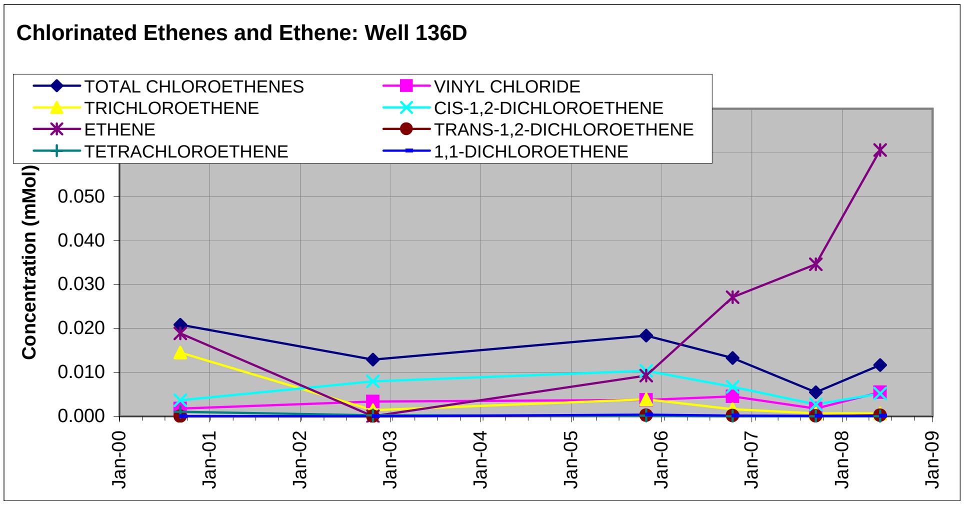


## WELL: 136D

**Monitoring Well Summary**

- Near downgradient well
- Flat Total Chlorinated Ethenes 2005-2008
- Mostly TCE, cDCE, VC
- Good ethene production
- Not sampled for DHE in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <7.2 UJ |
| TCE | 84 |
| Cis- 1,2 DCE | 500 |
| VC | 340 |
| Trans-1,2 DCE | 18 |
| 1,1-DCE | 7.8 |
| **TOTAL** | **950** |



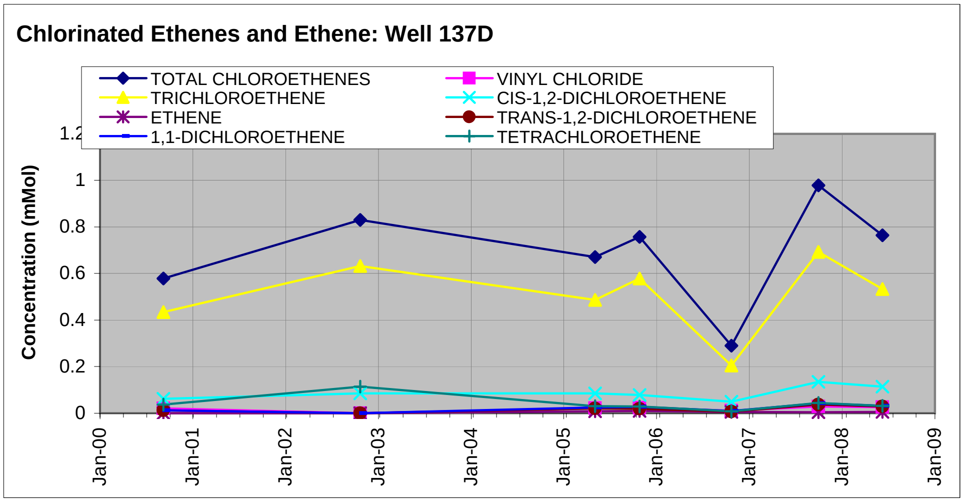
# Appendix E: Chlorinated Ethenes and Ethene
# C/D - Zone Wells
# Necco Park

## WELL: 137D

**Monitoring Well Summary**

- Source area
- Exceeds 1% solubility for PCE, TCE
- Flat Total Chlorinated Ethenes 2005-2008
- Exceeds effective solubility for PCE, TCE dominant species
- No DHEs were detected in 2008
- Moderate ethene production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | 5300 |
| TCE | 70000 |
| Cis- 1,2 DCE | 11000 |
| VC | 1600 |
| Trans-1,2 DCE | 2800 |
| 1,1-DCE | 3000 |
| **TOTAL** | **93,700** |



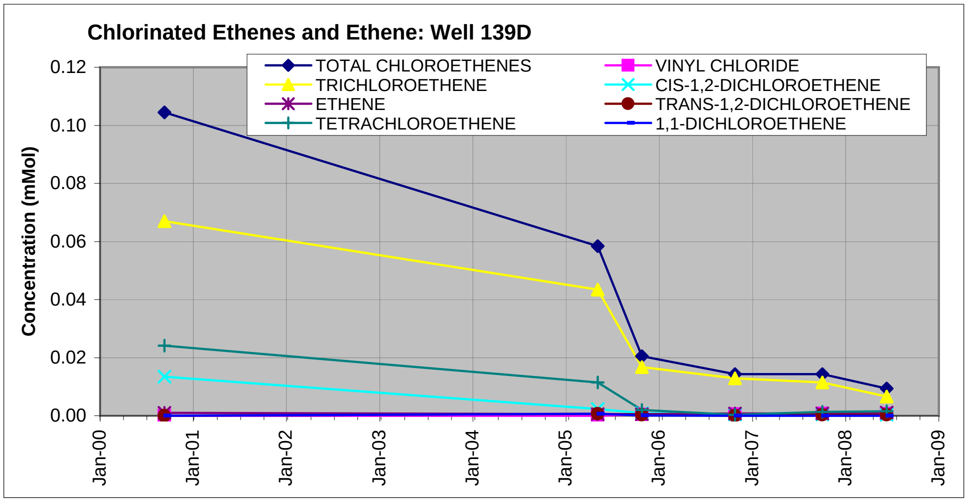
# Appendix E: Chlorinated Ethenes and Ethene
## D/E - Zone Wells
## Necco Park

## WELL: 139D

**Monitoring Well Summary**

- Source area
- DNAPL observed 1992
- Decrease in Total Chlorinated Ethenes 2005-2008
- Mostly TCE and PCE
- Moderate DHE signal
- Weak ethene production

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | 250 |
| TCE | 870 |
| Cis- 1,2 DCE | 32 |
| VC | 38 |
| Trans-1,2 DCE | 29 |
| 1,1-DCE | <6.3 |
| **TOTAL** | **1,219** |

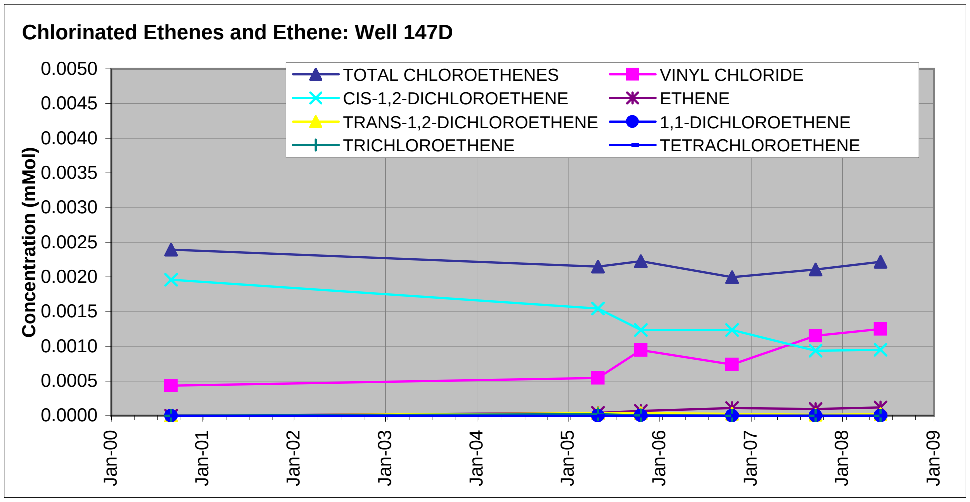


## WELL: 147D

**Monitoring Well Summary**

- Far downgradient
- Flat Total Chlorinated Ethenes 2005-2008
- Mostly cDCE, VC
- Not sampled for DHE in 2008
- Weak ethene production

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | <0.72 UJ |
| TCE | <0.42 |
| Cis- 1,2 DCE | 92 |
| VC | 78 |
| Trans-1,2 DCE | 2.1 |
| 1,1-DCE | <0.48 |
| **TOTAL** | **172** |

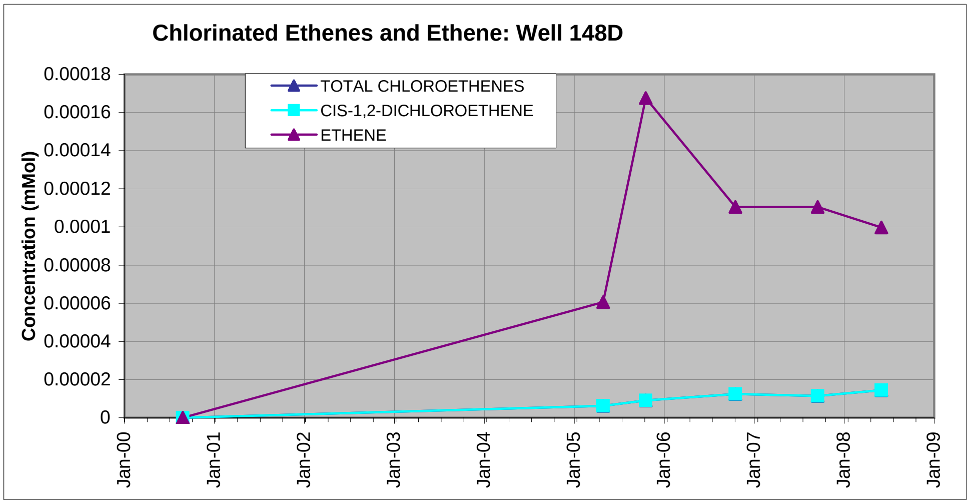


## WELL: 148D

**Monitoring Well Summary**

- Downgradient
- Flat Total Chlorinated Ethene 2005-2008
- Mostly cDCE
- Weak ethene production
- Not sampled for DHE in 2008

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 1.4 |
| VC | <0.22 |
| Trans-1,2 DCE | <0.19 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **1.4** |



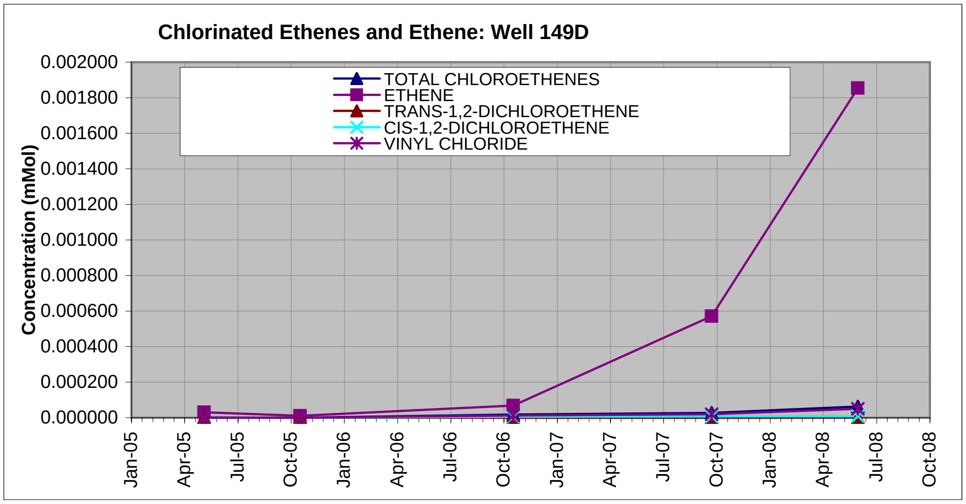
# Appendix E: Chlorinated Ethenes and Ethene
## D/E - Zone Wells
## Necco Park

### WELL: 149D

**Monitoring Well Summary**

- Side gradient
- Flat Total Chlorinated Ethene trend 2005-2008
- Mostly VC
- Weak Ethene production
- Not sampled for DHE in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 0.88 |
| VC | 3.2 |
| Trans-1,2 DCE | 0.25 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **4.33** |

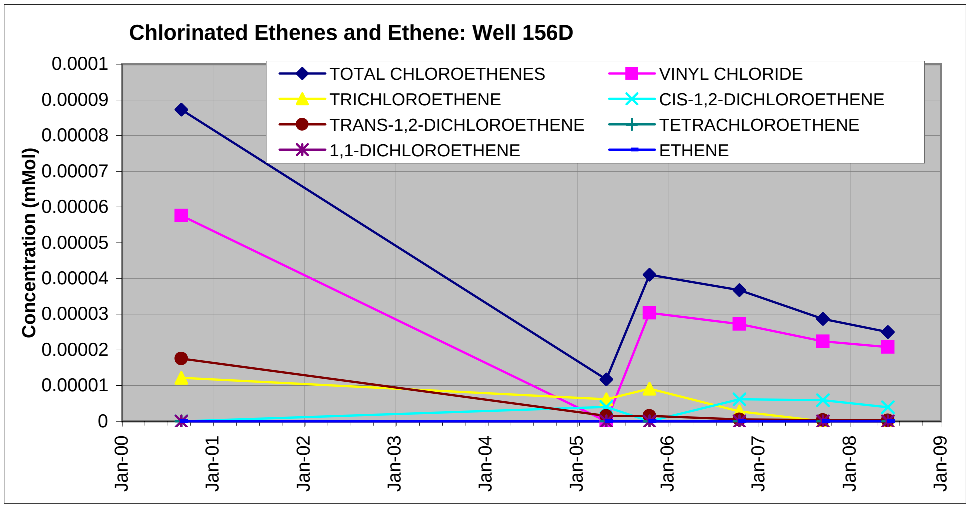


### WELL: 156D

**Monitoring Well Summary**

- Far downgradient
- Slight decrease Total Chlorinated Ethenes 2005-2008
- Mostly VC
- Not sampled for DHE in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 0.38 |
| VC | 1.3 |
| Trans-1,2 DCE | 0.24 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **1.92** |

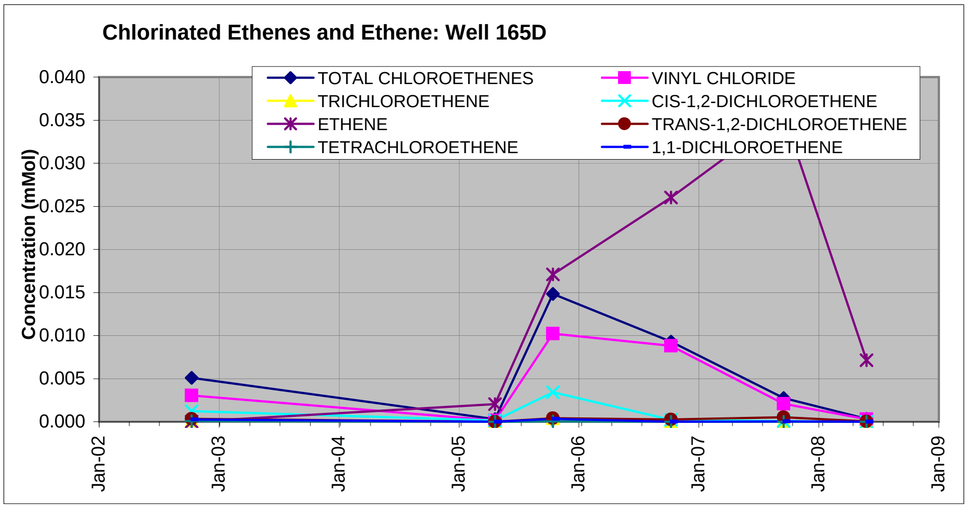


### WELL: 165D

**Monitoring Well Summary**

- Source area
- Near source boundary
- Decreasing Total Chlorinated Ethenes 2005-2008
- Moderate ethene production
- Not sampled for DHE in 2008
- Primarily VC

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 1.7 |
| VC | 18 |
| Trans-1,2 DCE | 2.6 |
| 1,1-DCE | 0.32 |
| **TOTAL** | **22.6** |



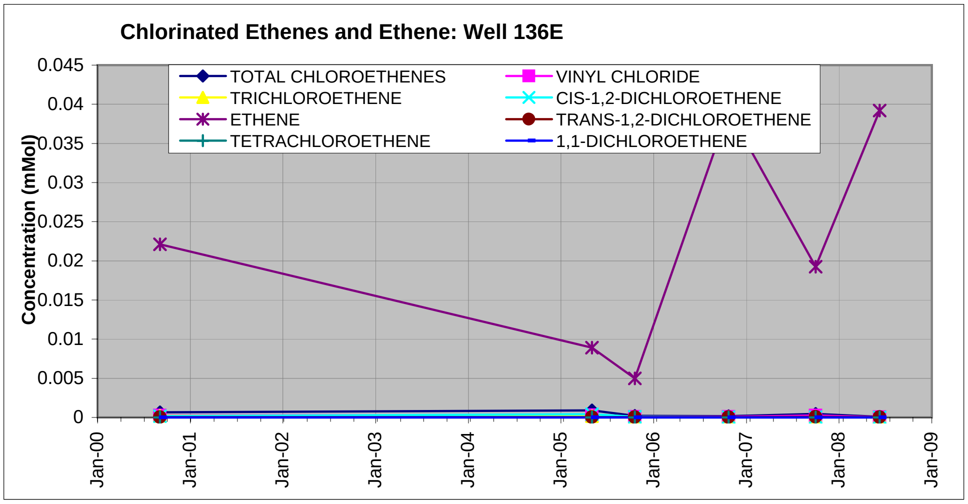
# Appendix E: Chlorinated Ethenes and Ethene
# D/E - Zone Wells
# Necco Park

## WELL: 136E

**Monitoring Well Summary**

- Near downgradient
- Flat Total Chlorinated Ethenes 2005-2008
- Good ethene production
- Not sampled for DHE in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <0.29 |
| TCE | 2.1 |
| Cis- 1,2 DCE | 0.89 |
| VC | 1.9 |
| Trans-1,2 DCE | 3.9 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **8.79** |

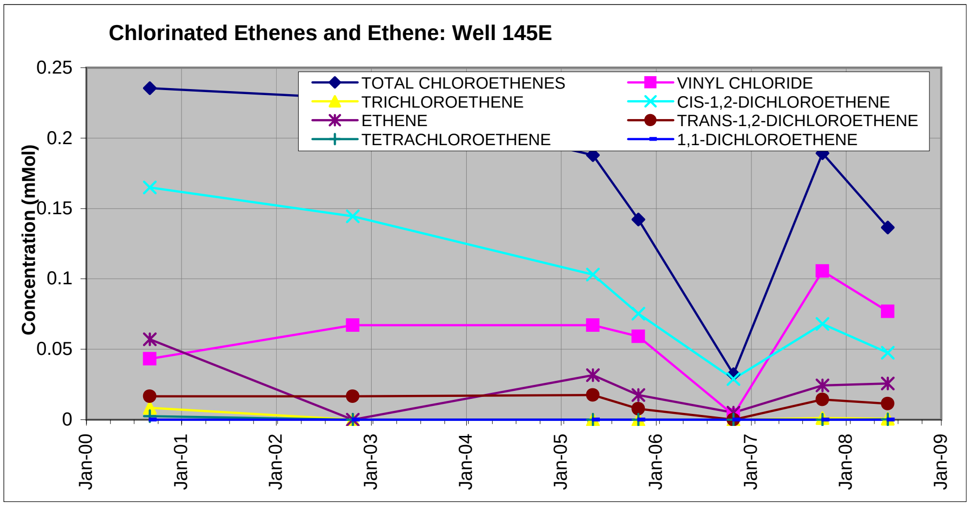

Chlorinated Ethenes and Ethene: Well 136E

## WELL: 145E

**Monitoring Well Summary**

- Sidegradient
- Slight decrease in Total Chlorinated Ethenes 2005-2008
- Mostly cDCE, tDCE, VC
- Not sampled for DHE in 2008
- Good Ethene production

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | 51 |
| TCE | 86 |
| Cis- 1,2 DCE | 4,600 |
| VC | 4,800 |
| Trans-1,2 DCE | 1,100 |
| 1,1-DCE | <32 |
| **TOTAL** | **10,637** |


Chlorinated Ethenes and Ethene: Well 145E

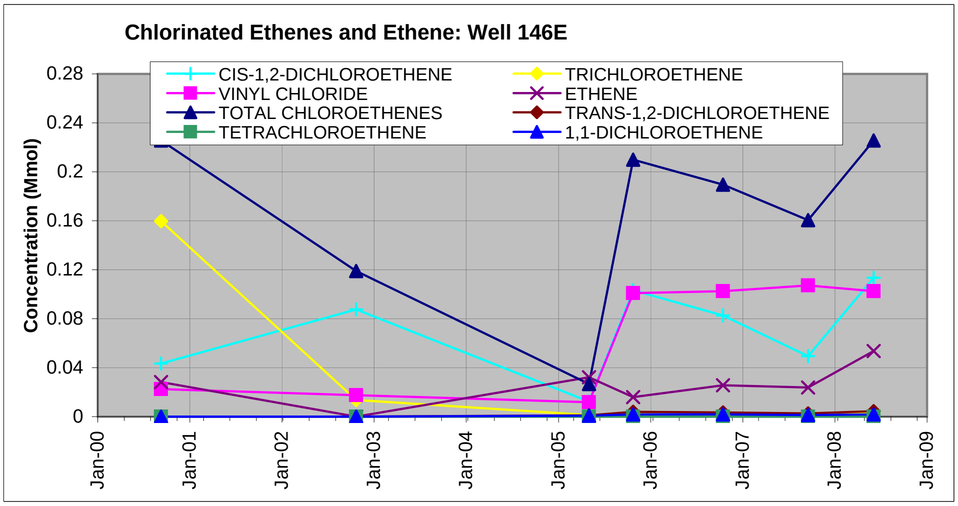
# Appendix E: Chlorinated Ethene and Ethene
## E/F - Zone Wells
## Necco Park

### WELL: 146E

**Monitoring Well Summary**

- Downgradient
- Near source boundary
- Increase in Total Chlorinated Ethenes 2005-2008
- Primarily VC and cDCE
- Not sampled for DHE in 2008
- Good Ethene production

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | <140 |
| TCE | 410 |
| Cis- 1,2 DCE | 11,000 |
| VC | 6,400 |
| Trans-1,2 DCE | 430 |
| 1,1-DCE | 190 |
| **TOTAL** | **18,430** |

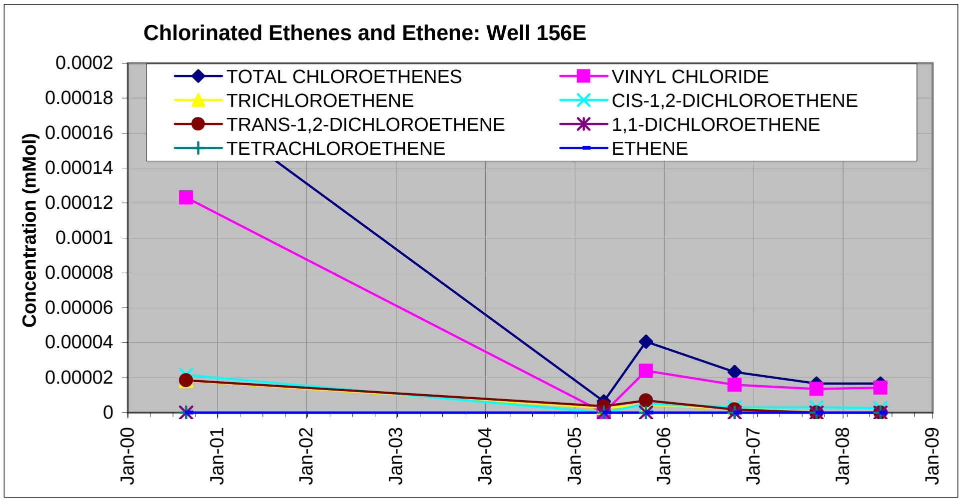


### WELL: 156E

**Monitoring Well Summary**

- Far downgradient
- Slight decreaseTotal Chlorinated Ethenes 2007-2008
- Not sampled for DHE in 2008

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | <0.29 |
| TCE | <0.17 |
| Cis- 1,2 DCE | 0.24 |
| VC | 0.89 |
| Trans-1,2 DCE | <0.19 |
| 1,1-DCE | <0.19 |
| **TOTAL** | **1.13** |

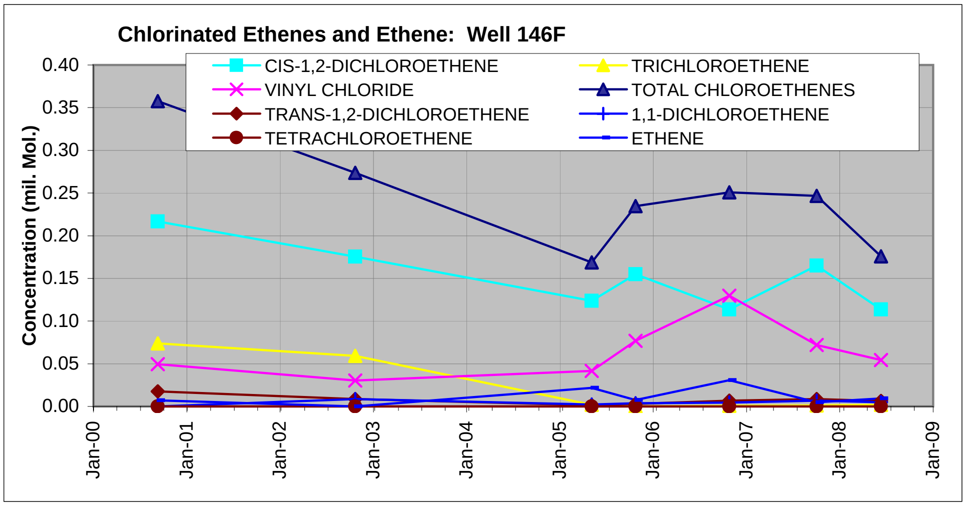


### WELL: 146F

**Monitoring Well Summary**

- Downgradient
- Near source boundary
- Slight decrease in Total Chlorinated Ethenes 2005-2008
- Primarily cDCE, VC
- Moderate Ethene production
- Not sampled for DHE in 2008

| 2008 Sample Results | (ppb) |
|---|---|
| PCE | <140 |
| TCE | 230 |
| Cis- 1,2 DCE | 11,000 |
| VC | 3,400 |
| Trans-1,2 DCE | 600 |
| 1,1-DCE | 490 |
| **TOTAL** | **15,720** |



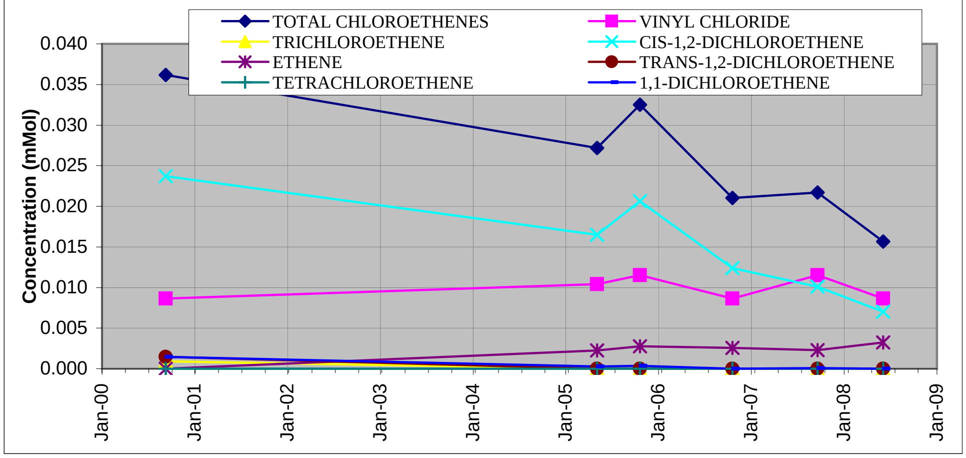
## WELL: 150F

**Monitoring Well Summary**

- Sidegradient
- Slight decrease in Total Chlorinated Ethenes trend 2005-2008
- Mostly cDCE, VC
- Weak ethene production
- Not sampled for DHE in 2008

| **2008 Sample Results** | **(ppb)** |
|---|---|
| PCE | <8.3 |
| TCE | <4.9 |
| Cis- 1,2 DCE | 680 |
| VC | 540 |
| Trans-1,2 DCE | <5.4 |
| 1,1-DCE | <5.4 |
| **TOTAL** | **1,220** |

**Chlorinated Ethenes and Ethene: Well 150F**



# APPENDIX F

# 2008 WELL INSTALLATION AND CLOSURE LOGS

# WELL DECOMMISSIONING RECORD

Site Name: DuPont - Necco Park
Site Location: Niagara Falls, NY
Drilling Co.: Nothnagle Drilling Co.

Well I.D.: RW-1
Driller: Steve Loranger
Inspector: Scot McCabe.
Date: 7/31/08

## DECOMMISSIONING DATA
(Fill in all that apply)

### OVERDRILLING

| | |
|---|---|
| Interval Drilled | |
| Drilling Method(s) | |
| Borehole Dia. (in.) | |
| Temporary Casing Installed? (y/n) | |
| Depth temporary casing installed | |
| Casing type/dia. (in.) | |
| Method of installing | |

### CASING PULLING

| | |
|---|---|
| Method employed | |
| Casing retrieved (feet) | |
| Casing type/dia. (in) | |

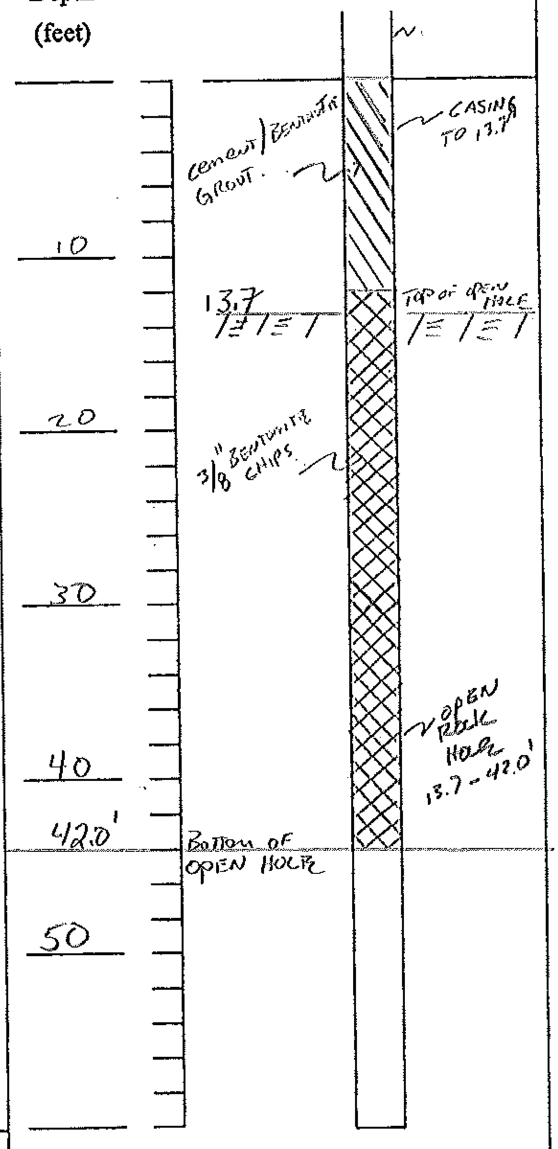
### CASING PERFORATING

| | |
|---|---|
| Equipment used | |
| Number of perforations/foot | |
| Size of perforations | |
| Interval perforated | |

### GROUTING

| | |
|---|---|
| Interval grouted (FBLS) | |
| # of batches prepared | |
| **For each batch record:** | |
| Quantity of water used (gal.) | |
| Quantity of cement used (lbs.) | |
| Cement type | |
| Quantity of bentonite used (lbs.) | |
| Quantity of calcium chloride used (lbs.) | |
| Volume of grout prepared (gal.) | |
| Volume of grout used (gal.) | |

## WELL SCHEMATIC*



*Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

COMMENTS: Sealed open hole interval using
3/8" Bentonite chips*. Sealed top 13' of steel
casing with cement/Bentonite grout.
Casing cut off at ground surface.

* 26 Bags

Drilling Contractor

Department Representative

# WELL DECOMMISSIONING RECORD

| | |
|---|---|
| Site Name: Dupont - Necco Park | Well I.D.: RW-2 |
| Site Location: Niagara Falls, NY | Driller: Steve Lorantr |
| Drilling Co.: Nothnagle Drilling Co. | Inspector: Scott McCabe |
| | Date: 7/29/08 |

## DECOMMISSIONING DATA
(Fill in all that apply)

### OVERDRILLING

| | |
|---|---|
| Interval Drilled | |
| Drilling Method(s) | |
| Borehole Dia. (in.) | |
| Temporary Casing Installed? (y/n) | |
| Depth temporary casing installed | |
| Casing type/dia. (in.) | |
| Method of installing | |

### CASING PULLING

| | |
|---|---|
| Method employed | |
| Casing retrieved (feet) | |
| Casing type/dia. (in) | |

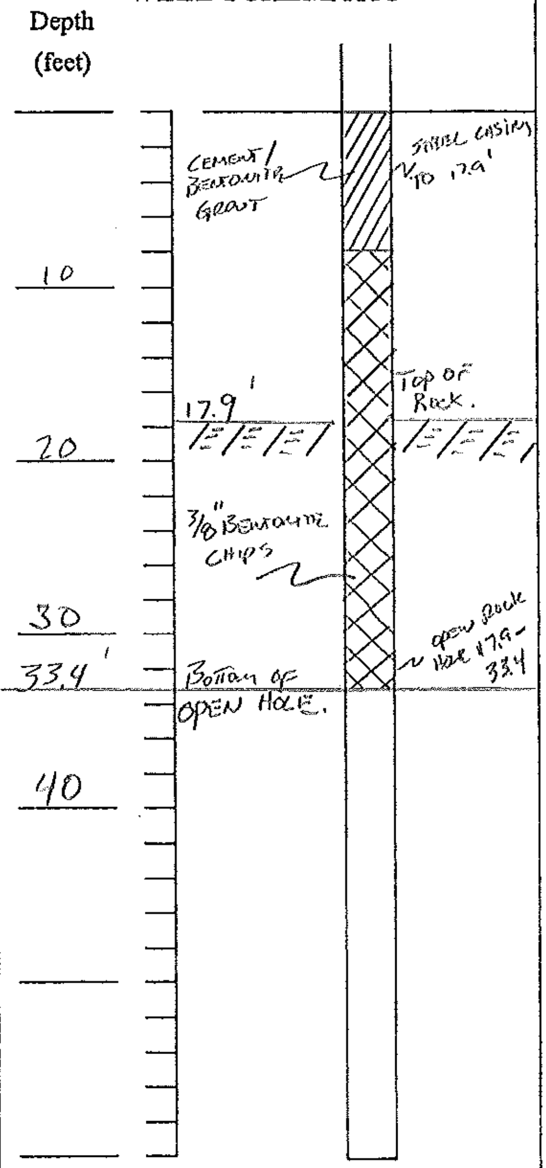
### CASING PERFORATING

| | |
|---|---|
| Equipment used | |
| Number of perforations/foot | |
| Size of perforations | |
| Interval perforated | |

### GROUTING

| | |
|---|---|
| Interval grouted (FBLS) | |
| # of batches prepared | |
| **For each batch record:** | |
| Quantity of water used (gal.) | |
| Quantity of cement used (lbs.) | |
| Cement type | |
| Quantity of bentonite used (lbs.) | |
| Quantity of calcium chloride used (lbs.) | |
| Volume of grout prepared (gal.) | |
| Volume of grout used (gal.) | |

## WELL SCHEMATIC*



COMMENTS: Sealed open hole interval and up into steel casing to 8.0' bgs using 3/8" bentonite chips*. Sealed top 8' using cement/ bentonite grout. Casing cutoff at ground surface.

*12 Bags

Drilling Contractor

*Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Department Representative

**DRILLING SUMMARY**

Geologist:
Craig Taylor / Gary Britt

Drilling Company:
Nothnagle Drilling Co.

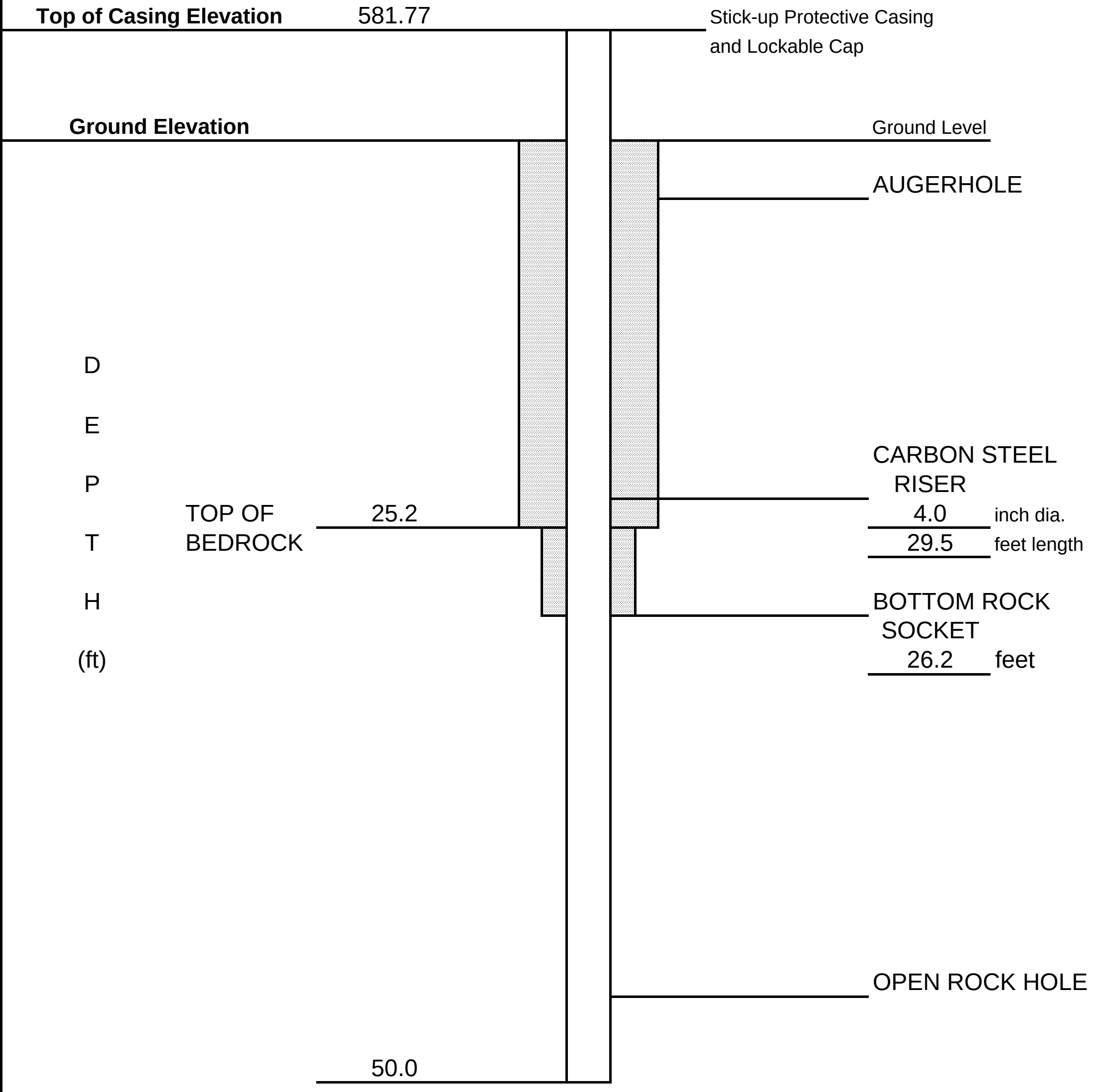
Driller:
Steve Lorante

Rig Make/Model:
CME-85

Date:
11/5/2008

## GEOLOGIC LOG

| Depth(ft.) | Description* |
|---|---|
| 0.0-2.0' | Medium brown, stiff, silty CLAY |
| 2.0-10.0' | Medium brown, very stiff Silty CLAY with trace plastic and slag (FILL) |
| 10.0-16.0' | Black and gray/green, stiff, clayey SILT |
| 16.0-25.2' | Red/brown, very stiff clayey SILT<br>*Overburden description based on 193A log |
| 25.2-50.0' | Lockport Group Guelph Dolomite thick bedded, fine to medium grained, dolostone |
|  | End of boring at 50.0' bgs |



**Not to Scale**

## WELL DESIGN

*CASING MATERIAL*

Surface: 4-inch steel stick-up

Well: 4-inch ID carbon steel

Monitor: open rock hole

*SCREEN MATERIAL*

Type: Open Rock Hole

*FILTER MATERIAL*

Type: None Setting: NA

*SEAL MATERIAL*

Type: Grout Setting: NA

*COMMENTS:*

*ROCK CORING*

| | |
|---|---|
| Cored Interval: | 25.2-50.0 |
| Core Diameter: | 3" |
| Rock Hole Diameter: | 3" |

*LEGEND*

▨ Cement/Bentonite Grout

**Client:** **DuPont CRG**

**Location:** **Necco Park**

**Project No.:** **18985651**

**URS Diamond**

**BEDROCK MONITORING WELL CONSTRUCTION DETAILS**

**Well Number:** **204 C**

## DRILLING SUMMARY

**Geologist:**
Scott McCabe

**Drilling Company:**
Nothnagle Drilling Co.

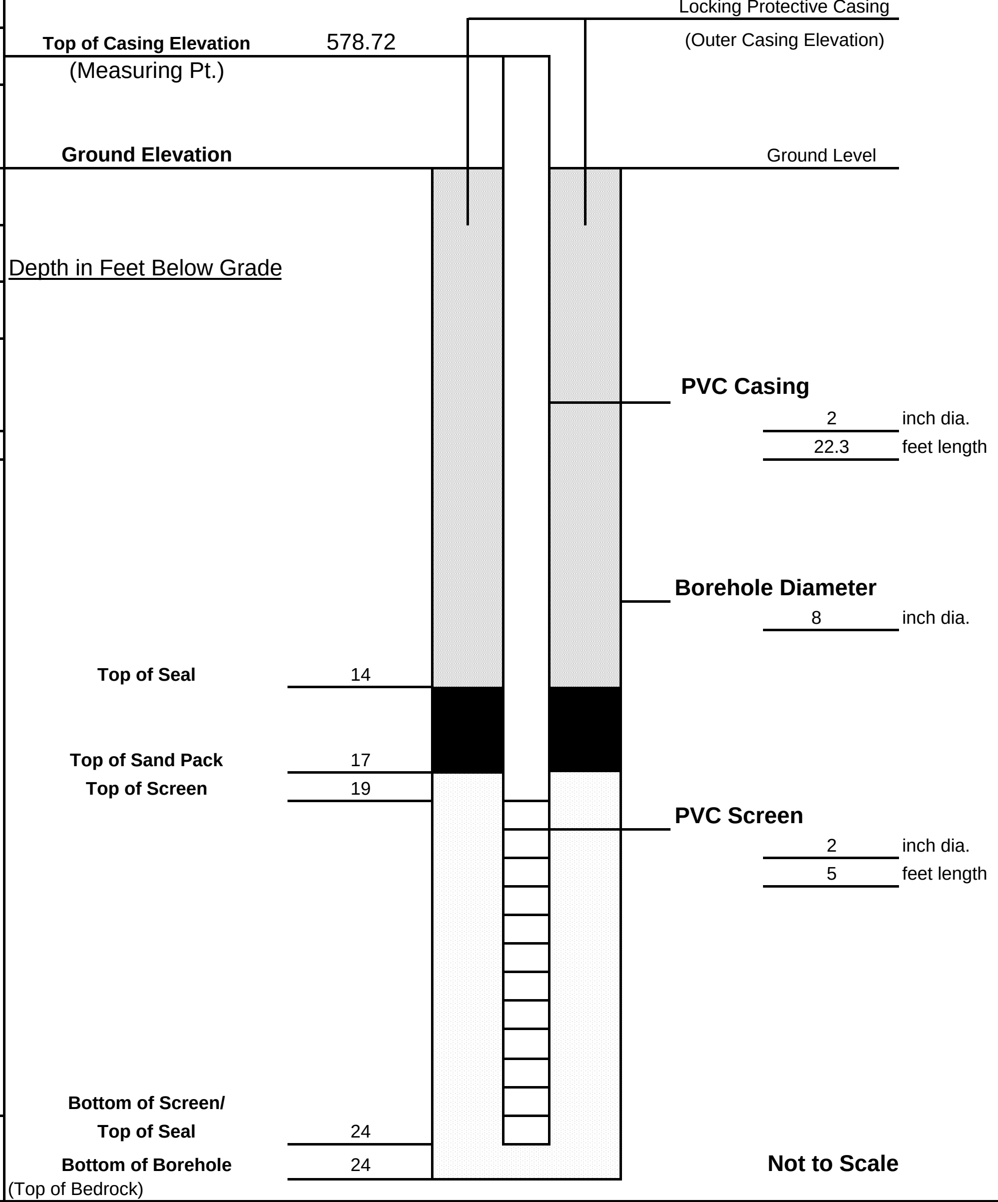
**Driller:**
Steve Lorante

**Rig Make/Model:**
CME-85

**Date:**
7/23/2008

## GEOLOGIC LOG

| Depth(ft.) | Description |
|---|---|
| 0.0-0.5' | Topsoil |
| 0.5-14.0' | Slag, some ciders, trace gravel and asphalt (FILL) |
| 14.0-22.0' | SILTY CLAY, thinnly laminated, few silt lenses |
| 22.0-24.0' | SANDY CLAY, trace to some gravel. |
| 24.0' | Refusal, top of rock<br>* Overburden description based on 168C log. |



**Top of Casing Elevation** 578.72
(Measuring Pt.)

**Ground Elevation**

Depth in Feet Below Grade

**PVC Casing**
2 inch dia.
22.3 feet length

**Borehole Diameter**
8 inch dia.

**Top of Seal** 14

**Top of Sand Pack** 17

**Top of Screen** 19

**PVC Screen**
2 inch dia.
5 feet length

**Bottom of Screen/ Top of Seal** 24

**Bottom of Borehole** 24
(Top of Bedrock)

## WELL DESIGN

***CASING MATERIAL***

**Surface:** Steel protective cover (Stick Up)

**Monitor:** PVC

***SCREEN MATERIAL***

**Type:** Schedule 40 PVC

**Slot Size:** 0.020"

***FILTER MATERIAL***

**Type:** #2 NSF Silica Sand
**Setting:** 24.0-17.0'

***SEAL MATERIAL***

**Type 1:** 3/8" Bentonite Chips
**Setting:** 17.0-14.0'

***COMMENTS:***

***LEGEND***

▨ Cement Grout
■ Bentonite Seal
☐ Sand Pack

**Client: DuPont CRG**

**Location:** **Necco Park**

**Project No.:** **18985651**

***URS Diamond***

**OVERBURDEN PIEZOMETER CONSTRUCTION DETAILS**

**Well Number:** **168 A**

***URS Diamond***

## TEST BORING LOG

**BORING NO:** 204C
**SHEET:** 1 of 2
**PROJECT:** Necco Park, Routine Maintence & Well Replacement
**JOB NO.:** 18985651
**CLIENT:** DuPont CRG
**BORING LOCATION:**
**BORING CONTRACTOR:** Nothnagle Drilling Co.
**GROUND ELEVATION:**
**DATE STARTED:** 11/04/08
**DATE FINISHED:** 11/05/08
**DRILLER:** Steve Lorante
**GEOLOGIST:** Craig Taylor / Gary Britt
**REVIEWED BY:** Dan Sheldon

**GROUNDWATER:**

| DATE | TIME | LEVEL | TYPE | | CAS. | SAMPLER | CORE | TUBE |
|---|---|---|---|---|---|---|---|---|
| | | | | TYPE | 6 1/4" | | HQ | |
| | | | | DIA. | HSA | | 2.5" ID | |
| | | | | WT. | - | | - | |
| | | | | FALL | - | | - | |
| | | | | * POCKET PENETROMETER READING | | | | |

| DEPTH FEET | STRATA | SAMPLE NO. | SAMPLE TYPE | BLOWS PER 6" | REC% RQD% | COLOR | CONSIST HARD | MATERIAL DESCRIPTION | USCS | PID | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | See 193A boring log for lithologic description. | | | |
| 5 | | | | | | | | | | | |
| | | | | | | | | | | | 0 PID readings in overburden. |
| 10 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| 25 | | | | | | | | | | | Auger refusal @ 25.2' |
| | ▨ | Core Run #1 | NX | | | grey | hard | Lockport Group | | | core #1 took 5.0 min. |
| | ▨ | | | | | | | Guelph Dolomite | | | lost ~20 gallons |
| | ▨ | | | | 93% | | | thick bedded, fine to medium | | | PID=5-19 ppm |
| | ▨ | | | | 82% | | | grained, dolostone | | | in water tub. |
| 30 | ▨ | | | | | | | -B Zone 29.0-29.3' | | | |
| | ▨ | | | | | | | | | | |
| | ▨ | | | | | | | | | | |
| | ▨ | Core Run #2 | NX | | | | | | | | |
| | ▨ | | | | 97% | | | | | | No water loss observed |
| 35 | ▨ | | | | 92% | | | | | | in Core Run #2 |
| | ▨ | | | | | ↓ | ↓ | | | | |

**Comments:** Boring advanced with truck-mounted CME-85 drill rig using
6 1/4" ID HSA to 25.2'. Roller Bit to 32.5' and set casing.
NX core 25.2'-50.0'.

**PROJECT NO.** 18985651
**BORING NO.** 204C

| *URS Diamond* | **TEST BORING LOG** |
|---|---|
| | **BORING NO:** 204C |
| **PROJECT:** **Necco Park, Routine Maintence & Well Replacement** | **SHEET:** 2 of 2 |
| **CLIENT:** **DuPont CRG** | **JOB NO.:** 18985651.00 |

| | **SAMPLE** | | | | | **DESCRIPTION** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEPTH FEET** | **STRATA** | **NO.** | **TYPE** | **BLOWS PER 6"** | **REC%<br>RQD%** | **COLOR** | **CONSIST HARD** | **MATERIAL DESCRIPTION** | **USCS** | **REMARKS**<br>**PID** | |
| 40 | ▨ | Core Run #2 | NX | | 97%<br>92% | grey | hard | Lockport Group<br>Guelph Dolomite<br>thick bedded, fine to medium grained, dolostone | | | |
| 45 | ▨ | Core Run #3 | NX | | 98%<br>97% | | | | | | No water loss observed in Core Run #3 |
| 50 | ▨ | | | | | | | | | | |
| | | | | | | | | Boring completed at 50.0' bgs | | | |
| 55 | | | | | | | | | | | |
| 60 | | | | | | | | | | | |
| 65 | | | | | | | | | | | |
| 70 | | | | | | | | | | | |
| 75 | | | | | | | | | | | |

**Comments:** Boring advanced with truck-mounted CME-85 drill rig using
6 1/4" ID HSA to 25.2'. Roller Bit to 32.5' and set casing.
NX core 25.2'-50.0'.

**PROJECT NO.** 18985651
**BORING NO.** 204C

# APPENDIX G

# LANDFILL CAP INSPECTION RESULTS

# EXHIBIT A
# NECCO PARK LANDFILL
# CAP AND SURFACE WATER DRAINAGE
# INSPECTION CHECKLIST

DATE: 10-3-08
INSPECTOR: Jerry Shepard
WITNESSES: Bary Britt

EMERGENCY CONTACT:
GERALD SHEPARD
716.278.5149

CONDITION: (Check) (Not Acceptable or Not Present require comments below)

| | Acceptable | Not Acceptable | Present | Not Present | Remarks |
|---|---|---|---|---|---|
| 1) Vegetative Cover, Ditches, Culverts | X | | | | |
| a) Sediment Build-Up/Debris | | | | X | |
| b) Pooling or Ponding | | | | X | |
| c) Slope Integrity | X | | | | |
| d) Overall Adequacy | X | | | | |
| e) Culvert Condition | X | | | | |
| 2) Access Roads | | | | | |
| 3) Landfill Cover System | | | | | |
| a) Erosion Damage | | | X | | Minor Ruts South Slope |
| b) Leachate Seeps | | | | X | |
| c) Settlement | | | | X | |
| d) Stone Aprons | X | | | | |
| e) Vegetation | X | | | | |
| f) Animal Burrows | | | X | | small Mole Burrows |
| 4) Slope Stability | | | | | |
| a) Landfill Top Soil | X | | | | |
| b) Landfill Side Slope | X | | | | |
| 5) Gas Vents | X | | | | |
| 6) Monitoring Wells | X | | | | |

COMMENTS:

DESCRIPTION OF CONDITION:

* Cap and Vegetation Acceptable - good Condition

* Ditch - good Condition/Acceptable

DESCRIPTION OF CONCERN:

DESCRIPTION OF REMEDY:

# EXHIBIT B
# NECCO PARK LANDFILL
# CAP AND SURFACE WATER DRAINAGE
# MAINTENANCE CHECKLIST

DATE: 10-3-08
INSPECTOR: Jerry Shepard
WITNESSES: Gary Britt

EMERGENCY CONTACT:
GERALD SHEPARD
716.278.5149

| Maintenance Performed (Check) | Item | Performed by: | Remarks |
|---|---|---|---|
| | 1) Vegetative Cover: | | |
| | a) Seeding | JS/GB | |
| | b) Fertilizing | " " | |
| | c) Topsoil Replaced | " " | |
| X | d) Removal of Undesirable Vegetation | JS/GB/Napier | ditch vegitation cut 9/30 |
| | 2) Drainage Ditches | | |
| | a) Sediment Removal | JS/GB | |
| | b) Fill | | |
| | c) Regrading | | |
| | d) Stone Apron Repair | | |
| | e) Vegetative Cover Placement | | |
| | f) Liner Replacement | | |
| | 3) Access Road | | |
| | a) Excavation | JS/GB | |
| | b) Fill | | |
| | c) Grading | | |
| | d) Stone Paving | | |
| | 4) Landfill Cap | | |
| | a) Excavation | JS/GB | |
| | b) Cover Materials | | |
| | - topsoil | | |
| | - barrier protection layer | | |
| | - drainage composite | | |
| | - geomembrane | | |
| | - geotextile | | |
| | c) Testing | | |
| | d) Barrier Protection Layer | | |
| X | e) Vegetative Cover | Napier | Mowed 9/30 |
| | 5) Gas Vents | | |
| | - Pipes | | |
| | - Bedding and Adjacent Media | | |
| | 6) Other | | |

DESCRIPTION OF MAINTENANCE ACTIVITIES: ____________________