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GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

September 7, 2004
Project 97598

Mr. Christopher Pyott
Environmental Analyst
Department of Environmental Protection
Bureau of Waste Site Cleanup
One Winter Street
Boston, MA 02108

Dear Mr. Pyott:

Re: Part 2 Construction-Related Release Abatement Measure (RAM) Status Report No. 8
Olin Wilmington Property
51 Eames Street
Wilmington, MA
RTN 3-0471

Enclosed is Status Report No. 8 for the Part 2 Construction-Related Release Abatement Measure (RAM) at the Olin Corporation (Olin) Property in Wilmington, Massachusetts, dated September 7, 2004. This RAM Status Report was prepared by GEI on behalf of Olin. A RAM and Utility Related Abatement Measure (URAM) Transmittal Form (BWSC-106), signed by the Licensed Site Professional (LSP) of Record, M. Margret Hanley, is enclosed with this letter.

This RAM Status Report proposes minor modifications to the RAM Plan, and/or the Post-Construction Monitoring Plan (PCMP). These proposed changes are described in Section 7 of the report.

Please note that for reasons not related to conditions at the Property, the proposed warehouse development plan upon which this Construction-Related RAM was based did not proceed. A new development plan is under consideration for the use of the northern portion of the Property as a transrail facility. Although remedial efforts taken during this RAM will contribute to conditions that support the use of the northern portion of the Property as a transrail facility, this RAM does not, nor is it intended to, meet the requirements of the Construction Policy as they apply to that use. An updated Focused Site Characterization (FSC), Focused Risk Assessment (FRA), Focused Feasibility Study (FFS), and Construction-Related RAM Plan, will be submitted to DEP for that purpose, in the future.

A copy of this RAM Status Report will be placed in the Olin Site Public Repository, which is maintained at the Town of Wilmington Memorial Library at 175 Middlesex Avenue in Wilmington, Massachusetts. Copies will also be provided to the Wilmington and Woburn Town Offices and Boards of Health.

Olin intends to submit a Completion Statement for this RAM, upon the off-site disposal of the Lake Poly soils. This work is scheduled to be completed in September 2004. At your request, a

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public comment period for this Status Report No. 8 and the RAM Completion Statement will be established and announced in the next Public Involvement Plan (PIP) Update, at the end of September 2004.

Please call Mr. Steve Morrow at Olin (423.336.4511) if you have any questions regarding the enclosed material.

Sincerely,

GEI CONSULTANTS, INC.

Thomas W. Kahl, P.E.
Branch Manager

MMH/LJW:lek
Enclosures
c: Larry Welch, GEI
Eric Axelrod, MACTEC
Steve Morrow, Olin
M. Margret Hanley, Sleeman Hanley & DiNitto, Inc.
Greg Erikson, Wilmington Board of Health
Christine Stewart, Wilmington Memorial Library
Michael Caira, Wilmington Town Manager
Jack Fralick, Woburn Board of Health
John Curran, Woburn Mayor

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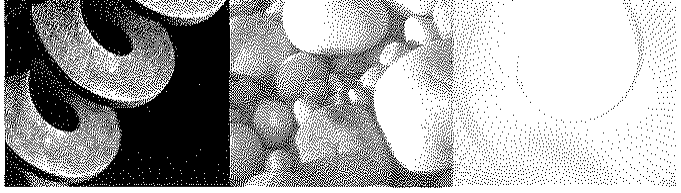

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GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Part 2 Construction-Related Release Abatement Measure Status Report No. 8

A Portion of the 51 Eames Street Site
Wilmington, MA, RTN 3-0471

Submitted to:
Olin Corporation
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Charleston, TN 37310-0248

Prepared by:
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1021 Main Street
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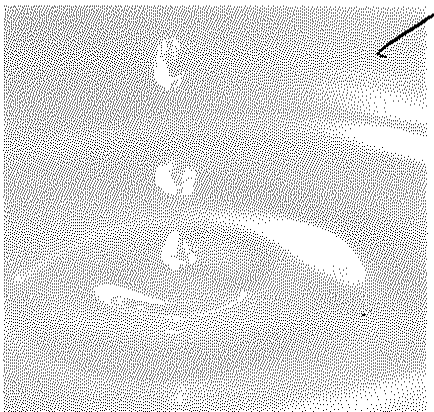
September 7, 2004

Project 97598



M. Margret Hanley, LSP
LSP of Record

Table of Contents

Executive Summary iv

Acronyms viii

1. Introduction 1
- 1.1 Background 1
- 1.2 Contact Information 3
- 1.3 Site Conditions 3
- 1.4 RAM Objectives 2
- 1.5 Environmental and Geological Setting 3

2. Plans and Permits 4
- 2.1 RAM Plan 4
- 2.2 RAM Plan Modifications 4
- 2.3 Other Permits and Approvals 6

3. Summary of 2004 RAM Activities 9
- 3.1 Biocell Drainage Sand Sampling 9
- 3.2 Lake Poly Excavation 10
- 3.3 Central Pond 10
- 3.4 Temporary Cap Drum Management 11
- 3.5 Post-Construction Monitoring Plan (PCMP) 11
  - 3.5.1 Surface Water Monitoring 11
  - 3.5.2 Groundwater Monitoring 12
  - 3.5.3 Sediment Monitoring 12
  - 3.5.4 Temporary Cap Inspections 12
  - 3.5.5 Annual Containment Wall/Cap System Performance Evaluation 13

4. Comprehensive Summary of RAM Activities 14
- 4.1 Pre-Construction Activities (July to September 2000) 14
- 4.2 Construction Activities 14
  - 4.2.1 Containment Wall/Cap System 14
  - 4.2.2 Bioremediation Cell 15
  - 4.2.3 Surface Water and Storm Water Management Structures 16
- 4.3 Sediment Excavation and Confirmatory Sampling Summary 17
  - 4.3.1 On-Property West Ditch and West Ditch Wetland 17
  - 4.3.2 Buried Debris Area 18
  - 4.3.2 South Ditch and Delta 18

4.3.4 Central Pond/Central Drainage Area 18
4.4 Hot Spot Excavations/Lake Poly 19
4.5 Central Pond Oily Soil Remediation 20
4.6 Remediation Waste and Soil Management 21
4.6.1 Soil Transported Off-Property 21
4.6.2 Soil Pending Off-Site Disposal 21
4.6.3 Soil Re-used On-Property 22
4.6.4 Soil Currently Stockpiled On-Property 22
4.6.5 Dewatering Effluent 23
4.7 Monitoring Activities 23
4.7.1 Monitoring During Construction and Remediation Activities 23
4.7.2 Post-Construction Monitoring 23
4.8 RAM Impacts on Site Characterization 26

5. Proposed Post-RAM Activities and Reporting 27
5.1 Containment Area Permanent Cap Installation 27
5.2 Biocell/Drainage Sand 27
5.3 Wetland Permits 27
5.6 Post-Construction Monitoring 28

6. Deviations from RAM Plan and Other DEP Approvals 30

7. Summary of Modifications or Proposals Presented in this Status Report 31

8. Schedule 32

Tables

1. Summary of Post-RAM Activities
2. Summary of Post-Construction Monitoring Plan (2004/2005)

Figures

1. Site Locus Map
2. Site Plan and Work Completed through July 2004
3. Monitoring and Sampling Locations through July 2004

Appendices

A. DEP RAM Transmittal Form
B. DEP and EPA Approvals / Correspondences
C. Bioremediation Cell Data

D. 2004 Lake Poly Remedial Excavation Details
E. Post-Construction Monitoring Plan Data, January through July 2004
F. Temporary Cap Quarterly Inspection Reports 2004 and Annual Analysis of Post-Construction Monitoring Plan Data (Geomega)
G. As-Built Construction Plans
H. Summary of Sediment and Hot Spot Removal Confirmatory Sampling Results for 2000 and 2001

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Executive Summary

This Part 2 Construction-Related Release Abatement Measure (RAM) Status Report No. 8 presents a summary of response actions performed as part of the Part 2 Construction-Related RAM at the Olin Corporation (Olin) Property at 51 Eames Street in Wilmington, Massachusetts (the Property). This report describes the recent RAM activities performed during the period from January through July 2004, and also provides summaries of activities conducted since July 2000. The majority of construction and remediation activities were conducted in 2000 and 2001 with the exception of additional excavation around the banks of Central Pond and upgrades to the Temporary Cap in 2003 and additional excavation in the former Lake Poly area in 2004. Since 2001, a Post-Construction Monitoring Plan (PCMP) has been conducted to monitor the effectiveness of the Containment Wall/Cap system.

The objectives of the original RAM plan were to:

- Remove chromium and phthalate-contaminated sediments from selected portions of the On-Property Ditch System to eliminate exceedances of the Upper Concentration Limits (UCLs) and to achieve Site background concentrations of Site-related contaminants of concern (COCs) to the extent feasible.
- Contain residual Dense Aqueous Phase Liquid (DAPL) and significantly contaminated groundwater within a subsurface containment system (slurry wall) to reduce the discharge of contaminated groundwater, and therefore mitigate the impact on surface water and sediments in the On-Property Ditch System.

Additional objectives were established by RAM Plan Modifications and correspondence with the Massachusetts Department of Environmental Protection (DEP) including:

- Eliminate three locations of significant soil contamination, generally referred to herein as "hot spots."
- Initiate a Post-Construction Monitoring Plan (PCMP) to monitor groundwater and surface water quality on and near the Property after the construction of the Containment Wall/Cap system was completed in 2001.
- Delineate the historical limits of the Former Lake Poly area and excavate soil with contaminant concentrations exceeding UCLs.
- Excavate soil along the banks of the Central Pond to remediate areas where oily subsurface soil was observed in 2001.

- Develop a plan for dismantling the Bioremediation Cell and reuse or disposal of the drainage sand.

The following activities have been completed to achieve the RAM objectives:

- Construction of a Containment Wall/Cap system to contain on-property DAPL and significantly contaminated groundwater. The current Containment Wall/Cap system consists of a subsurface soil-clay slurry wall and a temporary polyethylene cap. Periodic evaluations based on PCMP data have indicated that the Containment Wall/ Cap system provides effective hydraulic containment for the on-property DAPL and DAPL-affected groundwater.
- Excavation of chromium- and phthalate-contaminated sediment from the on-property wetland system, including the On-Property West Ditch and West Ditch Wetland, Central Pond, and portions of the South Ditch (the assessment of the of the lower 600 feet of the South Ditch is being addressed separately). The sediment excavations have successfully reduced chromium and phthalate concentrations to below UCLs and approached Site background concentrations to the extent feasible.
- Construction of a lined Bioremediation Cell (Biocell) to enable on-property biological treatment of phthalate-contaminated sediment excavated from on-property wetlands. Due to greater than expected chromium concentrations, the sediment was shipped off-property for disposal without treatment.
- Excavation of three hot spots (A8CW-1, RSO-6, and Lake Poly-1) was conducted in 2000. The excavations of hot spots A8CW-1 and RSO06 successfully reduced contaminant concentrations below UCLs and therefore the remediation objectives at these hot spot locations were met. However, results of confirmatory samples from the Lake Poly-1 hot spot excavation indicated that UCLs were not achieved with the initial excavation. As described herein, in June 2004, approximately 600 cubic yards (cy) of additional soil were excavated to address the Lake Poly contamination. Confirmatory sample results from the 2004 Lake Poly excavation indicate that the expanded remedial excavation was successful in reducing contaminant concentrations below UCLs.
- Excavation of oily subsurface soil from the east and north banks of Central Pond. The remedial excavations have successfully removed the area of oily soil adjacent to Central Pond. The purchase and placement of the additional topsoil required to restore the area to the original grade was completed on August 18, 2004.
- Off-site disposal of one 55-gallon drum of solid material discovered at the ground surface in April 2003, in the Containment Area. This material was tested for hazardous waste characteristics in August 2003 and disposed of off-site at a licensed disposal facility as a contaminated non-hazardous waste material, in August 2004.

The following remaining Activities are required to complete the RAM:

- Disposal of remediation waste currently stored on the Property, consisting of soil excavated from Lake Poly in June 2004. Olin is currently making arrangements with a licensed facility for the disposal of this remediation waste before the end of September 2004.

Olin intends to submit a Completion Statement for this RAM, in accordance with the MCP (310 CMR 40.0446) upon the removal, and appropriate off-site disposal of the stockpiled Lake Poly soils. This work is scheduled to be completed in September 2004. Olin proposes to continue certain activities associated with this RAM, as "Post-RAM Activities." Following the submission of the RAM Completion Statement, the status of the Post-RAM Activities will be reported to DEP semiannually as part of the PCMP.

Proposed Post-RAM Activities, which will be performed as part of the PCMP, will include:

- **Maintenance of Temporary Cap and Installation and Monitoring of Permanent Cap.** Until such time that the permanent cap is designed and installed over the Containment Area, the Temporary Cap will be maintained and inspected on a quarterly basis. Quarterly inspection reports will be submitted to DEP as part of the Post-Construction Monitoring Plan (PCMP) described below. As part of future property redevelopment, the Temporary Cap will be replaced with a permanent pavement cap. The design for the permanent cap will be submitted to DEP as part of the developer's RAM plan for property redevelopment. The permanent cap will be inspected on a periodic basis, as required by DEP.
- **Reuse of Biocell Sand.** The drainage sand stockpiled in the Biocell will be reused on-property as part of redevelopment activities or the drainage sand will be spread out as a uniform layer and left in place. After the sand is removed (or graded), the Biocell area will be restored.
- **Closure of Active Wetland Permits.** Active wetland permits obtained for the completed RAM activities will be closed after the required long term monitoring of restored wetlands have been completed, and following the review and approval of the Wilmington Conservation Commission (WilmCC), DEP, and the United States Army Corp of Engineers (USACE), as appropriate.
- **Post-Construction Monitoring.** The current PCMP program will continue, unless modifications are approved by DEP, and will include quarterly groundwater elevation measurements, quarterly groundwater and surface water sampling, annual sediment sampling in sediment remediation areas and annual analysis of the PCMP data and assessment of the ongoing effectiveness of the Containment Wall/Cap system.

For reasons not related to conditions at the Property, the proposed warehouse development plan upon which this RAM was based did not proceed.

Acronyms

ACOE	Army Corps of Engineers
AS/SVE	air sparging/soil vapor extraction
BSC	BSC Group
CA/T	Central Artery/Third Harbor Tunnel Project
COC	contaminant of concern
cy	cubic yards
DAPL	Dense Aqueous Phase Liquid
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
FFS	Focused Feasibility Study
FRA	Focused Risk Assessment
FSC	Focused Site Characterization
HDPE	high-density polyethylene
HESE	Harding ESE
IRA	Immediate Response Action
LSP	Licensed Site Professional
MACTEC	MACTEC Engineering and Consulting, Inc.
DEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
NDMA	N-nitrosodimethylamine
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
Olin	Olin Corporation
OOC	Order of Conditions
OPWD	Off-Property West Ditch
ORAD	Order of Resource Area Delineation
PCMP	Post-Construction Monitoring Plan
RAM	Release Abatement Measure
RTN	Release Tracking Number
SVOC	semivolatile organic compounds
TCLP	toxic characteristic leaching procedure
TPH	total petroleum hydrocarbons
UCL	Upper Concentration Limit
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound
WilmCC	Wilmington Conservation Commission
WMI	Waste Management, Inc.

1. Introduction

1.1 Background

This document is the eighth Status Report for the Construction-Related Release Abatement Measure (the RAM) performed at the Olin Property at 51 Eames Street in Wilmington, Massachusetts (the Property). The location of the Property is shown in Figure 1. A plan of the Property is presented in Figure 2. The Property is part of the area that constitutes the 51 Eames Street Site (RTN 3-0471), a Tier 1A site as defined in the Massachusetts Contingency Plan (MCP). The original RAM transmittal form (BWSC-106) for this document is attached and a copy is contained in Appendix A. This Status Report describes construction and monitoring work performed from July 2000 through July 2004.

The Part 1 RAM Plan was submitted to the Massachusetts Department of Environmental Protection (DEP) on April 6, 2000, in part to support a warehouse development plan for the northern portion of the Property. The Part 1 RAM Plan contained a Focused Site Characterization (FSC), Focused Risk Assessment (FRA), and Focused Feasibility Study (FFS), as required by DEP Policy No. WSC-00-425, Construction of Buildings in Contaminated Areas, dated January 2000 (the Construction Policy). The Part 1 RAM Plan was conditionally approved by DEP on June 26, 2000.

The Part 2 RAM Plan was submitted to DEP on July 24, 2000, and included excavation, treatment, and reuse or disposal of contaminated soil and sediment, and the construction of a soil-clay containment wall and cap to control the migration of on-property dense aqueous phase liquid (DAPL).

Concurrent with the RAM activities, separate assessment and remedial measures took place at the Property and included:

1. Surface water and groundwater monitoring activities were conducted on, and near, the Property as part of the South Ditch/Former Weir Area IRA. IRA Status Report No. 1 was submitted to DEP on June 1, 2001. IRA Status Report No. 2 and Completion Statement was submitted to DEP on December 5, 2001.
2. A Drum Removal RAM was performed for the purpose of excavating and removing buried drums, debris, and associated impacted soil from two areas at the property (Drum Areas A and B). A Completion Statement for the Drum RAM, dated July 12, 2001, was submitted to DEP.

3. Surface water monitoring activities were conducted in the South Ditch from December 2000 through October 2001. In December 2001, the surface water monitoring activities were incorporated into the Post-Construction Monitoring Plan (PCMP).
4. An Immediate Response Action (IRA) for the Plant B area was performed, which included the operation of a groundwater recovery and treatment system, soil-vapor extraction system, oil recovery and a nutrient injection system. The Plant B IRA is ongoing and the last status report was dated February 25, 2004.
5. An IRA related to the detection of N-Nitrosodimethylamine (NDMA) was established at the Site in April 2003. The IRA included Site-wide testing of shallow groundwater and other media at the Property for the purpose of evaluating if an imminent hazard existed due to the presence of NDMA. The IH evaluation for NDMA at the Site, including the Property, concluded that an IH does not exist due to NDMA and was submitted to DEP on July 2004. Interim data submittals, presenting laboratory data validation memorandums, were provided to DEP and the Site Repository of Information at the Wilmington Memorial Public Library on June 6, June 30, July 3, and July 29, 2003. Pending DEP's confirmation that the requirements for a private well inventory have been met, the IRA Completion Statement will be filed in late 2004.
6. Supplemental Phase II Investigations related to the detection of NDMA, hydrazine, and formaldehyde, were initiated at the Site in April 2004. The investigations included Site-wide testing to assess the source, nature and extent of NDMA, and included testing at the Property. The results of the Supplemental investigations have been summarized in a report dated December 2003. These investigations are ongoing. Interim data submittals for the Supplemental Phase II investigations, presenting laboratory data validation memorandum, were submitted to the DEP and the Site Repository of Information on October 27, 2003 and July 1, 2004.

Analytical data developed for the Property during this RAM and the MCP response actions described above, were collected, analyzed, and validated in accordance with the Project QAPP, and entered with qualifiers, as appropriate, in the Olin Project database. Unless noted above, per Olin's agreement with DEP, copies of the analytical data provided by the laboratory and data validation summaries are not included in this or previous submittals, but are available upon request.

1.2 Contact Information

Responsibility for the Construction-Related RAM
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1.3 Site Conditions

The Olin Property is comprised of approximately 53 acres of undeveloped land and an inactive industrial facility located in a commercial and industrial area in Wilmington, Massachusetts. A plan showing the existing conditions of the Property is shown in Figure 2.

The Property was the location of a former chemical manufacturing facility that operated from 1953 until 1986. The former manufacturing processes conducted at the Property generated liquid wastes, which contained sulfuric acid, sodium chloride, sodium sulfate, ammonium sulfate, chromium sulfate, and other constituents, including oils and organic compounds. Prior to 1972, the discharge of these wastes into unlined pits, Lake Poly, and other disposal areas on the Property caused subsurface contamination both on and off the Property.

These historical releases of oil and hazardous material at the Property have resulted in the contamination of soil, groundwater, sediment, and surface water at the Property, and areas to the east, south and west of the Property. As a result of some these releases, a Dense Aqueous Phase Liquid (DAPL) is present at the top of bedrock in groundwater in portions of the Property and in the subsurface at areas to the west of the Property. Light Non-Aqueous Phase Liquid (LNAPL) composed of organic compounds is also present in groundwater in the Plant B Area. Both the DAPL and the LNAPL contribute to the presence of contamination in groundwater and, at some locations, surface water on the Property. Detailed histories for the Property and the Site are contained in the report entitled Supplemental Phase II Comprehensive Site Assessment (Phase II CSA) prepared by Smith, dated June 1997, and the Part 1 RAM Plan.

1.4 RAM Objectives

These RAM response actions are intended to make the property suitable for a specific warehouse redevelopment scenario proposed for the Property in 2000. Accordingly, submittals associated with the RAM were prepared in accordance with the requirements of DEP's Policy No. WSC-00-425 Construction of Buildings in Contaminated Areas, dated January 2000 (the Construction Policy).

The two initial objectives presented in the RAM Plan were:

1. Remove chromium and phthalate-contaminated sediments from selected portions of the On-Property Ditch System to eliminate exceedances of the Upper Concentration Limits (UCL) and to achieve background concentrations of Site-related contaminants of concern (COCs) to the extent feasible.
2. Contain residual DAPL and significantly contaminated groundwater within a subsurface containment system (slurry wall) to mitigate the impact of the discharge of contaminated groundwater on surface water and sediments in the On-Property Ditch System.

Additional objectives were established by RAM Plan Modifications and correspondence with the Massachusetts Department of Environmental Protection (DEP) including:

- Eliminate three locations of significant soil contamination, generally referred to herein as "hot spots."
- Initiate a Post-Construction Monitoring Plan (PCMP) to monitor groundwater and surface water quality on and near the Property after the construction of the Containment Wall/Cap system was completed in 2001.
- Delineate the historical limits of the Former Lake Poly area and excavate soil with contaminant concentrations exceeding UCLs.
- Excavate soil along the banks of the Central Pond to remediate areas where oily subsurface soil was first observed in 2001.
- Develop a plan for dismantling the Bioremediation Cell and reuse or disposal of the drainage sand.

For reasons not related to conditions at the Property, the proposed warehouse development plan did not proceed.

1.5 Environmental and Geological Setting

The areas of sediment remediation and the Containment Wall/Cap system were comprised of a combination of open, wooded, and wetland areas. Sediment excavation areas included the Central Pond, portions of the Central Pond Drainage Area, the South Ditch, and the On-Property West Ditch and West Ditch Wetland. The shallow subsurface soils of the Property consist of sand, with some silt and gravel. Deeper soils are less well-sorted and contain sand, gravel, cobbles, and occasional boulders. Wetland overburden soils are similar, with 0.5 to 4 feet of organic sediment or peat at the surface. Ground surface elevations at the Property range from 74 to 105 feet National Geodetic Vertical Datum (NGVD). Depth to bedrock in the vicinity of the containment wall ranges from 0 to about 40 feet. Measured groundwater elevations at the Property have ranged from 76 to 84 feet NGVD.

2. Plans and Permits

2.1 RAM Plan

The RAM Plan for this work was submitted to DEP on April 6, 2000. The RAM Plan was conditionally approved by DEP on June 26, 2000. The locations and Site features that are relevant to the implementation of this RAM Plan, including the locations of warehouses, soil stockpile areas, sediment excavation areas, the Containment Area, the Bioremediation Cell, and other features are depicted in Figure 2.

2.2 RAM Plan Modifications

Through July 2004, eleven RAM modification requests and associated addendums have been submitted to DEP.

- Modification No. 1 was submitted to DEP on September 12, 2000, and requested approval to perform bedrock blasting to construct the storm water Detention Pond south of the Containment Area. The bedrock blasting was approved by DEP on September 28, 2000, and the blasting was completed in September 2000. Details of the blasting were reported in Status Report No. 1.
- Modification No. 2 was submitted to DEP on October 5, 2000, and requested approval to establish sediment excavation cleanup criteria and redefine the proposed sediment excavation limits for the On-Property West Ditch and West Ditch Wetland. The modification was conditionally approved by DEP on November 9, 2000. Details of the sediment excavation in these areas were presented in Status Report No. 1.
- Modification No. 3 was submitted to DEP on October 24, 2000, and requested approval to excavate three locations of significant soil contamination outside of the sediment excavation areas and the Containment Area. The locations and associated soil contamination are Lake Poly-1 (ammonia, trimethylpentenes, and chromium), A8CW-1 (polycyclic aromatic hydrocarbons (PAHs) and dibenzofuran), and RSO-6 (cadmium). The modification was conditionally approved by DEP on November 2, 2000, and the excavations were completed in November 2000. Details of the excavation in these areas were presented in Status Report No. 1.
- Modification No. 4 was submitted to DEP on April 18, 2001, and requested approval to reuse the approximately 2,700 cy of topsoil stripped from the Containment Area to restore aquatic and non-aquatic areas of the property that were disturbed during the RAM activities. Addendum to Modification No. 4 was submitted to DEP on

November 9, 2001, and provided ecological risk potential of using average soil stockpile concentrations to supplement the original request to re-use the topsoil excavated during the RAM. In a letter to Olin dated February 2, 3002, DEP granted Olin permission to reuse the stockpiled topsoil only in upland areas of the Property. To date, the topsoil has not been reused and remains stockpiled at the Property.

- Modification No. 5 was submitted to DEP on April 20, 2001, and requested approval for an insignificant change to the weir design. An alternative design was developed to eliminate an off-property extension of the existing railroad culvert. The modification was verbally approved by DEP in May 2001 and the alternative design was constructed in 2001.
- Modification No. 6 was submitted to DEP on April 27, 2001, and requested approval to dispose of approximately 3,460 cy of excavated sediment at an off-site landfill, in lieu of on-property treatment and reuse. The modification was verbally approved by DEP in May 2001 and the sediment was transported off-site for disposal at a licensed facility as described in Status Report No. 2.
- Modification No. 7 was submitted to DEP on May 14, 2001, and requested approval to increase the estimated volume of excavated materials from 6,000 to 10,800 cy. The modification was verbally approved by DEP in May 2001. The total volume of material that has been excavated and transported offsite during the RAM activities to date is 7,250 cy. An additional 600 cy of soil excavated from Lake Poly in June 2004 is currently stored at the Property pending final arrangements for disposal at a licensed facility.
- Modification No. 8 was submitted to DEP on June 12, 2001, and requested approval to collect and analyze soil and groundwater samples to further delineate the historical limits of the Former Lake Poly Area. Approval to excavate up to 2,600 cy of the Former Lake Poly materials was also requested. The modification was verbally approved by DEP on June 19, 2001, and the proposed investigations took place in August 2001. Details of the 2001 investigations were presented to DEP in an Interim Status Report dated October 12, 2001.
- Addendum to Modification No. 8 was submitted to DEP on August 28, 2003, and proposed additional investigation in the Lake Poly area prior to remedial excavation to update the characterization to include N-nitrosodimethylamine (NDMA), hydrazine and formaldehyde. Proposed modifications to the scope of work were also submitted on November 21, 2003. DEP conditionally approved the addendum in a letter dated December 12, 2003. The additional investigations were conducted in December 2003 and were reported to DEP in a letter report dated February 9, 2004. Following DEP's approval, the excavation of the Lake Poly area was completed in June 2004.

- Modification No. 9 was submitted to DEP on October 9, 2001, and requested approval to perforate the liner of the Bioremediation Cell and leave the drainage sand in place pending natural attenuation of organic contaminants. DEP reviewed the modification and requested additional sampling of the water in the Biocell and in surrounding groundwater. The water quality sampling was conducted in March 2002 and the results were submitted to DEP as addendum to Modification No. 9.
- Addendum to Modification No. 9 was submitted to DEP on June 3, 2002, and provided chemical data for the sampling of surface water in the Biocell and surrounding groundwater and proposed penetrating the Biocell liner and leaving the stockpiled drainage sand in place. DEP granted approval to penetrate the liner and leave the drainage sand in place for up to one year. The Biocell liner was penetrated in July and December 2002 to allow precipitation detained by the Biocell liner to infiltrate to groundwater. The drainage sand remains stockpiled in the Biocell and has been sampled on an annual basis to monitor the ongoing natural attenuation of organic contaminants in the sand.
- A scope of work for a Post-Construction Monitoring Plan (PCMP) was presented to DEP on August 29, 2001. The PCMP included installing additional wells and monitoring groundwater and surface water on and near the property. DEP conditionally approved the PCMP in a letter dated October 5, 2001. The PCMP monitoring is ongoing and results are presented to the DEP semiannually.
- Modification No. 10 was submitted to DEP on July 17, 2002, and contained a scope of work for remedial excavation of contaminated soil observed along the eastern bank of Central Pond. DEP conditionally approved the scope of work in a letter dated August 5, 2002. The remedial excavation took place in the summer and fall of 2003. Results of confirmatory sampling were reported to DEP in Status Report No. 7, dated February 26, 2004.
- Modification No. 11 was submitted to DEP on November 18, 2002, and proposed improvements to the Temporary Cap. DEP approved the modification in a letter dated November 21, 2002. The Temporary Cap improvements were completed in spring 2003.

2.3 Other Permits and Approvals

A description, and in most cases a copy, of each of the following permits and approvals were presented in previous Status Reports as indicated below:

- Massachusetts Environmental Policy (MEPA) Act Waiver. The MEPA Waiver states that the Secretary of Environmental Affairs determined that an Environmental Impact Report (EIR) was not required. This determination is summarized in the Record of

Decision dated August 14, 2000. A copy of the determination was submitted with RAM Status Report No. 1.

- Town of Wilmington Conservation Commission (WilmCC), Order of Conditions (OOC), DEP File No. 344-733. The OOC was granted on July 25, 2000. After a request by Olin, the WilmCC approved to extend the OOC deadline until September 1, 2003. A Request for Certificate of Compliance was submitted to the WilmCC on May 7, 2004. The WilmCC review of the Request for Certificate of Compliance is ongoing at this time.
- DEP 401 Water Quality Certification. The Water Quality Certification was granted on July 27, 2000, and a copy was submitted with RAM Status Report No. 1.
- U.S. Army Corps of Engineers (USACE) 404 Dredging Permit. The 404 Dredging Permit for work in and around wetlands was granted on August 21, 2000. Following the completion of the required five-year monitoring program for restored wetland areas, Olin will submit a permit closure request to USACE in 2006.
- National Pollution Discharge Elimination System (NPDES) Permit Exclusion. The original NPDES Permit Exclusion for treatment and discharge of water to a surface body was granted on August 25, 2000, and was issued for a period of two months. Permit extensions were granted through October 2001. Per EPA's request, a NPDES Permit Exclusion Application-Incident Notification Form was submitted on June 24, 2002, for the potential treatment and discharge of water from July 1, through December 1, 2002. No water from RAM activities has been discharged to surface water since December 1, 2002.
- Licensed Site Professional (LSP) Opinions dated April 30 and May 11, 2001, for use of imported soil and loam for restoration of the wetlands at the Property. The soil and loam were tested prior to used to verify that the use of the materials at the Property would be consistent with the non-degradation provision of the MCP (310 CMR 40.0032[3][a] and [b]).
- DEP Bureau of Waste Site Cleanup approval to use Central Artery/Third Harbor Tunnel project (CA/T) soil at the Property. CA/T soil was used as one component of the backfill mix for the slurry wall constructed in 2000.
- Wilmington Fire Department approval of the soil transportation route. The majority of the soil shipped off property for disposal occurred in 2000 and 2001.
- WilmCC, OOC, DEP File No. 344-879. The OOC was issued on July 23, 2003, and authorized the additional remedial excavations around Central Pond to remove oily soil. The remedial excavations were completed in October 2003.
- On November 7, 2003, GEI submitted an Order of Resource Area Delineation to the WilmCC for the wetland delineation of the entire Olin property to support evaluation

of RAM impacts to wetlands and the success of restoration efforts. This information was presented as part of the Request for Certificate of Compliance for DEP File No. 344-733.

Permitting and Approval Activity Since Status Report No. 7:

The following correspondences were received by DEP and EPA since the last Status Report. Copies of each are contained in Appendix B.

- In a letter dated April 28, 2004, DEP approved the proposed limits of the Former Lake Poly Excavation.
- In a letter dated June 8, 2004, DEP responded to changes proposed in Status Report No. 7: DEP approved re-sampling the Biocell drainage sand, DEP requested that a statistical analysis be performed to justify a reduction in PCMP groundwater sampling frequency from quarterly to semiannually, and DEP provided an interim deadline of 90 days from the date of the letter to dispose of the materials contained in a drum that was found in 2003 while conducting improvements to the Temporary Cap.
- On August 23, 2004, Olin submitted a Request for Certificate of Compliance to the WilmCC for the OOC authorizing the remedial work adjacent to the Central Pond wetland (DEP File No. 344-879).
- In response to Olin's letter titled "Voluntary Disclosure Pursuant to EPA Audit Policy," dated September 29, 2003, EPA issued a letter to Olin dated May 12, 2004, stating that EPA will not seek penalties or recovery of economic benefit because Olin disclosed and corrected the violations in accordance with the Self-Disclosure Policy.

3. Summary of 2004 RAM Activities

This section describes the recent RAM activities performed during the period from January through July 2004. A comprehensive summary of all RAM activities conducted since July 2000 is presented in Section 4 of this report.

3.1 Biocell Drainage Sand Sampling

On April 21, 2004, five samples of the Biocell drainage sand were collected and submitted to Severn Trent Laboratories, Inc. (STL) for analysis. The purpose of the analyses for total petroleum hydrocarbons (TPH) and semivolatile organic compounds (SVOCs) was to assess whether the ongoing natural biodegradation process had reduced the concentrations of bis (2 Ethyl Hexyl) phthalate and TPH to background levels. Results of the 2004 sampling confirmed results from previous sampling rounds conducted in 2003 and 2002 that indicated the concentrations of TPH and bis (2 Ethyl Hexyl) phthalate in the sand are below Method 1 S-3 soil standards and are steadily decreasing, but have not yet reached background levels for the area around the Biocell. A table summarizing the analytical results of the 2004 drainage sand sampling is presented in Appendix C.

The drainage sand samples collected in April 2004 were also analyzed for compounds recently identified as contaminants of concern at the Site, including hydrazine and N Nitrosodimethylamine. These compounds were not detected in the Biocell sand above the laboratory reporting limits.

A summary table presenting the most recently obtained information regarding contaminant concentrations for the Biocell sand is presented in Appendix C. Current concentrations of all contaminants that were detected above laboratory reporting limits, including bis (2-Ethyl Hexyl) phthalate and TPH, are below applicable Method 1 soil standards, qualify as persistent compounds as defined in DEP Policy No. WSC-04-160, Section 9.3.2.4. Based on an applicable soil classification of S-3 (the entire Site is currently fenced, and is generally inaccessible to the public), and consistent with DEP Policy No. WSC-04-160, it is our opinion that the levels of COCs in soil in the Biocell sand supports a finding that it is categorically infeasible to achieve or approach background for persistent compounds in soil located in an area classified as S-3.

Therefore, Olin proposes to reuse the Biocell on-property by either spreading it as a uniform layer within the current footprint of the Biocell, or as upland fill material on the northern portion of the Property as part of future redevelopment construction activities. In either case,

it can be expected that the documented natural biodegradation of the organic contaminants will likely continue. Upon removal or spreading of the drainage sand, the Biocell area will be restored by removing any visible sidewall liner material, additional perforations will be made to the remaining bottom liner to further restore hydrologic conditions, spreading the perimeter topsoil berms as a uniform layer over the Biocell footprint, and seeding the disturbed area to restore the previous grassy cover.

3.2 Lake Poly Excavation

In a letter to Olin dated April 28, 2004, DEP approved the final scope of work and extent of additional excavations in the Lake Poly area. A copy of the DEP approval is contained in Appendix D. Between June 7 and June 15, 2004, the soil was excavated from within the former Lake Poly area that previous investigations had indicated ammonia and chromium concentrations exceeded UCLs. The excavation area was approximately 3,500 square feet (sf) and ranged in depth from 6 to 9 feet. Approximately 600 cy of contaminated subsurface soil was excavated and stockpiled on-property pending disposal at an off-property facility. A total of twelve confirmatory samples were collected from the excavation and submitted to STL for analysis of chromium and ammonia. Backfilling and restoration of the excavation area was completed on June 18, 2004. Details of the excavation and backfilling and a summary table of the analytical results of the confirmatory samples are contained in Appendix D. Based on the results of the confirmatory samples, chromium and ammonia concentrations in the soil remaining in the Former Lake Poly area are below UCLs and therefore the remedial objectives of this RAM have been met.

Three samples from the excavated soil stockpile were collected on July 7, 2004, and submitted to STL for disposal characterization. The covered soil stockpile remains on-property and arrangements are currently being made for disposal at Waste Management's Turnkey Facility in New Hampshire. The soil will be transported off-property for disposal in September 2004.

3.3 Central Pond

In November 2003, the excavation areas where oily subsurface soil had been removed from the banks of Central Pond were partially backfilled. At that time, the water level of Central Pond had risen above the limits of the excavation areas. To minimize migration of backfill into the pond, silt fence was installed between the water in Central Pond and the excavations and the excavations were backfilled from the shore to the silt fence. The remainder of the backfilling was scheduled for summer 2004 when the water elevation subsided.

On July 22, 2004, GEI personnel inspected the partially backfilled areas along the banks of Central Pond. GEI personnel noted that the water elevation was below the excavated areas

and that approximately 8 cy of topsoil would be needed to complete the restoration beyond the silt fence. The purchase and placement of the additional topsoil was completed on August 18, 2004. On August 23, 2004, Olin submitted a Request for Certificate of Compliance to the WilmCC for the OOC authorizing the remedial work adjacent to the Central Pond wetland (DEP File No. 344-879).

3.4 Temporary Cap Drum Management

As reported in Status Report No. 6, during the installation of the new Temporary Cap material in April 2003, a subsurface drum encased within a concrete structure was uncovered at the northern edge of the Containment Area. The drum location is shown in Figure 2. The encased drum was filled with soil at the surface, and a white material was observed below the surface soil, possibly being calcium sulfate. In August 2003, a composite sample of the drum contents was submitted to STL for disposal characterization. Results of the drum sampling were summarized in Status Report No. 7. The drum contents exhibited no hazardous characteristics and contaminant concentrations were non-detect and/or below S1-GW1 soil criteria and Olin proposed to leave the drum and its contents in place.

In a letter to Olin dated June 8, 2004, DEP required that Olin properly dispose of the drum and its contents at an appropriate off-property disposal facility. DEP noted that although no hazardous chemicals were identified in the testing that was completed on the drum contents, the drum and its contents must be appropriately disposed of due to the unknown nature of the drum contents and the potential hazards associated with physical degradation of the drum itself (Appendix B).

On June 11, 2004, Olin personnel transferred the contents of the encased drum into a new drum. The carcass of the encased drum remained in place, fixed to the surrounding concrete structure. The drum containing the remediation waste for disposal weighs 625 pounds (lbs) and was transported to CWM Chemical Services, LLC, in Model City, New York, for disposal on August 30, 2004.

3.5 Post-Construction Monitoring Plan (PCMP)

This section describes the monitoring that was conducted on, and near, the Property as part of the Post-Construction Monitoring Plan (PCMP) for the first and second quarter of 2004. Locations of PCMP monitoring locations are shown in Figure 3.

3.5.1 Surface Water Monitoring

During the recent monitoring period, surface water samples were collected on Monday, February 2, 2004, and Monday, May 10, 2004. Samples are collected on Monday mornings

to minimize influence from the discharge of the Plant B groundwater treatment system (during weekends there is no active Plant B discharge to the upper South Ditch). During the February round, samples were collected from two locations in the South Ditch and from one location in the East Ditch (samples are typically collected from three locations along the South Ditch, however, the ice cover at the ISCO2 location was too thick to penetrate and collect a water sample). Surface water samples were submitted for laboratory analysis of total metals, dissolved metals, sulfate, chloride, ammonia, nitrate, nitrite, and specific conductance. Samples were also field-measured for pH, specific conductance, and temperature. Analytical results of samples collected on February 2, and May 10, 2004, are summarized in Appendix E.

MACTEC's PCMP sampling reports for the first and second quarter of 2004 summarize the quarterly monitoring activities and present values for field-measured parameters, including water elevations and estimated stream flow rate, and are presented in Appendix E.

3.5.2 Groundwater Monitoring

Groundwater elevations were measured in February and May 2004 in selected monitoring wells and piezometers on and near the Property. Quarterly groundwater sampling of PCMP wells in and around the Containment Area was also performed in February and May 2004. Groundwater samples were submitted for laboratory analysis of dissolved metals, sulfate, chloride, ammonia, and specific conductance. MACTEC's PCMP sampling report for the first and second quarters of 2004 summarize the quarterly monitoring activities and values for field-measured parameters, including groundwater elevations, and is presented in Appendix E. The results of laboratory analyses for groundwater samples collected in February and May 2004 are presented in Appendix E.

3.5.3 Sediment Monitoring

Olin conducts annual sediment sampling in areas where sediment remediation was conducted as part of the RAM. The sediment monitoring areas include the On-Property West Ditch Wetland, Central Pond, and the South Ditch. Five sampling locations were established on the Property and the first annual sampling round was conducted in June 2003. Sediment monitoring in the ditch system was performed on August 10, 2004, and will be submitted to DEP in the next PCMP Monitoring Report, as described in Section 5.6 of this report.

3.5.4 Temporary Cap Inspections

Pending proposed redevelopment of the Property and the installation of the permanent pavement cap, the Containment Area was temporarily capped with 6-mil reinforced polyethylene sheeting. In April 2001, the Temporary Cap installation was complete and

covered most of the area within the Containment Wall. In April 2003, a layer of 8-mil impervious material was installed over the existing 6-mil cap.

Temporary Cap inspection reports for the first and second quarter of 2004 are presented in Appendix F. During the 2004 inspections the Temporary Cap appeared to be in good condition. GEI recommended that Olin personnel reseal the cap to bollards and wells with Transit-Seal Tape, as necessary, to prevent leakage of the cap. Olin personnel conducted the minor repairs in July 2004.

3.5.5 Annual Containment Wall/Cap System Performance Evaluation

Based on data collected as part of the PCMP program through May 2004, Geomega prepared an assessment of the performance of the Containment Wall/Cap system. A copy of Geomega's most recent report dated August 30, 2004, is included in Appendix F. Geomega concluded:

- The Containment Wall/Cap system continues to provide effective hydrologic containment of the on-property DAPL and DAPL-affected groundwater
- Water quality west of the Containment Area is improving. However, groundwater and surface water data collected south of the Containment Area indicates increasing Olin-related contaminants and may be attributed to a shift in the location of the stream-capture divide between the Ephemeral Ditch and the South Ditch.

4. Comprehensive Summary of RAM Activities

This section summarizes the RAM activities conducted through July 2004. For additional details on any of the described activities, please see RAM Status Reports 1 through 7. Figures 2 and 3 show locations for areas and features described in this section. Appendix G contains as-built figures showing detailed information for the construction activities completed to date.

4.1 Pre-Construction Activities (July to September 2000)

- Fifteen borings were performed along the proposed alignment of the containment wall to confirm general soil conditions and refine the top-of-bedrock design plans.
- A former 450-foot-deep production well (MW99) located approximately 50 feet south of the former lab building was filled with grout and abandoned.
- Five surface water samples were collected from the on-property ditch system to determine pre-construction surface water conditions and support an application for an NPDES Permit Exclusion.
- Sediment samples were collected on a 25-foot grid within the On-Property West Ditch Wetland with the objective of identifying areas of the wetland that were not significantly affected by historic waste disposal practices. Based on the results of the sampling, much of the southern and western area of the On-Property West Ditch Wetland was excluded from the sediment excavation program.

4.2 Construction Activities

4.2.1 Containment Wall/Cap System

Prior to construction of the Containment Wall, topsoil within the Containment Area was stripped and stockpiled. Samples were collected from the stockpiled soil and submitted to STL for laboratory analysis. DEP has approved the re-use of the topsoil in upland areas of the Property. The topsoil remains stockpiled at the Property as shown in Figure 2.

Between October 24 and December 9, 2000, a 3-foot-wide soil-clay Containment Wall (also referred to as the slurry wall) was installed from the ground surface to the top of bedrock along the approximate alignment shown in Figure 2. Testing results of samples taken during construction indicate that the Containment Wall has an average permeability of about 4.4 by

10^{-8} centimeters per second (cm/s). The top 2 feet of the wall was stabilized with a geotextile, a geogrid, and compacted granular soil. An equalization window approximately 50 feet long and 8 feet deep was installed in the west side of the Containment Wall. The window consists of crushed stone backfill that extends about 3 feet below the groundwater table to allow the groundwater elevation inside and outside the Containment Wall to equalize.

From December 2000 to April 2001, a Temporary Cap was constructed of sheets of 6-mil reinforced polyethylene placed over the Containment Area. Individual sheets were overlapped and held in place with ballast bags. In April 2003, improvements to the Temporary Cap were made by placing 8-mil reinforced polyethylene sheeting over the existing 6-mil sheeting. The seams of the 8-mil sheets were sewn with ultraviolet (UV) - resistant thread. UV-resistant ballast bags were used to keep the interior cap material in place and a continuous row of gravel secured the perimeter of the Temporary Cap.

The Temporary Cap will be replaced with a permanent pavement cap as part of future redevelopment plans for the Property.

4.2.2 Bioremediation Cell

Between August and September 2000, a lined Bioremediation Cell (the Biocell) was constructed at the south end of the Property as shown in Figure 2. The Biocell construction included stripping existing topsoil and forming a perimeter berm, installation of a continuously welded 40-mil HDPE liner, and installation of a drainage system consisting of plastic piping, a layer of imported drainage sand, and a collection sump.

The purpose of the Biocell was to bioremediate phthalate contamination in the sediment to be excavated from the wetlands on the northern portion of the Property to enable reuse of the material. Due to elevated chromium concentrations, bioremediation of the sediment was not conducted. Instead the excavated sediment was temporarily stored and dewatered in the Biocell and then transported off-property for disposal at a licensed facility. After removing the sediment, the lined Biocell was periodically used as a temporary storage reservoir for the dewatering effluent generated during wetland restoration activities. With DEP approval, in July and December 2002 the Biocell liner was penetrated to allow precipitation detained in the Biocell to infiltrate to groundwater. The layer of Biocell drainage sand was placed into two stockpiles and remains in the Biocell.

In June 2001, the drainage sand was sampled for disposal characterization. Since 2002 the Biocell drainage sand has been analyzed annually for total petroleum hydrocarbons (TPH) and semivolatile organic compounds (SVOCs) to assess whether the ongoing natural biodegradation process have reduced the concentrations of bis (2-Ethyl Hexyl) phthalate and

TPH to background levels. Results of the 2002 through 2004 sampling indicate the concentrations of TPH and bis (2 Ethyl Hexyl) phthalate in the sand are steadily decreasing, but have not yet reached background levels for the area around the Biocell.

As indicated in Section 3.1, Olin proposes to reuse the drainage sand on-property and restore the Biocell area. The sand will either be used in place or as upland fill material at the northern portion of the Property, during future redevelopment of the Property.

4.2.3 Surface Water and Storm Water Management Structures

Detention Pond and Containment Area Drainage

In September 2000, the Detection Pond was excavated between the Containment Area and the South ditch, as shown in Figure 2. The purpose of the Detention Pond is to manage storm water runoff from the Containment Area. The construction also included the installation of a 7-foot-high, 202-foot-long reinforced-concrete retaining wall along the north side of the Detention Pond to provide support for the Containment Wall. The Detention Pond outlet discharges to the South Ditch and the outlet consists of a low-level 6-inch PVC drainpipe, a mid-level 24-inch HDPE pipe, and a rip-rapped overflow spillway.

A temporary catch basin was installed within the Containment Area and a 36-inch HDPE pipe was installed to join the catch basin to the Detention Pond. The pipe was sealed at the concrete retaining wall and at the catch basin entrance with concrete and was backfilled up to the crown with imported clean granular fill.

On-Property West Ditch Culvert and Outlet Structure No. 1

Between September 25 and October 24, 2000, a 30-inch-diameter reinforced concrete culvert was installed along the western property boundary just outside the Containment Wall alignment, as shown in Figure 2. The culvert was installed to replace the former On-Property West Ditch channel. The culvert terminates at Outlet Structure No. 1 in the upper South Ditch, which is equipped with stop-logs that can be used to control the minimum water elevation in the culvert and in the On-Property West Ditch Wetland.

Outlet Structure No. 2/Weir

In October 2000, Outlet Structure No. 2 was installed at the confluence of the Off-Property West Ditch (OPWD) and the upper South Ditch. The structure consists of a pre-cast concrete tank that is 16 feet long, 11 feet wide, and 9 feet deep and fitted with an outlet trough. The purpose of the structure is to function as a sedimentation basin to permit floc and other suspended solids to settle out of the water column before entering the South Ditch.

In May 2001, a concrete weir (the Weir) was constructed adjacent to the Outlet Structure No. 2. The Weir extends from the Outlet Structure No. 2 across the South Ditch to the opposite bank. The Weir contains stop-logs to both divert surface water through Outlet Structure No. 2 and to control the water elevation upstream of the Weir.

4.3 Sediment Excavation and Confirmatory Sampling Summary

Chromium- and phthalate-contaminated sediment was excavated from the On-Property West Ditch and West Ditch Wetland areas, the South Ditch, and Central Pond. Figures showing the depth of each excavation and location of confirmatory samples, and data tables listing individual confirmatory sample results were presented in Status Report No. 2.

Appendix H of this report contains data summary tables for confirmatory samples collected from each of the sediment remediation areas and each table presents a comparison of the minimum, maximum, and mean concentrations of Site-related COCs to the corresponding UCLs and Site background levels. The statistical summaries do not include results for duplicate samples or results that were superseded by subsequent excavation and re-sampling.

As indicated on the summary tables in Appendix H, results for a few confirmatory samples exceeded UCLs for aluminum and iron, but chromium and phthalate concentrations were reduced to below the UCLs and mean concentrations of Site-related COCs approach previously reported Site background concentrations for soil. Therefore, the remedial objective to remove chromium- and phthalate-contaminated sediments from selected portions of the on-property wetland system to eliminate exceedances of UCLs and to achieve background concentrations of Site-related COCs to the extent feasible has been achieved.

4.3.1 On-Property West Ditch and West Ditch Wetland

In September and October 2000, approximately 275 cy of contaminated sediment was excavated from the On-Property West Ditch to depths of up to 4 feet below ground surface. A total of 31 confirmatory samples were collected from the bottom and the sidewalls of the excavation and were submitted for laboratory testing. The ditch was backfilled in October 2000 and its location is now within the Containment Area. The surface water that previously flowed from the On-Property West Ditch Wetland through the On-Property West Ditch to the South Ditch has been re-routed via a drainage swale to a new culvert installed parallel to the western property boundary. The excavated sediment was transported off-property for disposal in May 2001.

In September 2000, areas of contaminated sediment and peat were excavated from the On-Property West Ditch Wetland to depths of up to 3 feet. Approximately 425 cy of soil was excavated in 2000. Twenty-five confirmatory samples were collected from the limits of the

initial excavation and were submitted for laboratory testing. Based on the results of the initial confirmatory sampling, approximately 85 cy of additional soil was excavated in May 2001 and three additional confirmatory samples were collected. Sediment and peat from this area were transported off-property for disposal in May 2001.

4.3.2 Buried Debris Area

In September and October 2000, approximately 2,065 cy of contaminated peat and organic sediment were excavated from the Buried Debris Area. A total of 34 confirmatory samples were collected from the bottom and the sidewalls of the initial excavation and were submitted for laboratory testing. Based on the results of the initial confirmatory sampling, in May 2001 approximately 250 cy of additional soil was excavated and additional confirmatory samples were collected. The excavated peat and sediment was transported off-property for disposal from April through July 2001.

4.3.2 South Ditch and Delta

In September 2000, approximately 430 cy of contaminated sediment were excavated from the South Ditch to depths of up to 3 feet below ground surface.

In October 2000, after an accidental discharge of untreated groundwater to the lower South Ditch (also referred to as the Delta), the lower end of the South Ditch was re-excavated to remove floc resulting from the discharge. The excavated material, about 50 cy, was tested for re-use and then used as shallow fill within the Containment Area.

In October and November 2000, 74 confirmatory bottom and sidewall samples were collected from the ditch and were submitted for laboratory testing. Based on the results of the initial confirmatory sampling, in May 2001 approximately 100 cy of additional soil was excavated along the sides of the South Ditch and in the Delta area. An additional 23 confirmatory samples were collected. Sediment excavated from the South Ditch was transported for off-property disposal in May and July 2001.

4.3.4 Central Pond/Central Drainage Area

Between September and October 2000, a total of approximately 2,670 cy of soil were excavated from the Central Pond/Central Drainage Area. Between September and November 2000 a total of approximately 2,400 cy of soil was excavated and 72 confirmatory samples were collected. Based on the results of the initial confirmatory sampling, in November and December 2000 approximately 60 cy of additional soil were excavated and an additional three confirmatory samples were collected.

In May 2001, an area of blast rock and woodchips covering approximately 2,500 sf adjacent to the southwest end of Central Pond (Central Drainage Area) was excavated to a depth of about 1 foot. Approximately 100 cy of this material was excavated and remains stockpiled at the Property. Six confirmatory samples were collected from the bottom of the excavation. Based on the results of the confirmatory samples, approximately 20 cy of additional soil was excavated and one confirmatory sample was collected.

Also in May 2001, based on results from the September and October 2000 confirmatory sampling, additional excavations along the south, east and north banks of Central Pond were conducted. An additional 70 cy of soil was excavated and nine confirmatory samples were collected. During the excavation along the east bank of Central Pond, an intermittent layer of oily soil was uncovered. The oily soil was present along about 75 linear feet (lf) of the eastern bank and varied in thickness from 0 to about 2 inches. An additional approximately 20 cy of soil was excavated from the east perimeter at this time to reduce the quantity of oily soil remaining. Further investigation and remediation followed (see Section 4.5 of this report).

Soil and sediment excavated from this area was transported off-property for disposal at a licensed facility in May and July 2001.

4.4 Hot Spot Excavations/Lake Poly

On November 9 and 17, 2000, three hotspots (Lake Poly-1, A8CW-1, and RSO-6) were excavated in accordance with the procedures and sampling plan described in Modification No. 3 of the Part 2 RAM Plan, dated October 24, 2000. The size and purpose of each excavation were:

- Lake Poly-1: The purpose of the Lake Poly-1 excavation was to eliminate significant concentrations of ammonia, trimethylpentenes, and chromium in soil. The excavation was 10 feet wide, 10 feet long, and 10 feet deep.
- A8CW-1: The purpose of the A8CW-1 excavation was to eliminate significant soil contamination due to polycyclic aromatic hydrocarbons (PAHs). The excavation was 10 feet wide, 10 feet long, and 3 feet deep.
- RSO-6: The purpose of the RSO-6 excavation was to eliminate significant soil contamination due to cadmium. The excavation was 12 feet wide, 14 feet long, and 8 feet deep.

The locations of these excavations are shown in Figure 2. At the completion of each excavation, a total of five confirmatory samples were taken from the four sides and bottom of each excavation. All of the samples were submitted for laboratory testing for SVOCs

(including PAHs), pesticides, cadmium, chromium, and lead. The samples from the Lake Poly excavation were also submitted for VOC testing.

Summary tables for the confirmatory sample results for A8CW-1 and RSO-6 are contained in Appendix H. Based on the results of the confirmatory sampling for these areas, contaminants were reduced to below UCLs and the remediation objectives at these hot spot locations were met. Based on the results of the limited Lake Poly excavation of November 2000, chromium concentrations in remaining soil exceeded UCLs and therefore additional investigations and excavation was required.

Additional Lake Poly Investigations included a test pit excavation in May 2001, soil borings and groundwater sampling in July 2001 and December 2003, update of the FRA, and preparation of a Focused Feasibility Study (FFS). Based on these investigations and assessment, additional excavation was proposed to eliminate UCL exceedances of ammonia and chromium. In a letter to Olin dated April 28, 2004, DEP approved the final scope of work and extent of additional excavations in the Lake Poly area and the excavation was conducted in June 2004. Refer to Section 3.2 and Appendix D for more details of the 2004 Lake Poly excavation.

4.5 Central Pond Oily Soil Remediation

In May 2001 during sediment excavation activities, areas of oily subsurface soil were observed along the east bank of Central Pond. On September 18, 2001, field investigations along the eastern perimeter of Central Pond were conducted. A total of 33 shallow test pits were excavated with hand tools and soil samples were screened with a flame ionization detector (FID) and a photoionization detector (PID). Based on field screening, four samples were selected for laboratory analysis of PCBs, EPH, and metals. Results of the September 2001 sampling were reported in Status Report No. 3.

Based on the laboratory results of the September 2001 investigation, a scope of work to excavate the areas of oily soil was submitted to DEP. In a letter to Olin dated August 5, 2002, DEP approved of the excavation plan. After obtaining an OOC for the work, the excavation along the banks of Central Pond was conducted in August and October 2003. A total of approximately 12 cy of soil was excavated from the banks of Central Pond and transported off-property in December 2003 for disposal at a licensed facility.

Twelve confirmatory samples were collected from the oily soil excavation areas. The laboratory testing results for individual confirmatory sample results was represented in Status Report No. 7 and in Appendix H of this report. Contaminant concentrations for all final confirmatory samples were below UCLs and therefore the remedial objective was achieved.

In November 2003, the excavation areas were partially backfilled. At that time, the water level of Central Pond had risen above the limits of the excavation areas. To minimize migration of backfill into the pond, silt fence was installed between the water in Central Pond and the excavations and the excavations were backfilled from the shore to the silt fence. The purchase and placement of the additional topsoil was completed on August 18, 2004. On August 23, 2004, Olin submitted a Request for Certificate of Compliance to the WilmCC for the OOC authorizing the remedial work adjacent to the Central Pond wetland (DEP File No. 344-879).

4.6 Remediation Waste and Soil Management

4.6.1 Soil Transported Off-Property

Excavated soil and sediments from the Buried Debris Area, On-Property West Ditch and West Ditch Wetland, Central Pond, South Ditch and the Hot Spot excavations was transported off-property for disposal at two licensed facilities. A total of approximately 1,300 cy and 5 drums of soil was transported to CWM Chemical Services, L.L.C, in Model City, New York. A total of approximately 5,950 cy of soil was transported to MWNH Turnkey Landfill in Rochester, New Hampshire. Shipping records for the soil were included in previous Status Reports.

On June 11, 2004, Olin personnel transferred the contents of the encased drum into a new drum. The carcass of the encased drum remained in place, fixed to the surrounding concrete structure. The drum containing the remediation waste for disposal weighs 625 lbs and was transported to CWM Chemical Services, LLC, in Model City, NY, for disposal on August 30, 2004.

4.6.2 Soil Pending Off-Site Disposal

Approximately 600 cy of soil generated from the 2004 Lake Poly excavation remains temporarily stockpiled on-property. Three samples from the excavated soil stockpile were collected on July 7, 2004, and submitted to STL for disposal characterization. The covered soil stockpile remains on-property and arrangements are currently being made for disposal at Waste Management's Turnkey Facility in New Hampshire. The soil will be transported off-property for disposal in September 2004. Laboratory testing results and shipping documentation will be sent to DEP under separate cover.

4.6.3 Soil Re-used On-Property

Approximately 250 cy of granular material from the Buried Debris Area and approximately 50 cy of sandy soil and floc from the lower South Ditch were re-used as backfill material within the Containment Area in October and November 2000.

4.6.4 Soil Currently Stockpiled On-Property

The extents of soil stockpiles, with the exception of the Biocell soil stockpiles, were surveyed in December 2003. The actual locations of the stockpiles are shown in Figure 2. Prior to this survey, the locations of the stockpiles had been estimated.

Topsoil

Approximately 3,000 cy of topsoil stripped from the Containment Area during August and September 2000 remain stockpiled at the Property, northeast of the Containment Area. Results of reuse and disposal characterization were presented in Status Report No. 2. DEP has granted approval for the reuse of the topsoil as upland fill on the Property. Reuse of the soil is pending Property redevelopment.

Biocell Drainage Sand

Approximately 2,000 cy of imported drainage sand remains stockpiled in the Biocell. As detailed in Section 3.1, Olin proposes to reuse the drainage sand on-property, either in place or as upland fill material for future redevelopment of the northern portion of the Property.

Other Soil Stockpiles

Approximately 450 cy of soil, blast rock, and wood chips is stockpiled northeast of the Containment Area. The stockpile consists of blast rock, wood chips, and soil resulting from the May 2001 removal of the temporary access roads along the South Ditch. Also, on June 1, 2001, the temporary backfill placed between the Containment Area and the South Ditch for use as a working pad during the Containment Wall construction was excavated and added to the stockpile. A summary of analytical results for samples collected from the stockpile was presented in Status Report No. 3. It is anticipated that this material will be reused for landscaping purposes at the Property in the future.

4.6.5 Dewatering Effluent

A total of approximately 1.6-million gallons of dewatering effluent was treated using a mobile water treatment plant operated under NPDES Exclusion Permit Reference No. 00-177.

A total of 35 drums containing purge water generated during post-construction monitoring activities were transported to CWM in Model City, New York, for disposal.

4.7 Monitoring Activities

4.7.1 Monitoring During Construction and Remediation Activities

Surface Water Monitoring

During excavation in the South Ditch and during treatment and discharge of water to the South Ditch, surface water samples were collected on a daily basis downstream of the working or discharge area, at a location defined as ISCO 2 (Fig. 3). The purpose of the surface water sampling was to document the extent to which excavation activities and discharge of treated water impacted the surface water conditions. An assessment of surface water quality trends during active construction was presented in the South Ditch IRA Status Report No. 2 and Completion Statement Report, dated December 5, 2001.

Perimeter Air Monitoring

Perimeter air monitoring was performed daily during drum removal excavation for the concurrent Drum Removal RAM, and periodically thereafter during intrusive construction activities. The air monitoring data was provided in the Drum Removal RAM Status Report No. 2 and Completion Statement, July 2001.

Meteorological Data

Meteorological data was generally collected once or twice daily during intrusive construction activities, as required by the RAM Plan. The meteorological data was provided in Status Report No. 2.

4.7.2 Post-Construction Monitoring

The PCMP is intended to monitor the effectiveness of the Containment Wall/Cap System. The scope of the PCMP was initially proposed in Status Report No. 2, and was approved by DEP in letters to Olin dated October 5, 2001, and February 4, 2002. Revisions to the PCMP

were proposed in Status Reports Nos. 3, 4, 5, and 6 and conditionally approved by DEP in correspondence to Olin dated December 6, 2002, and April 17, June 9, and November 13, 2003, respectively. In a letter to Olin dated June 8, 2004, DEP requested that Olin perform a statistical evaluation to support the proposed revisions to the frequency of the PCMPR groundwater monitoring frequency. The statistical evaluation was performed by Geomega, Inc., and is included in Appendix F of this report.

Surface Water Monitoring

The surface water monitoring first proposed as part of the PCMP included monitoring water elevations at 12 locations and collecting surface water samples at five locations (ISCO1, ISCO2, ISCO3, PZ-16R, PZ-17R) and testing the samples for alkalinity, chloride, sulfate, ammonia, pH, specific conductivity, dissolved oxygen (DO), temperature, and total nitrate and nitrite. DEP approved the initial scope of the PCMP. In Status Report No. 3, Olin proposed to drop the sampling location PZ-16R and DEP approved the change. In Status Report No. 4, Olin proposed to reduce the sampling frequency from monthly to quarterly sampling and DEP approved the change. In December 2002, the surface water monitoring frequency was changed to quarterly.

Groundwater Monitoring

As part of the PCMP, Olin installed a well couplet south of the Containment Area (GW202S and GW202D) and a single well east of the Containment Area (GW201S), and replaced GW34S with GW34SR.

The initial PCMP approved DEP included measurement of groundwater elevations in 29 existing wells plus the four new wells once installed, collection of groundwater samples in 18 wells and analysis of the samples for alkalinity, ammonia, chloride, pH, specific conductance, sulfate, dissolved aluminum, dissolved chromium. In Status Report No. 3, Olin proposed to discontinue analysis of groundwater for alkalinity and to eliminate 3 wells and add a different monitoring well to the sampling program. DEP agreed to stop analyzing for alkalinity and to eliminate sampling of two wells and to add one well (for a total of 17 wells) to the sampling program. In status report No. 4, Olin voluntarily added monitoring well GW78S to the quarterly sampling round.

In Status Report No. 5, Olin proposed to remove two monitoring wells from the quarterly groundwater elevation survey due to physical restrictions that had frequently prevented accurate measurement of groundwater levels. In Status Report No. 6, Olin proposed to eliminate laboratory testing of pH for both surface water and groundwater because of the short hold-times and the redundancy with the field measurement of pH for the samples. DEP

approved of the proposed changes in an email and letter to Olin dated June 6, and November 13, 2003, respectively.

In Status Report No. 7, Olin proposed to reduce groundwater sampling from quarterly to semiannually. DEP subsequently requested that Olin perform a statistical analysis to support the propose reduction in sampling frequency. The statistical evaluation is presented in Appendix F of this report. Based on the statistical analysis performed by Geomega, it is recommended that quarterly sampling be continued at three PCMP groundwater monitoring locations (GW25, GW202S, and GW79S). The sampling frequency at the remaining PCMP groundwater monitoring locations should be reduced from quarterly to semiannually without compromising the integrity or effectiveness of the PCMP monitoring program.

Sediment Monitoring

In a letter to Olin dated April 17, 2002, DEP indicated that sediment in restored wetland areas should be sampled annually to assess the potential for recontamination by ongoing floc generation. In Status Report No. 4, GEI proposed to conduct the annual sediment sampling at five locations in the restored wetland areas of the On-Property West Ditch Wetland, Central Pond, and the South Ditch. The first annual sediment samples were collected in June 2003 and result reported in Status Report No. 6. Sediment sampling was performed in August 2004, and will be reported in the next Status Report or PCMP Report, as described in Section 5.6 of this report.

Temporary Cap Inspections

In June 2001, discrete areas of the Temporary Cap had begun to show signs of degradation including blistering and separation of the two layers of the material. GEI began performing quarterly inspections of the Temporary Cap in the fourth quarter of 2001. Based on the quarterly inspections, the cap material continued to slowly degrade and in the spring of 2003 a new 8-mil, 3-layer polyethylene cap was placed over the existing 6-mil, 2-layer polyethylene cap. The newly installed cap material has not shown signs of degradation. Quarterly inspections of the Temporary Cap will continue as part of the PCMP until a permanent cap is constructed as part of future property redevelopment. As of October 1, 2004, MACTEC will perform the quarterly cap inspections at the Property.

Analysis of PCMP Data / Slurry Wall and Cap Performance Evaluation

Beginning in January 2002, semiannual analyses of selected PCMP data has been performed by Geomega. The analyses included assessment of groundwater elevations and hydraulic gradients in and around the Containment Area, examination of analytical results for key chemicals of concern and physical parameters in surface water and in selected monitoring

wells near the slurry wall, and computation of groundwater and solute mass fluxes through the equalization window at the top of the slurry wall. In Status Report No. 6, GEI proposed to reduce the frequency of the analysis of PCMP data from semiannually to annually. DEP approved the reduced frequency in a letter to Olin dated November 13, 2003. The most recent analysis by Geomega is included in Appendix F.

4.8 RAM Impacts on Site Characterization

The RAM excavations, backfilling, and grading activities have significantly and favorably altered the conditions at the Property. The locations of many historical soil samples have been excavated and changes to ground surface elevation have changed the previously recorded depth to subsurface soil samples and groundwater. The Olin database has been updated to reflect these changes.

An update of the previous Focused Risk Assessment (FRA) and Focused Site Assessment (FSA), reflecting these changes is in progress and will be submitted to DEP in the future.

5. Proposed Post-RAM Activities and Reporting

Olin intends to submit a Completion Statement for this RAM, upon the removal, and off-site disposal of the Lake Poly Soils. This work is scheduled to be completed in September 2004. Olin proposes to continue the monitoring programs currently associated with this RAM, as "Post-RAM Activities." Following the submission of the RAM Completion Statement, the status of the Post-RAM Activities will be reported to DEP semiannually as part of the PCMP. A summary of Post-RAM Activities and schedule for implementation, are presented in Table 1.

5.1 Containment Area Permanent Cap Installation

The existing Temporary Cap will be replaced with a permanent pavement cap in conjunction with future redevelopment of the Property.

5.2 Biocell/Drainage Sand

As presented in Section 3.1, Olin will reuse the drainage sand on-property, either in place or as upland fill material for future redevelopment of the northern portion of the Property. Upon reuse of the drainage sand, the Biocell area will be restored by removing any visible sidewall liner material, perforating the remaining bottom liner to restore hydrologic conditions, spreading the perimeter topsoil berms as a uniform layer over the Biocell footprint, and seeding the disturbed area to restore the previous grassy cover

5.3 Wetland Permits

There are four active wetland-related permits:

- WilmCC, OOC, DEP File No. 344-733. A Request for Certificate of Compliance was submitted to the WilmCC on May 7, 2004. The WilmCC review of the Request for Certificate of Compliance is ongoing at this time. To support the review, Olin is currently confirming wetland boundary conditions and the area of impact associated with remediation.
- DEP 401 Water Quality Certification. As required under the terms of the 401 Water Quality Certification, Olin has prepared a draft Restrictive Covenant for the land south of the South Ditch which will restrict future development or use for any

purpose other than open space or remediation of Site conditions. The Draft Restrictive covenant will be submitted to DEP for review and approval.

- U.S. Army Corps of Engineers 404 Dredging Permit. Following the completion of the required five-year monitoring program for restored wetland areas, Olin will submit a permit closure request in 2006.
- WilmCC, OOC, DEP File No. 344-879. On August 23, 2004, Olin submitted a Request for Certificate of Compliance to the WilmCC for the OOC authorizing the remedial work adjacent to the Central Pond wetland (DEP File No. 344-879).

5.6 Post-Construction Monitoring

Results of the PCMP will be reported to DEP semiannually , unless a modification to the PCMP reporting schedule is approved by DEP. A summary of the current PCMP activities is presented in Table 2.

Surface Water Monitoring

Quarterly surface water samples will be collected from three locations in the South Ditch (ISCO1, SD-17, and ISCO2) and one location in the east ditch (ISCO3). Field measurements will include pH, specific conductivity and flow rate. Laboratory analysis will include total and dissolved chromium, dissolved aluminum, sulfate, chloride, ammonia, nitrite/nitrate, and specific conductivity.

Groundwater Monitoring

Quarterly groundwater samples will be collected from 17 wells. Analysis will include pH (field measurement), dissolved chromium, dissolved aluminum, sulfate, chloride, ammonia and specific conductivity. Additionally, groundwater elevations at 62 monitoring wells in and around the Property will be measured.

Sediment Monitoring

Sediment samples will be collected on an annual basis from three locations in the South Ditch, one location in the Central Pond, and one location in the On-Property West Ditch Wetland. The samples will be tested for primary floc constituents (chromium, aluminum and iron). The samples will be collected from depths of 0 to 3 inches and from 3 to 24 inches (or the bottom of the sediment layer).

Temporary Cap Inspections

Inspection of the Temporary Cap will continue on a quarterly basis until a permanent cap, approved by DEP, is installed.

Performance Evaluation

An evaluation of PCMP data and the effectiveness of the Containment Wall/Cap system will be performed annually.

6. Deviations from RAM Plan and Other DEP Approvals

It is my opinion that the activities for the current monitoring period, as described in this Status Report, were performed in substantial accordance with the RAM Plan, subsequent modifications, and the conditions of approval established by DEP.

7. Summary of Modifications or Proposals Presented in this Status Report

- Olin proposes to decrease the frequency of select PCMP groundwater sampling from quarterly to semiannually. PCMP surface water monitoring and groundwater elevations will continue to be performed on a quarterly basis and the number of PCMP monitoring points and their locations will remain unchanged.
- Olin proposes to reuse the drainage sand on-property, either in place or as upland fill material for future redevelopment of the northern portion of the Property. Upon reuse of the drainage sand, the Biocell area will be restored by removing any visible sidewall liner material, perforating the remaining bottom liner to restore hydrologic conditions, spreading the perimeter topsoil berms as a uniform layer over the Biocell footprint, and seeding the disturbed area to restore the previous grassy cover.

8. Schedule

The primary tasks related to the RAM and RAM Amendments have been completed at the Property, with the following exceptions:

- Lake Poly Remediation: The excavated soil from the Lake Poly remediation, is currently stockpiled at the Property pending off-site disposal at a licensed facility in September 2004.
- Installation of Permanent Cap: Olin intends to maintain a Temporary Cap over the Containment Area until a permanent cap is installed. Until a permanent cap is installed, quarterly Temporary Cap inspections will continue, and will be reported to DEP.

Olin intends to submit a Completion Statement for this RAM, upon the off-site disposal of the Lake Poly Soils. This work is scheduled to be completed in September 2004. Olin proposes to continue the monitoring programs currently associated with this RAM, as "Post-RAM Activities," as described in Section 5 of this Status Report. A summary of Post-RAM activities and schedule for implementation is presented in Table 1.

TABLES

Table 1
Summary of Post-RAM Activities
Olin Corporation
51 Eames Street
Wilmington, MA

Activity to be Conducted	Status/Description	Anticipated Completion Date
Permit Closure: Wilmington Conservation Commission, Order of Conditions (OOC), MADEP File No. 344-733	Request for Certificate of compliance was submitted on May 7, 2004.	Fall 2004
Permit Closure: Wilmington Conservation Commission, OOC, MADEP File No. 344-879, for Central Pond oily soil excavation	Request for Certificate of compliance was submitted on August 23, 2004.	Fall 2004
Permit Closure: U.S. Army Corps of Engineers (USACE) 404 Dredging Permit	Request permit closure following 5-year monitoring period.	2006
Site Work: Permanent Cap	Place a permanent cap (asphalt) over the existing containment area.	During redevelopment.
Site Work: Reuse of Biocell Drainage Sand	Leave in place or reuse as part of property redevelopment	2005 (pending MADEP approval)
Site Work: Post Construction Monitoring Plan.	See Table 2.	Ongoing
DEP Submittal: Redevelopment RAM	Submit RAM plan for work related to the proposed property redevelopment.	Prior to redevelopment.

Tables 2a. through 2d.
Summary of Post-Construction Monitoring Plan (2004/2005)
Olin Corporation
51 Eames Street
Wilmington, MA

Table 2a.
Surface Water Monitoring

Activity	Frequency	Number of Locations	Parameter(s)	Location ID(s)	
Water Quality Laboratory Analysis	Quarterly	4	Conductivity Ammonia Total Chromium Dissolved Chromium Dissolved Aluminum Chloride Sulfate Nitrite/Nitrate	ISCO1 ISCO2 ISCO3	SD17
Water Quality Field Measurements	Quarterly	4	pH Conductivity Flow Rate	ISCO1 ISCO2 ISCO3	SD17
Elevations	Quarterly	12	Water Surface Elevation	PZ11 PZ12 PZ14 PZ15 PZ16R PZ17R PZ18R	SG8 SG14 SG16 East Ditch SG

Note: Olin proposes in this report to add location PZ16RSW for quarterly water quality laboratory analysis and field measurements.

Table 2b.
Containment Area Monitoring

Activity	Frequency	Parameter(s)	Location ID(s)
Temporary Cap Inspection	Quarterly	Cap Integrity	Containment Area Temporary Cap

Note: Olin will continue to conduct quarterly temporary cap inspections until a permanent cap is placed.

Tables 2a. through 2d.
Summary of Post-Construction Monitoring Plan (2004/2005)
Olin Corporation
51 Eames Street
Wilmington, MA

Table 2c.
Groundwater Monitoring

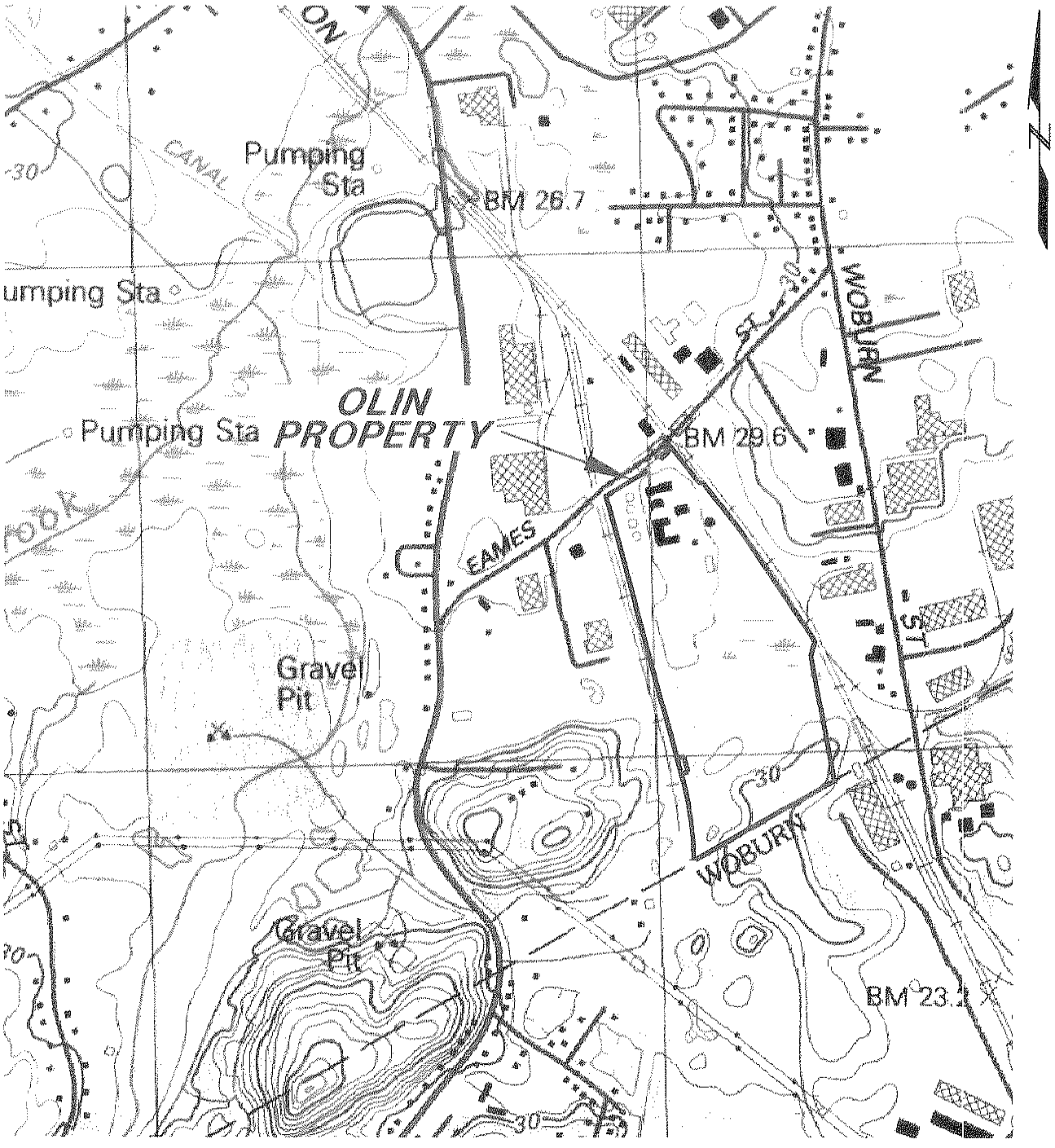
Activity	Frequency or Duration	Number of Locations	Parameter(s)	Location ID(s)		
Water Quality Analysis	Quarterly	17	Conductivity Ammonia Dissolved Chromium Dissolved Aluminum Chloride Sulfate pH (field)	GWCA1 GW34SR GW34D GW10S GW78S GW79S	GW201S GW202S GW202D GW24 GW25 GW26	GW35S GW39 GW42S GW43S GW55S
Elevation	Quarterly	62	Elevation	GW3D GW3S GW4 GW4D GW8 GW6D GW6S GW10S GW12 GW17S GW18D GW20 GW24 GW25 GW26 GW28D GW28S GW29D GW29S GW32S GW34D	GW34SR GW35D GW35S GW39 GW42D GW42S GW43D GW43S GW50D GW50S GW51D GW51S GW54S GW55D GW55S GW56D GW56S GW69D GW69S GW76S GW77S	GW78S GW79S GW201S GW202D GW202S GWCA1 GWCA2 GWCA3D GWCA3S GWCA4S GWLPB11 PW2 PZ11 PZ12 PZ15 PZ14 PZ16R PZ17R PZ18R SP03

Note: Olin proposes in this report to decrease the frequency of groundwater sampling from quarterly to semiannually with the exception of wells: GW25, GW2025, and GW79S.

Table 2d.
Soil/Sediment Monitoring

Activity	Frequency or Duration	Number of Locations	Parameter(s)	Location ID(s)		
Sediment Quality Analysis	Annually (Spring)	5	Chromium Aluminum Iron	On-Property West Ditch Wetland: SDS1	South Ditch: SDS2 SDS3 SDS4	Central Pond: SDS6

FIGURES



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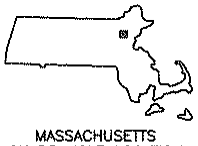
SCALE, FEET

This Map Image provided by MassGIS is taken from U.S.G.S. Topographic 7.5 X 15 Minute Series Reading, MA Quadrangle, 1987.
Datum is National Geodetic Vertical Datum (NGVD).
Contour Interval is 3 Meters.



MASSACHUSETTS QUADRANGLE LOCATION

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	LOCUS MAP
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure 1

97598-648 djm 09/03/04

LEGEND:

- EXISTING CONTOURS (FT., NGVD)
- WETLANDS BOUNDARY DELINEATED DECEMBER 2003
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- PROPOSED LIMITS OF SEDIMENT EXCAVATION
- ACTUAL LIMITS OF SEDIMENT EXCAVATION
- SOIL "HOT SPOT" EXCAVATIONS
- GROUNDWATER MONITORING WELL / PIEZOMETER

NOTES:

1. BASE PLAN PROVIDED BY DANA F. PERKINS, INC., 2001 AND 2003.

0 100 200
SCALE, FEET

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	SITE PLAN AND WORK COMPLETED THROUGH JULY 2004
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure 2

97598-639 djm 09/03/04

LEGEND:

- EXISTING CONTOURS (FT., NGVD)
- WETLANDS BOUNDARY DELINEATED DECEMBER 2003
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- ACTUAL LIMITS OF SEDIMENT EXCAVATION
- SOIL "HOT SPOT" EXCAVATIONS
- GROUNDWATER MONITORING & PIEZOMETER LOCATION
- SURFACE WATER MONITORING LOCATION
- STAFF GAUGE
- ANNUAL SEDIMENT MONITORING LOCATION

NOTES: 1. BASE PLAN PROVIDED BY DANA F. PERKINS, INC., 2001 AND 2003.

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	MONITORING AND SAMPLING LOCATIONS THROUGH JULY 2004
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure 3

97598-640 djm 09/03/04

Appendix A

DEP RAM Transmittal Form

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

Release Tracking Number
3.(- 0471

RELEASE ABATEMENT MEASURE (RAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

A. SITE LOCATION:

1. Site Name/Location Aid: Olin Corporation
2. Street Address: 51 Eames Street
3. City/Town: Wilmington 4. ZIP Code: 01887-3393

☐ 5. Check here if a Tier Classification Submittal has been provided to DEP for this disposal site.

☑ a. Tier 1A ☐ b. Tier 1B ☐ c. Tier 1C ☐ d. Tier 2

6. If a Tier I Permit has been issued, provide Permit Number: 83004

B. THIS FORM IS BEING USED TO: (check all that apply)

1. List Submittal Date of Initial RAM Written Plan (if previously submitted): 08/08/2000 (MM/DD/YYYY)

☐ 2. Submit an **Initial Release Abatement Measure (RAM) Plan.**

☐ a. Check here if this RAM Plan received previous oral approval from DEP as a continuation of a Limited Removal Action (LRA).

b. List Date of Oral Approval: _____

☐ 3. Submit a **Modified RAM Plan** of a previously submitted written RAM Plan.

☑ 4. Submit a **RAM Status Report.**

☐ 5. Submit a **RAM Completion Statement.**

☐ 6. Submit a **Revised RAM Completion Statement.**

7. Provide Additional RTNs:

☐ a. Check here if this RAM Submittal covers additional Release Tracking Numbers (RTNs). RTNs that have been previously linked to a Primary Tier Classified RTN do not need to be listed here. This section is intended to allow a RAM to cover more than one unclassified RTN and not show permanent linkage to a Primary Tier Classified RTN.

b. Provide the additional Release Tracking Number(s) covered by this RAM Submittal. ☐ - ☐ ☐ - ☐

(All sections of this transmittal form must be filled out unless otherwise noted above)

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

Release Tracking Number
3.(- 0471

RELEASE ABATEMENT MEASURE (RAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

C. RELEASE OR THREAT OF RELEASE CONDITIONS THAT WARRANT RAM:

1. Identify Media Impacted and Receptors Affected: (check all that apply)

☐ a. Air ☐ b. Basement ☐ c. Critical Exposure Pathway ☑ d. Groundwater ☐ e. Residence
☐ f. Paved Surface ☐ g. Private Well ☐ h. Public Water Supply ☐ i. School ☑ j. Sediments
☑ k. Soil ☐ l. Storm Drain ☑ m. Surface Water ☐ n. Unknown ☑ o. Wetland ☐ p. Zone 2
☐ q. Others Specify: _____

2. Identify all sources of the Release or Threat of Release, if known: (check all that apply)

☐ a. Above-ground Storage Tank (AST) ☐ b. Boat/Vessel ☐ c. Drums ☐ d. Fuel Tank
☐ e. Pipe/Hose/Line ☐ f. Tanker Truck ☐ g. Transformer ☐ h. Under-ground Storage Tank (UST)
☐ i. Vehicle ☑ j. Others Specify: Historical Discharge of Wastewater

3. Identify Oils and Hazardous Materials Released: (check all that apply)

☑ a. Oils ☐ b. Chlorinated Solvents ☑ c. Heavy Metals
☐ d. Others Specify: Chromium, Ammonia, other organic / inorganic compounds

D. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply, for volumes list cumulative amounts)

☐ 1. Assessment and/or Monitoring Only
☑ 2. Temporary Covers or Caps
☐ 3. Deployment of Absorbent or Containment Materials
☐ 4. Temporary Water Supplies
☐ 5. Structure Venting System
☐ 6. Temporary Evacuation or Relocation of Residents
☐ 7. Product or NAPL Recovery
☐ 8. Fencing and Sign Posting
☑ 9. Groundwater Treatment Systems
☐ 10. Soil Vapor Extraction
☐ 11. Bioremediation
☐ 12. Air Sparging
☑ 13. Excavation of Contaminated Soils

☐ a. Re-use, Recycling or Treatment ☐ i. On Site Estimated volume in cubic yards _____
☑ ii. Off Site Estimated volume in cubic yards 600

iia. Receiving Facility: TBD Town: TBD State: _____

iib. Receiving Facility: _____ Town: _____ State: _____

iii. Describe: _____

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

Release Tracking Number
3.(- 0471

RELEASE ABATEMENT MEASURE (RAM) TRANSMITTAL FORM
Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

D. DESCRIPTION OF RESPONSE ACTIONS (cont.): (check all that apply, for volumes list cumulative amounts)

☐ b. Store ☐ i. On Site Estimated volume in cubic yards _____

☐ ii. Off Site Estimated volume in cubic yards _____

iia. Receiving Facility: _____ Town: _____ State: _____

iib. Receiving Facility: _____ Town: _____ State: _____

☐ c. Landfill

☐ i. Cover Estimated volume in cubic yards _____

Receiving Facility: _____ Town: _____ State: _____

☐ ii. Disposal Estimated volume in cubic yards _____

Receiving Facility: _____ Town: _____ State: _____

☑ 14. Removal of Drums, Tanks or Containers:

a. Describe Quantity and Amount: One 55 gallon Drum of Solid Waste

b. Receiving Facility: CMW Town: Model City State: NY

c. Receiving Facility: _____ Town: _____ State: _____

☐ 15. Removal of Other Contaminated Media:

a. Specify Type and Volume: _____

b. Receiving Facility: _____ Town: _____ State: _____

c. Receiving Facility: _____ Town: _____ State: _____

☐ 16. Other Response Actions:

Describe: _____

☐ 17. Use of Innovative Technologies:

Describe: _____

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

Release Tracking Number
3.C - 0471

RELEASE ABATEMENT MEASURE (RAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

E. LSP SIGNATURE AND STAMP :

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and 309 CMR 4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> *if Section B of this form indicates that* ***a Release Abatement Measure Plan*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B of this form indicates that* ***a Release Abatement Measure Status Report*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B of this form indicates that a* ***Release Abatement Measure Completion Statement*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal:

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

1. LSP #: 8494
2. First Name: Margret
3. Last Name: Hanley
4. Telephone: (617) 330-2800
5. Ext.:
6. FAX: (617) 330-2801
7. Signature: M Margret Hanley
8. Date: 09/03/2004
9. LSP Stamp: COMMONWEALTH OF MASSACHUSETTS M. MARGRET HANLEY No. 8494 REGISTERED LICENSED SITE PROFESSIONAL

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

Release Tracking Number
3.(- 0471

RELEASE ABATEMENT MEASURE (RAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

F. PERSON UNDERTAKING RAM:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person undertaking response actions

2. Name of Organization: Olin Corporation

3. Contact First Name: Stephen 4. Last Name: Morrow P.E.

5. Street: 1186 Lower River Road 6. Title: Principal Environmental Specialist

7. City/Town: Charleston 8. State: TN 9. ZIP Code: 37310-0248

10. Telephone: (423) 336-4511 11. Ext.: 12. FAX:

G. RELATIONSHIP TO RELEASE OR THREAT OF RELEASE OF PERSON UNDERTAKING RAM:

☑ 1. RP or PRP ☑ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☐ e. Other RP or PRP Specify:

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Undertaking RAM Specify Relationship:

H. REQUIRED ATTACHMENT AND SUBMITTALS:

☐ 1. Check here if any Remediation Waste, generated as a result of this RAM, will be stored, treated, managed, recycled or reused at the site following submission of the RAM Completion Statement. You must submit a Phase IV Remedy Implementation Plan along with the appropriate transmittal form (BWSC108).

☑ 2. Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

☑ 3. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the implementation of a Release Abatement Measure.

☐ 4. Check here if any non-updatable information provided on this form is incorrect, e.g. Release Address/Location Aid. Send corrections to the DEP Regional Office.

☐ 5. If a RAM Compliance Fee is required for this RAM, check here to certify that a RAM Compliance Fee was submitted to DEP, P. O. Box 4062, Boston, MA 02211.

☑ 6. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC106

Release Tracking Number
3 - 0471

RELEASE ABATEMENT MEASURE (RAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 (Subpart D)

I. CERTIFICATION OF PERSON UNDERTAKING RAM:

1. I, STEVE MORROW, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

2. By: Steve Morrow (Signature) 3. Title: PRINCIPAL ENV. SPECIALIST

4. For: OLIN CORPORATION (Name of person or entity recorded in Section F) 09/07/04 (mm/dd/yyyy)

☐ 5. Check here if the address of the person providing certification is different from address recorded in Section F.

6. Street: _____

7. City/Town: _____ 8. State: _____ 9. ZIP Code: _____

10. Telephone: _____ 11. Ext.: _____ 12. FAX: _____

YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

Date Stamp (DEP USE ONLY:)

Appendix B

DEP and EPA Approvals / Correspondences

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

ELLEN ROY HERZFELDER
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

APRIL 28, 2004

Olin Corporation
P.O. Box 248
Charleston, TN 37310
Attn: Stephen Morrow

RE: Wilmington – Olin Chemical
DEP RTN 3-0471
Additional Investigations
Former Lake Poly

Dear Mr. Morrow,

The Massachusetts Department of Environmental Protection (DEP) has received a report dated February 9, 2004, entitled "Former Lake Poly Investigation – Field Activity Report." The document was prepared by MACTEC Engineering and Consulting, Inc. (MACTEC) on behalf of the Olin Corporation, and was signed and submitted by Margret Hanley, the Licensed Site Professional of Record. The report describes the results of an assessment of the potential presence of N-nitrosodimethylamine (NDMA), acetaldehyde, formaldehyde, hydrazine, monomethylhydrazine, and unsymmetrical dimethylhydrazine (UDMH) in soil and groundwater located in the vicinity of the former Lake Poly, in order to determine if the ammonia hot spot area that was identified for soil excavation in the April 10, 2003 Focused Feasibility Study needs to be redefined. Based on the results of this investigation, MACTEC concludes that the previously proposed excavation area to remove the Lake Poly ammonia hot spot does not have to be redefined.

In accordance with the Public Involvement Plan for this site, the report was placed in the public library and a public comment period ran from February 13, 2004 through March 10, 2004. No public comments were received regarding this document.

Lake Poly Investigation

In order to assess the potential presence of the contaminants listed above in soil in the vicinity of the former Lake Poly area, MACTEC installed 12 soil borings and collected a total of 18 soil samples on November 20, 2003. The results of the laboratory analysis indicate no detectable concentrations of NDMA, monomethylhydrazine, UDMH, or acetaldehyde. Hydrazine

This information is available in alternate format. Call Aprel McCabe, ADA Coordinator at 1-617-556-1171. TDD Service - 1-800-298-2207.

DEP on the World Wide Web: http://www.mass.gov/dep
Printed on Recycled Paper

was detected at one location in a visibly contaminated soil layer at a concentration of 1.9 milligrams per kilogram (mg/kg). Formaldehyde was detected at concentrations ranging from 0.13 mg/kg to 1.2 mg/kg, with the highest concentrations identified in a visibly contaminated soil layer.

In order to assess the potential presence of these contaminants in the groundwater, samples were collected from 8 monitoring wells located within and adjacent to the former limits of Lake Poly. The results of the laboratory analysis indicated no detectable concentrations of hydrazine, monomehtylhydrazine, UDMH, formaldehyde, or acetaldehyde. NDMA was identified in groundwater at concentrations ranging from 7.6 nanograms per liter (ng/l) to 130 ng/l.

MACTEC assessed the potential risks to human health associated with the results of the laboratory analysis completed on the soil samples collected from the region outside of the ammonia hot spot area. Soil outside the hot spot area is intended to remain at the site. MACTEC assessed the potential risks by comparing the results to risk-based screening values developed by the United States Environmental Protection Agency. The only contaminant identified outside the proposed excavation area was formaldehyde at a maximum concentration of 0.920 mg/kg, which is orders of magnitude below EPA risk-based screening levels for soils at residential and industrial properties. The soil containing low levels of hydrazine is planned to be excavated for off-site disposal.

MACTEC also evaluated the adequacy of reporting limits by comparing them to available EPA risk-based screening levels for NDMA, hydrazine, monomethylhydrazine, and UDMH. Overall the reporting limits were appropriate for conducting a risk-based screening of the soil analytical results. MACTEC notes the reporting limits were below the risk-based screening values, for all contaminants investigated, with the exception of UDMH. The reporting limits for UDMH were higher than the Region IX screening value, but lower than the Region III value.

MACTEC concludes that the soil analytical results do not indicate that a change is necessary to the proposed Lake Poly ammonia hotspot excavation area, because there is not a potential direct contact risk to human health for industrial workers or construction workers due to chemicals included in this investigation.

DEP – Conditional Approval

DEP approves of the excavation of the previously identified ammonia hot spot area, and agrees that the excavation area does not have to be expanded based on the soil and groundwater data collected as part of this investigation. However, it should be noted that DEP reviewed the Lake Poly investigation report only as it pertains to the parameters and provisions of DEP Policy No. WSC-00-425, *Construction of Buildings in Contaminated Areas*. The approval of the remedial plan will not preclude DEP from potentially requiring further remedial actions in the future to achieve a Response Action Outcome for the Lake Poly area.

Your cooperation in this matter is appreciated. If you have any further questions regarding this matter, please contact Christopher Pyott at (617) 654-6654 or at the letterhead address.

Sincerely,

This final document copy is being provided to you electronically by the Department of Environmental Protection. A signed copy of the original document is on file at the DEP office listed on the letterhead.

Christopher Pyott
Environmental Analyst

Stephen M. Johnson
Chief, Site Management Section

cc via e-mail:
Wilmington, Chairman of the Community Advisory Panel, Attn: Jeff Hull
Wilmington Conservation Commission, Attn: Robert J. Douglas
Wilmington Board of Health, Attn: Greg Erickson
Wilmington Water Department, Attn: Mike Woods
GeoInsight, Inc., 319 Littleton Road, Suite 100, Westford, MA 01886, Attn: Michael Webster
Jack Fralick, Board of Health, City Hall, 10 Common Street, Woburn, MA 01801
DEP/NERO/Water Supply, Attn: Jim Persky
DEP/Boston/Legislative Liaison: Marc LaPlante
Olin Corporation, P.O. Box 248, Charleston, TN 37310
Attn: Stephen Morrow
Sleeman, Hanley & DeNitto, 50 Congress Street, Boston, MA 02109
Attn: Margret Hanley
MACTEC Engineering and Consulting, 107 Audubon Road, Wakefield, MA 01880
Attn: Michael Murphy
Foley, Hoag & Eliot LLP, 155 Seaport Boulevard, Boston, MA 02210
Attn: Laurie Burt
Kathleen & Winifred Barry, 14 Powder House Circle, Wilmington, MA 01887
Senator Bruce Tarr, Room 507, State House, Boston, MA 02133
Rep. James Miceli, Room 167, State House, Boston, MA 02133
Rep. Charles Murphy, Room 166, State House, Boston, MA 02133
Rep. Carol Donovan, Room 473-B, State House, Boston, MA 02133

cc via mail:
DEP/Data Management: C&E/INTLET
Chairman, Board of Selectmen, 121 Glen Road, Wilmington, MA 01887
Mayor John Curran, City Hall, 10 Common Street, Woburn, MA 01801
Public Library, 175 Middlesex Avenue, Wilmington, MA 01887
Attn: Olin Site Repository

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
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Lieutenant Governor

ELLEN ROY HERZFELDER
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

JUNE 8, 2004

Olin Corporation
P.O. Box 248
1186 Lower River Road, NW
Charleston, TN 37310

ATTN: Stephen Morrow

RE: Wilmington
Olin Chemical
51 Eames Street
RTN 3-0471
Part 2 Construction-Related Release Abatement Measure Status Report No. 7

Dear Mr. Morrow:

On February 27, 2004 the Department of Environmental Protection (DEP) received a report entitled "Part 2 Construction-Related Release Abatement Measure Status Report No. 7." The report was prepared by GEI Consultants, Inc. (GEI) on behalf of the Olin Corporation and reviewed and submitted by Margret Hanley, the Licensed Site Professional of Record.

GEI presented the following proposals and/or modifications to the ongoing activities of the Construction Release Abatement Measure (RAM):

- Leave the Biocell drainage sand stockpiled in place in the Biocell pending further biodegradation of contaminant concentrations and/or the identification of a reuse scenario related to the potential redevelopment of the Property. If a re-use scenario has not been identified by the summer of 2004, GEI will re-sample the sand for analysis of total petroleum hydrocarbons and semi-volatile organic compounds in order to determine if background concentrations have been achieved;

- GEI proposes to decrease the frequency of groundwater sampling in the Post Construction Monitoring Plan (PCMP) from quarterly to semi-annually, because there have not been any significant short-term fluctuations in groundwater quality. PCMP surface water monitoring and groundwater elevation monitoring will continue on a quarterly basis, and no changes in the number or locations of monitoring points are proposed.

- The contents of an encased drum uncovered in April 2003 near the northern edge of the containment structure have been sampled. The material exhibits no hazardous characteristics and the contaminant concentrations are below S1-GW-1 soil criteria. GEI proposes to leave the drum and its contents in place and manage it as construction debris if it is disturbed during property redevelopment.

DEP REVIEW

DEP approves of the proposed revisions to the Construction RAM with the following exceptions:

- A statistical analysis must be submitted to DEP to justify that a reduction in sampling frequency from quarterly to semi-annually is warranted. Construction RAM Status Report No. 7 only included a qualitative review of PCMP data. The next detailed evaluation of PCMP data for assessing the performance of the Containment Wall/Cap will be presented in Status Report No. 8. If GEI believes that a reduction in groundwater sampling frequency is warranted, a statistical analysis should be provided as part of Status Report No. 8. DEP will review this information to determine if a reduction in groundwater sampling frequency is warranted.

- Olin must properly dispose of the drum and its contents at an appropriate off-property disposal facility within 90 days of the date of this letter. Although no hazardous chemicals were identified in the testing that was completed on the drum contents, the status report indicates that a white material is present in the drum. The report postulates that this substance could be calcium sulfate, but a confirmation of the drum contents was provided. The drum and its contents must be appropriately disposed of due to the unknown nature of the drum contents, and the potential hazards associated with physical degradation of the drum itself. Please be advised the date established for disposal of the drum is an Interim Deadline, pursuant to 310 CMR 40.0167.

Your cooperation in this matter is appreciated. If you have any further questions regarding this matter, please contact Christopher Pyott at (978) 661-7739 or at the letterhead address.

Very truly yours,

This final document copy is being provided to you electronically by the Department of Environmental Protection. A signed copy of the original document is on file at the DEP office listed on the letterhead.

Christopher Pyott
Environmental Analyst
Site Management

Stephen Johnson
Section Chief
Site Management

cc via e-mail:
Wilmington, Chairman of the Community Advisory Panel, Attn: Jeff Hull
Wilmington Conservation Commission, Attn: Robert J. Douglas
Wilmington Board of Health, Attn: Greg Erickson
Wilmington Water Department, Attn: Mike Woods
GeoInsight, Inc., 319 Littleton Road, Suite 100, Westford, MA 01886, Attn: Michael Webster
Jack Fralick, Board of Health, City Hall, 10 Common Street, Woburn, MA 01801
DEP/NERO/Water Supply, Attn: Jim Persky
DEP/Boston/Legislative Liaison: Marc LaPlante
Olin Corporation, P.O. Box 248, Charleston, TN 37310
Attn: Stephen Morrow
Sleeman, Hanley & DeNitto, 50 Congress Street, Boston, MA 02109
Attn: Margret Hanley
MACTEC Engineering and Consulting, 107 Audubon Road, Wakefield, MA 01880
Attn: Michael Murphy
Foley, Hoag & Eliot LLP, 155 Seaport Boulevard, Boston, MA 02210
Attn: Laurie Burt
Kathleen & Winifred Barry, 14 Powder House Circle, Wilmington, MA 01887
Senator Bruce Tarr, Room 507, State House, Boston, MA 02133
Rep. James Miceli, Room 167, State House, Boston, MA 02133
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cc via mail:
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Chairman, Board of Selectmen, 121 Glen Road, Wilmington, MA 01887
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Public Library, 175 Middlesex Avenue, Wilmington, MA 01887
Attn: Olin Site Repository

91598

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

MAY 12

Olin Corporation
c/o Laurie Burt
Foley Hoag LLP
155 Seaport Blvd.
Boston, MA 02210

Subject: Self-Disclosure of Violations under the Audit Policy at Olin Corporation, the former facility at 51 Eames Street in Wilmington, Massachusetts 01887

Dear Ms. Burt:

The United States Environmental Protection Agency ("EPA") has completed review of your letters dated September 24 and 29, 2003, in which you acknowledge the failure of Olin Corporation ("Olin"), to prepare and complete a written Notice of Intent ("NOI") for coverage under EPA's Construction Stormwater General Permit for stormwater discharges associated with remedial construction work from its facility, located in Wilmington, MA. Your letter describes the circumstances of the discovery of these violations and the actions the company has taken to correct and prevent recurrence of such violations.

On December 22, 1995, EPA issued a final statement of policy, "Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations," published at 60 FR 66706 ("Self-Disclosure Policy"). The policy was revised on April 11, 2000, published at 65 FR 19618. The policy states that EPA will not pursue gravity-based penalties for violations that are discovered through an environmental audit or compliance management system, voluntarily disclosed to EPA and promptly corrected when certain criteria are met. The Self-Disclosure Policy also states that EPA will retain its discretion to recover the economic benefit of noncompliance through the assessment of penalties in order to maintain an even playing field among the regulated community.

Based solely on the information currently known to EPA, the Agency has determined that the Self-Disclosure Policy applies to the situation that you have described. Thus, EPA will not seek gravity-based penalties or recovery of economic benefit because Olin discovered, disclosed, and corrected the violations in accordance with the Self-Disclosure Policy, and no significant economic benefit was gained by the company from these violations. This determination of the

applicability of the Self-Disclosure Policy is conditioned on the truthfulness and accuracy of your disclosure and is limited to the specific violations which you have disclosed.

EPA appreciates the willingness of Olin to self-police, voluntarily disclose and correct violations quickly without government intervention. If you have any questions regarding this letter, please contact Joel Blumstein at (617) 918-1771.

Sincerely,

Stephen S. Perkins, Director
Office of Environmental Stewardship

cc: Joel Blumstein

Appendix C

Bioremediation Cell Data

Table C-1
Chemical Results - Biocell Drainage Sand Sampling 2004
Olin Corporation
51 Eames Street
Wilmington, MA

		Location:	BIOCELL	BIOCELL	BIOCELL	BIOCELL	BIOCELL
		Sample ID:	1140-BP-DS1	1140-BP-DS2	1140-BP-DS3	1140-BP-DS4	1140-BP-DS5
		Date Sampled:	4/21/04	4/21/04	4/21/04	4/21/04	4/21/04
Parameter	**Analysis**	**Units**					
Volatiles							
Hydrazine	STL-SOP Hydrazine	ug/Kg	< 280 G	< 280 G	< 290 G	< 270 G	< 310 G
Monomethylhydrazine (MMH)	STL-SOP Hydrazine	ug/Kg	< 280 G	< 280 G	< 290 G	< 270 G	< 310 G
Unsymmetrical dimethylhydrazine (UDMH)	STL-SOP Hydrazine	ug/Kg	< 560 G	< 550 G	< 590 G	< 540 G	< 620 G
Semivolatiles							
N-Nitrosodimethylamine	EPA 8270C	ug/Kg	< 5.7	< 5.4	< 5.4	< 5.4	< 5.9
bis(2-EthylHexyl)phthalate	EPA 8270C	ug/Kg	340 J	310 J	< 360	< 360	< 390
Extractable Petroleum Hydrocarbons							
Diesel Range Organics	SW8468015M	mg/Kg	29	25	6.7	12	5.1

General Notes:
1. Analytes detected in at least one sample are reported here. For a complete list of analytes see the *Olin-Wilmington Active Project Database,* updated July 21, 2004.
2. Data validation performed by MACTEC Engineering and Consulting.
3. mg/kg = milligrams per kilogram.
4. ug/kg = micrograms per kilogram.
5. "<" = Analyte not detected at a concentration above the specified laboratory reporting limit.

Qualifying Notes:
G Elevated reporting limit. The reporting limit is elevated due to matrix interference.
J. The associated value is an estimated quantity.

Table C-2
Chemical Results - Biocell Drainage Sand Characterization
Olin Corporation
51 Eames Street
Wilmington, MA

Parameter	Units	MCP Method 1 Standards S-3/GW-1	Frequency of Detection	Minimum	Maximum	Average
Volatile Organic Compounds (VOCs)	mg/kg					
Hydrazine		NS	0 / 5	-	-	ND
Monomethylhydrazine (MMH)		NS	0 / 5	-	-	ND
Unsymmetrical dimethylhydrazine (UDMH)		NS	0 / 5	-	-	ND
Semivolatile Organic Compounds (SVOCs)	mg/kg					
bis(2-EthylHexyl)phthalate		100	4 / 5	0.31	0.34	0.241
N-Nitrosodimethylamine		NS	0 / 5	-	-	ND
Extractable Petroleum Hydrocarbons (EPH)	mg/kg					
MODF (C14-C28)		NS	0 / 5	-	-	ND
Motor Oil (C14-C36)		NS	0 / 5	-	-	ND
Fuel Oil #2 (C9-C25)		NS	0 / 5	-	-	ND
Fuel Oil #6 (C9-C36)		NS	0 / 5	-	-	ND
Kerosene (C9-C22)		NS	0 / 5	-	-	ND
Unmatched		NS	5 / 5	6	140	78.4
Total Petroleum Hydrocarbons (TPH)	mg/kg					
Diesel Range Organics		200	5 / 5	5.1	29	15.6
Metals	mg/kg					
Aluminum, Total		NS	5 / 5	3500	38010	10642
Arsenic, Total		30	5 / 5	3.7	6	4.36
Barium, Total		5000	5 / 5	18	19	18.2
Cadmium, Total		80	0 / 5	-	-	ND
Chromium, Total		5000	5 / 5	8.6	40	23.3
Iron, Total		NS	5 / 5	7700	9800	8740
Lead, Total		600	5 / 5	2.6	3.2	2.94
Magnesium, Total		NS	5 / 5	1300	1700	1480
Mercury, Total		60	0 / 5	-	-	ND
Nickel, Total		700	5 / 5	5.2	7.8	5.86
Selenium, Total		2500	0 / 5	-	-	ND
Silver, Total		200	0 / 5	-	-	ND
Zinc, Total		5000	5 / 5	16	18	17.2
Pesticide/PCB	mg/kg					
4,4'-DDT	mg/Kg	9	1 / 5	0.015	0.015	0.0074
Inorganics/Physical						
Flash Point	degrees F	NS	5 / 5	200	200	200
pH	pH Units	NS	5 / 5	6.12	6.44	6.23
Reactivity - Hydrogen Cyanide	mg/kg	NS	0 / 5	-	-	ND
Reactivity - Hydrogen Sulfide	mg/kg	NS	0 / 5	-	-	ND
Solids, Percent	%	NS	5 / 5	81	92.9	87.8
Specific Conductance	umhos/cm	NS	5 / 5	69	117	91.6

General Notes:

1. Generally analytes detected in at least one sample are presented. For a complete list of analytes see the *Olin Wilmington Active Project Database , dated July 21, 2004.*
2. The data presented for VOCs, SVOCs and TPH were calculated using the most recent sampling round, which includes five samples collected on April 21, 2004.
3. The data presented for EPH, Metals, Pesticide/PCBs and Inorganics/Physical were calculated using the first sampling round, which includes five samples collected on June 15, 2001. This was the only sampling round that samples were tested for the above listed parameters.
4. MCP = 310 CMR 40.0000 Massachusetts Contingency Plan, dated October 31, 1997 with revisions effective June 27, 2003.
5. Method 1 Standards (e.g., S2/GW1), where identified, are cited from the MCP.
6. mg/kg = milligrams per kilogram
7. NS = No MCP standard has been established.
8. ND = The analyte was not detected above the laboratory reporting limits.
9. The average concentrations were calculated using half the detection limits the case that the analyte was not detected above the laboratory reporting limit.

Appendix D

2004 Lake Poly Remedial Excavation Details

Appendix D

2004 Lake Poly Excavation and Backfill Summary of Field Activities

Excavation

Between June 7 and 14, 2004, soil with ammonia and chromium concentrations in excess of UCLs was excavated from the former Lake Poly area. The limits of the excavation are shown in Figure D-1.

Surface Soil for Reuse

On June 7, 2004, the top 3 to 4 feet of surface soil consisting of top soil and granular fill was excavated and stockpiled on a polyethylene liner. The top 3 to 4 feet was previously characterized in-situ and was determined to be suitable for reuse as per the Focused Feasibility Study, submitted to DEP in April 2002. Approximately 450 cy of soil was excavated and temporarily stockpiled for re-use.

Subsurface Soil for Disposal

On June 8 and 9, 2004, an additional 4 to 6 feet of soil was excavated and was placed on a polyethylene liner placed over a perimeter hay bale berm to contain potential pore water seepage from saturated soil. The horizontal limits of the deep excavation were extended beyond the proposed excavation limits on the north and east sides to remove visual evidence of Kempore™.

The total depth of the excavation generally ranged from 6 to 9 feet, which corresponds to an elevation of approximately 79 to 80 feet, which is the approximate elevation of the top of the local till layer. The southeast corner of the excavation extended approximately 3 feet deeper than the rest of the excavation. Within this section, the till interface was deeper and Kempore™ extended to the depth of the top of till. Approximately 600 cy of subsurface soil was excavated and stockpiled separate from the surface soil.

One June 14, 2004, approximately 30 cy of additional subsurface soil was excavated on the northeast corner of the excavation due to the results of confirmatory sampling for sample LP-C01, which exceeded UCLs for ammonia.

Confirmatory Sampling

On June 9, 2004, a total of 12 confirmatory samples were collected. Nine of the samples were sidewall samples, LP-C01 through LP-C08 and one duplicate sample, LP-C07D. The sidewall samples were collected over an approximate 2-foot interval near the bottom of the excavation,

which corresponds to the zone of significant subsurface contamination. Three composite bottom samples, LP-BOT-A, LP-BOT-B, and LP-BOT-D, each made up of four discrete sampling locations, were collected from the bottom of the excavation. Each of the nine sidewall samples and three composite bottom samples were submitted to Severn Trent Laboratories (STL) for chromium and ammonia testing.

Based on laboratory results of the initial round of confirmatory samples, one sample (LP-C01) had ammonia concentrations that exceeded UCLs. LP-C01 was located on the northeast corner of the excavation near railroad tracks. Additional excavation in the area was performed on June 14, 2004. The excavation extended to the existing railroad tracks. One confirmatory sample (LP-C09) was collected at the same depth as LP-C01. The results of the laboratory testing are shown in Table D-1. The second excavation was successful in reducing contaminant concentrations for the former Lake Poly area to below UCLs.

Dewatering

On June 8 and June 9, 2004, groundwater was pumped during the excavation activities at a rate ranging from 1 to 20 gallons per minute (gpm) and was held in a fractionation (frac) tank. The groundwater was monitored periodically for pH, specific conductance, temperature, and color prior to entering the tank. The results of the groundwater monitoring are presented on Table D-2. A total of approximately 6,500 gallons of water was pumped while excavating.

After reviewing the groundwater monitoring data, it was determined that the groundwater had similar qualities to the groundwater that was sampled in the monitoring wells in the area and the groundwater was decanted back to the excavation on June 11, 2004.

On June 14, 2004, prior to resuming excavation and backfilling, the groundwater from within the open excavation was pumped back to the frac tanks. The water was pumped at a rate ranging from 25 to 220 gpm and a total of 32,000 gallons of water was pumped. The water was decanted back to the excavation at the end of the day after a filter fabric was placed in the excavation. No further dewatering took place after June 14, 2004.

Backfilling

On June 14, 2004, after dewatering the excavation and after excavating the additional soil on the northeast side of the excavation, a geotextile fabric was placed at the bottom and along the sides of the excavation and was held in place with crushed stone. The geotextile fabric sheets were 16 feet wide and overlapped each other from 5 to 10 feet. An additional 5 to 15 feet of fabric extended past the top banks of the excavation for the purpose of folding it over the crushed stone that was to be used as backfill material.

Crushed stone from Benevento Sand and Gravel of Wilmington, Massachusetts, was delivered to the Site for use in backfilling Lake Poly throughout the day. Dewatering was not conducted during backfilling. After each delivery, the stone was spread throughout the excavation and was tamped in place using the excavator bucket until the level of the groundwater table was reached.

On June 17, 2004, the crushed stone was leveled out across the entire excavation to an approximate depth of 3 feet and was then compacted using a 1-ton vibratory roller making three passes over the stone in cross directions. Approximately 825 tons of crushed stone was used to backfill the excavation to the groundwater level.

A geogrid material was placed directly on top of the compacted stone on the east side of the excavation as requested by the prospective developer for improved structural bearing capacity. It was cut roughly to the shape of the walls of the excavation. The geogrid was 8 feet wide and extended the entire distance of the eastern wall. A second layer of geogrid was placed near the central part of the excavation area overlapping the first layer of geogrid approximately 2 to 3 feet. The second layer was approximately 5 feet short of the north and south ends of the excavation area.

The fabric overlapping the walls of the excavation area was folded over the compacted stone and geogrid material. This fabric covered approximately 5 feet around the perimeter of the excavation area. The remaining area was then covered with additional fabric. The fabric overlapped approximately 3 feet throughout the excavation area.

After all the stone was covered with fabric, the remaining approximate 3 feet of excavated area was backfilled with the stockpiled surface soil originally removed from the top of the excavation. The soil was placed in 6- to 8-inch lifts and was compacted with three passes of a 1-ton vibratory roller and repeated until the top of the excavation area was reached. The contractor then spread the rest of the remaining topsoil over the excavation area and seeded the Lake Poly excavation area and the surrounding disturbed areas.

Soil for Off-Site Disposal

Approximately 600 cy of contaminated subsurface soil was excavated, stockpiled and covered. On July 7, 2004, three composite samples were collected from the stockpile and were submitted to STL for chemical testing of various parameters for disposal. Results of the sampling have been submitted to Turnkey Landfill in Rochester, New Hampshire, and the soil is expected to be shipped off-property for disposal in September 2004. Laboratory testing results along with material shipping records will be submitted to the DEP under separate cover.

Table D-1
Lake Poly Confirmatory Samples
Olin Corporation
51 Eames Street
Wilmington, MA

		Parameter: Units: UCL:	Chromium (mg/kg) 10,000	Ammonia (mg/kg) 10,000
Sample Name	**Date Sampled**	**Depth (ft)**		
Sidewall Samples				
LP-C01 (Excavated 6/15/04)	6/9/04	5.5-7.5	610	14,000 J
LP-C02	6/9/04	5-6.5	12	3.6 J
LP-C03	6/9/04	5-7.0	16	64 J
LP-C04	6/9/04	5-7.0	41	46 J
LP-C05	6/9/04	4.5-5.5	24	58 J
LP-C06	6/9/04	4.0-6.0	3,100	4,100 J
LP-C07	6/9/04	4.5-6.5	340	270 J
LP-C07D (Duplicate)	6/9/04	4.5-6.5	460	350 J
LP-C08	6/9/04	5.0-7.0	7,900	41 J
LP-C09	6/15/04	5.5-7.5	30	25 J
Bottom Samples				
LP-BOT-A	6/9/04	Bottom	780	110 J
LP-BOT-B	6/9/04	Bottom	640	2,200 J
LP-BOT-C	6/9/04	Bottom	930	4,700 J

General Notes:

1. Laboratory analysis was conducted by Severn Trent Laboratories (STL).
2. Chemical results will be validated by MACTEC Engineering and Consulting, Inc.
3. The sample locations are shown on Figure D1. The ground elevation ranged from 85.65 ft to 88.33 ft.
4. The location of LP-C01 was excavated after being sampled. Sample LP-C09 was collected from the new limit of excavation.
5. Each of the bottom samples were made up of four discrete locations and were composited together in the field. The bottom samples ranged in elevation from 77.28 ft to 80.08 ft.
6. UCL = Upper Concentration Limit sited from the Massachusetts Contingency Plan dated October 1999 with revisions effective June 27, 2003.
7. mg/kg = milligrams per kilogram.

Qualifying Note:

J The result is estimated.

Table D-2
Lake Poly Excavation
Water Quality Monitoring
Olin Corporation
51 Eames Street
Wilmington, MA

Date and/or Comment	Time	Temp (F)	ph (st. units)	Specific Conductivity (uS)	Clarity	Flow (gpm)	Cumulative Quantity (gallons)
6/8/04	8:00 AM	64	6.8	300	Cloudy	1	-
	8:30 AM	72	6.7	293	Cloudy	1	-
	10:00 AM	77	6.9	319	Cloudy	1	-
	11:00 AM	79	6.4	285	Cloudy	1	-
	11:15 AM	82	6.51	271	Silty	20	-
	12:00 PM	85	6.67	256	Silty	10	-
	1:00 PM	88	6.72	254	Cloudy	5	437
	1:45 PM	91	6.76	286	Cloudy	5	-
	2:30 PM	89	6.82	294	Cloudy	3	-
	2:55 PM	87	6.72	276	Cloudy	3	785
	8:15 PM	74	6.97	260	Fairly Clear	7	2005
6/9/04	5:20 AM	65	6.99	277	Clear	20	-
	9:45 AM	84	6.85	288	Cloudy	10	-
	10:45 AM	87	6.84	275	Cloudy	5	4800
	11:45 AM	85	6.8	273	Cloudy	10	-
	2:10 PM	80	6.73	270	Cloudy	10	-
	2:50 PM	82	6.75	274	Cloudy	10	6500

General Notes:
1. F = Fahrenheit
2. st. units = standard units
3. uS =
4. gpm = gallons per minute

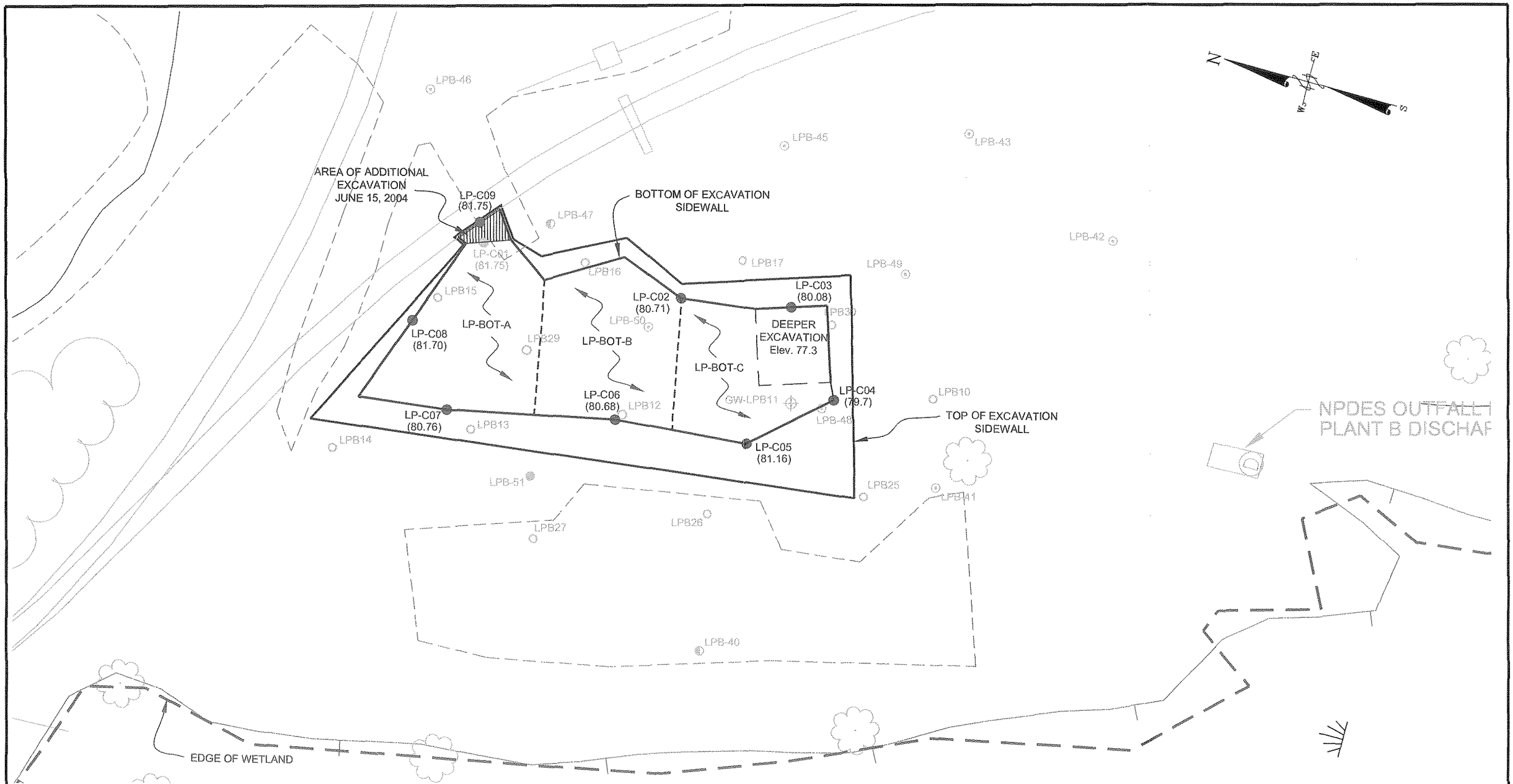
Table D-3
Chemical Testing Results
Disposal Characterization of Lake Poly Subsurface Soil Stockpile
Olin Corporation
51 Eames Street
Wilmington, MA

		Sample Identification:	LP-DIS-1	LP-DIS-2	LP-DIS-3
		Date Collected:	7/7/04	7/7/04	7/7/04
Parameter Name	**Analysis Method**	**Units**			
Volatile Organic Compounds (VOCs)	SW846 8260B	mg/kg			
p-Isopropyl Toluene			< 0.045	< 0.040	0.130
1,2-Dichlorobenzene			< 0.045	0.086	0.069
1,4-Dichlorobenzene			< 0.045	0.130	0.077
1,2,3-Trichlorobenzene			< 0.045	< 0.040	0.049
1,2,4-Trichlorobenzene			< 0.045	0.052	0.064
2,4,4-Trimethyl-1-pentene			0.920	0.460	0.370
2,4,4-Trimethyl-2-Pentene			0.300	0.380	0.460
Semivolatile Organic Compounds (SVOCs)	SW846 8270C	mg/kg			
Di-n-butyl phthalate			< 3.7	5.3	5.50
N-Nitrosodiphenylamine			1400	11	210
Polychlorinated Biphenyls (PCBs)	SW846 8082A	mg/kg	ND	ND	ND
Pesticides	SW846 8081A	mg/kg			
Endosulfan II			0.13	<0.0097	0.051
Total Petroleum Hydrocarbons (TPH)	SW846 8015B(M)	mg/kg			
Diesel Range Organics (DRO), total			3100	3,000	1900
Metals		mg/kg			
Arsenic, Total	SW846 6010B		3.30	3.90	3.5
Barium, Total	SW846 6010B		26.00	20.00	24
Cadmium, Total	SW846 6010B		< 0.23	< 0.11	< 0.14
Chromium, Total	SW846 6010B		1800	500.00	690
Lead, Total	SW846 6010B		15	5.80	7.2
Mercury, Total	SW846 7471A		3	0.18	0.22
Selenium, Total	SW846 6010B		< 1.1	< 0.57	< 0.72
Silver, Total	SW846 6010B		< 1.1	< 0.57	< 0.72
TCLP Lead	SW846 6010B	mg/L	0.12	0.05	0.065
Inorganics/Physical					
Corrosivity	SW846 9045C	pH	7.91	7.36	7.78
Flash Point	EPA 1010	degrees F	>200	>200	>200
Specific Conductance @ 25°C	SM18 2510B	umhos/cm	29.3	24.10	27.80
Solids, Percent	EPA 160.3	%	90	92	90.50

General Notes:

1. Only numerical results for analytes detected in at least one sample are reported here. For a complete list of analytical results, refer to laboratory data sheets or the Olin-Wilmington Active Project Database update July 21, 2004.
2. Data validation performed by LAW Engineering and Environmental Services, Inc.
3. mg/kg = Milligrams per kilogram
4. ug/kg = Microgram per kilogram (dry weight)
5. umhos/cm = Micromhos per centimeter
6. ND = Analyte(s) not detected above laboratory reporting limit. See the laboratory data sheets or the Olin-Wilmington Active Project Database for laboratory reporting limits.
7. "<" = Analyte not detected at a concentration above the specified laboratory reporting limit.

FIGURES



Legend:

- MONITORING WELL BY MACTEC (2003)
- MONITORING WELL BY GEI (2001)
- SOIL BORING BY MACTEC (2003)
- SOIL BORING BY GEI (2001)
- EDGE OF WETLAND
- LP-C06 (80.68) CONFIRMATORY SAMPLE LOCATION AND ELEVATION IN FEET
- LP-BOT-A COMPOSITE BOTTOM SAMPLE LOCATION, MADE OF 4 DISCRETE SAMPLES
- LP-C01 SAMPLE WAS EXCAVATED AND SUPERCEED BY SAMPLE LP-C09

0 20 40

SCALE, FEET

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	2004 LAKE POLY EXCAVATION LIMITS AND CONFIRMATORY SAMPLE LOCATIONS
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure D1

97598-647 djm 07/29/04

Appendix E

Post-Construction Monitoring Plan Data, January through July 2004

Table E-1
Chemical Testing Results: Surface Water
Olin Corporation
51 Eames Street
Wilmington, MA

		Ditch:	South Ditch	South Ditch	South Ditch	South Ditch	South Ditch	South Ditch	East Ditch	East Ditch
		Location ID:	ISCO1	ISCO1	ISCO1	SD-17	SD-17	ISCO2	ISCO3	ISCO3
		Sample ID:	1170-ISCO1-67	1170-ISCO1-68	1170-ISCO1-68	1170-PZ-17-67	1170-PZ-17-68	1170-ISCO2-68	1170-ISCO3-67	1170-ISCO3-68
		Date Sampled:	2/2/04	5/10/04	5/10/04	2/2/04	5/10/04	5/10/04	2/2/04	5/10/04
Parameter	**Analysis Method**	**Units**			**Duplicate**					
Metals	200.7/6010	mg/L								
Aluminum, Dissolved			< 0.1	0.03 BJ	0.013 BJ	4.63	0.65	0.056	< 0.1	< 0.05
Chromium, Dissolved			0.018	0.024	0.015	1.33	0.31	0.022	< 0.005	0.001 B
Chromium, Total			0.492	0.035	0.036	2.29	0.86	0.1	< 0.005	0.015
Sulfate as SO4	EPA 300.0/375.4	mg/L	122	190	180	1080	530	470	38.9	63
Inorganic / Physical										
Chloride	SM18 4500CL	mg/L	120	110	100	284	170	140	91.2	110
Nitrate as N	SM4500-NH3/Lachat	mg/L	0.323	0.42	0.46	0.288	0.96	0.87	1.43	1.2
Nitrite as N	SM4500-NH2	mg/L	< 0.01	0.011	0.010	< 0.1	0.010	0.011	< 0.01	< 0.01
Nitrogen, Ammonia	SM4500F/Lachat	mg/L	19.4	65 J	54	195	110	99	2.01	4.3
Specific Conductance	SM2510B	umhos/cm	755	836	832	4780	1770	1630	463	563
pH	field measured	pH Units	6.82			5.8			6.68	

General Notes:
1. Source of laboratory analytical data: *Olin-Wilmington Active Project Database*, updated July 21, 2004. Values for pH were referenced from PCMP Well Sampling Report, Second Quarter May 2004, by MACTEC Engineering and Consulting.
2. Data validation performed by MACTEC Engineering and Consulting.
3. Field parameters measured by MACTEC personnel in accordance with generally accepted engineering and scientific practices.
4. Dissolved metal samples were filtered in the field with a 0.45 um filter.
5. Sampling locations are shown on Figure 2.
6. "<" = Analyte not detected at a concentration above the specified laboratory reporting limit.
7. mg/L = milligrams per liter.
8. umhos/cm = microms per centimeter.
9. Laboratory testing was conducted by Severn Trent Laboratories of Westfield, MA.

Qualifying Notes:
B The analyte was detected in both the sample and its associated laboratory blank.
J The associated value is an estimated quantity.

Table E-2
Chemical Testing Results: Groundwater
Olin Corporation
51 Eames Street
Wilmington, MA

		Sampling Period:	PCMP First Quarter, 2004															
		Well identification:	GW-10S	GW-201S	GW-202D	GW-202S	GW-24	GW-25	GW-26	GW-34D	GW-34SR	GW-35S	GW-39	GW-42S	GW-43S	GW-78S	GW-79S	GW-CA1
		Date Sampled:	2/12/04	2/10/04	2/2/04	2/2/04	2/12/04	2/12/04	2/12/04	2/10/04	2/10/04	2/11/04	2/11/04	2/12/04	2/12/04	2/2/04	2/2/04	2/11/04
Parameter	**Analysis Method**	**Units**																
Metals, Dissolved																		
Aluminum	200.7/6010	mg/L	3.39	< 0.1	0.235	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.127	0.457	< 0.1	0.714	< 0.1	< 0.1
Chromium	200.7/6010	mg/L	< 0.005	0.023	0.072	< 0.005	< 0.005	0.014	0.013	0.008	< 0.005	0.021	< 0.005	0.016 J	< 0.005	0.242	0.024	0.012
Inorganic / Physical																		
Chloride	SM18 4500CL	mg/L	23.0	32.6	145	80.5	20.0	47.0	55.3	5.0	1.6	19.3	47.2	68.0	251	47.8	112	14.8
Nitrogen, Ammonia	SM4500F/Lachat	mg/L	< 0.1	37.0 J	245 J	74.7 J	56.0 J	35.0 J	52.2 J	15.6 J	0.62 J	27.8 J	0.39 J	1.24 J	7.05 J	57.0 J	202 J	12.2 J
Specific Conductance	SM2510B	umhos/cm	194	1670	5450	1770	781	835	909	294	135	716	659	346	1060	1490	6370	851
Sulfate as SO4	EPA 300.0/375.4	mg/L	50.2	853	1440	697	160	252	232	68.8	28.6	201	252	34.4	90.2	798	1630	234
pH	Field Measured	pH units	4.58	6.4	8.6	6.86	7.4	6.55	6.14	6.08	5.93	7.68	5.4	5.43	6.1	5.53	6.42	6.92

General Notes:

1. Source of laboratory analytical data: *Olin-Wilmington Active Project Database,* updated July 21, 2004. Values for pH were referenced from *PCMP Well Sampling Report, Second Quarter May 2004*, by MACTEC Engineering and Consulting.
2. Data validation performed by MACTEC Engineering and Consulting.
3. Dissolved metal samples were filtered in the field with a 0.45 um filter.
4. Sampling locations are show on Figure 2.
5. "<" = Analyte not detected at a concentration above the specified laboratory reporting limit.
6. mg/L = milligrams per liter.
7. umhos/cm = microms per centimeter.
8. Laboratory testing was conducted by Severn Trent Laboratories of Westfield, MA.

Qualifying Notes:

B The analyte was detected in both the sample and its associated laboratory blank.
J The associated value is an estimated quantity.

Table E-2
Chemical Testing Results: Groundwater
Olin Corporation
51 Eames Street
Wilmington, MA

		Sampling Period:	PCMP Second Quarter, 2004																
		Well Identification:	GW-10S	GW-201S	GW-202D	GW-202S	GW-24	GW-25	GW-26	GW-34D	GW-34SR	GW-35S	GW-39	GW-42S	GW-43S	GW-55S	GW-78S	GW-79S	GW-CA1
		Date Sampled:	5/7/04	5/28/04	5/10/04	5/10/04	5/7/04	5/7/04	5/20/04	5/5/84	5/5/04	5/5/04	5/20/04	5/20/04	5/28/04	5/21/04	5/10/04	5/10/04	5/5/04
Parameter	**Analysis Method**	**Units**																	
Metals, Dissolved																			
Aluminum	200.7/6010	mg/L	2.5	< 0.05	0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.28	0.6	< 0.05	0.84	0.95	< 0.05	0.05
Chromium	200.7/6010	mg/L	< 0.005	0.1	0.1	< 0.005	< 0.005	0.015	0.021	0.008	< 0.005	0.016	< 0.005	0.046	< 0.005	< 0.005	0.28	0.011	< 0.005
Inorganic / Physical																			
Chloride	SM18 4500CL	mg/L	6.4	55	390	65	23	29	93	5.0	5.2	15	22	89	130	310	49	320	16
Nitrogen, Ammonia	SM4500F/Lachat	mg/L	0.14	120	260	130	100	53 J	130	13	0.47	40	0.33	1.7	22	290	64	240	0.086 B
Specific Conductance	SM2510B	umhos/cm	83.8	3440	5980	2060	714	693	806	289	130	1040	1140	381	345	623	2130	5080	716
Sulfate as SO4	EPA 300.0/375.4	mg/L	26	1100	1900	660	140	180	500	78	26	430	440	28	86	1600	800	1600	200
pH	Field Measured	pH units	4.28	6.37	6.07	6.72	7.6	6.35	5.86	6.26	5.88	6.83	5.46	5.22	6.01	5.63	5.25	6.12	6.62

General Notes:

1. Source of laboratory analytical data: *Olin-Wilmington Active Project Database,* updated July 21, 2004. Values for pH were referenced from *PCMP Well Sampling Report, Second Quarter May 2004*, by MACTEC Engineering and Consulting.
2. Data validation performed by MACTEC Engineering and Consulting.
3. Dissolved metal samples were filtered in the field with a 0.45 um filter.
4. Sampling locations are show on Figure 2.
5. "<" = Analyte not detected at a concentration above the specified laboratory reporting limit.
6. mg/L = milligrams per liter.
7. umhos/cm = microms per centimeter.
8. Laboratory testing was conducted by Severn Trent Laboratories of Westfield, MA.

Qualifying Notes:

B The analyte was detected in both the sample and its associated laboratory blank.
J The associated value is an estimated quantity.

MACTEC

March 23, 2004

PN: 6300030008/10.03

Mr. Stephen G. Morrow, P.E.
Principal Environmental Specialist
Olin Corporation
Post Office Box 248
Charleston, Tennessee 37310

Subject: PCMP Well Sampling Report
First Quarter February 2004 Sampling Event
Olin Corporation, Wilmington, Massachusetts

Dear Mr. Morrow:

MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to provide Olin Corporation (Olin) with this report summarizing the field activities relative to sampling and analysis of sixteen (16) of the seventeen (17) Post Construction Monitoring Plan (PCMP) wells and three (3) surface water sampling locations. Monitoring location GW-55S could not be sampled, as the water inside the wellhead was frozen. Fourteen (14) of the 16 sampled PCMP wells are South Ditch/Weir wells which have been incorporated into the PCMP sampling program per the Licensed Site Professional (LSP). The 14 South Ditch/Weir monitoring wells are associated with the man-made drainage system at Olin's Eames Street property in Wilmington, Massachusetts.

The purpose of the quarterly ground-water sampling and chemical analysis is to monitor concentrations of site-specific compounds of concern (COCs) in the selected wells and to evaluate ground-water elevations and flow direction. In addition, MACTEC monitored the South Ditch Pilot Wetland per the approved scope of work during the 1st Quarter program. This was conducted at the request of Geomega.

MACTEC personnel performed the sampling work in general accordance with the approved Quality Assurance Project Plan (QAPP), dated August 1999.

Please do not hesitate to contact Eric Axelrod or Jason Naiden at (781) 245-6606 if you have any questions.

Sincerely,
MACTEC Engineering and Consulting, Inc.

Jason Naiden
Staff Scientist

Eric M. Axelrod, LSP
Project Manager

Michael Murphy
Sr. Principal Environmental Scientist

cc: Margret Hanley, MA LSP
Larry Welch, GEI
Dan Stone, Geomega
MACTEC Project File [P:\WS-CHEM\OLIN\Wilmington\2004QUARTERLYSAMPLING\1stQuarter2004\PCMP\PCMPsamprptcvrltr1Q04.doc]

MACTEC Engineering and Consulting, Inc.
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PCMP WELL SAMPLING REPORT
FIRST QUARTER FEBRUARY 2004 SAMPLING EVENT
OLIN CORPORATION
WILMINGTON, MASSACHUSETTS

INTRODUCTION

The purpose of the Post Construction Monitoring Plan (PCMP) surface and ground-water sampling and analysis activities is to monitor the concentrations of selected surface and ground-water constituents in the on-site monitoring wells and to collect ground-water levels over a portion of the Wilmington facility site.

This sampling summary report presents the field activities completed in association with the first quarter 2004 surface and ground-water sampling event for the PCMP Monitoring Program, and the assessment of the South Ditch Pilot Wetland. The first quarter 2004 ground-water and surface water monitoring program included the sampling of sixteen (16) of a seventeen (17) PCMP wells, the collection of PCMP surface water samples from three (3) locations within the South Ditch, collection of water levels from two (2) Pilot wetland piezometers installed by Geomega, collection of water quality parameters from the Plant B south ditch discharge vault, 2 locations within the south ditch, and the gauging of sixty-four (64) monitoring wells, piezometers and staff gauges.

The 16 monitoring wells were chosen and sampled to provide a representation of water quality over a portion of the Wilmington site. During sampling activities the purged ground-water was continuously monitored with a Horiba U-22 water quality instrument for pH, specific conductivity (SC), dissolved oxygen (DO), oxidation/reduction potential (ORP), and temperature. Upon stabilization of these parameters, ground-water samples were collected for laboratory analysis for specific conductivity, chloride, ammonia-nitrogen, sulfate and dissolved aluminum and chromium. The wells were sampled between February 2 and February 13, 2004. Surface water samples and synoptic water levels were collected on Monday, February 2, 2004 before discharge from the Plant B treatment area to the south ditch occurred. Surface water samples were collected for laboratory analysis of ammonia-nitrogen, chloride, nitrate, nitrite, sulfate, specific conductance, dissolved aluminum and chromium and total chromium. Severn Trent Laboratories (STL) has completed implementing a new chemical analysis method for nitrate, nitrite and chloride for the PCMP program. All nitrate, nitrite and chloride analysis were conducted under EPA 300.0 methodology.

The two piezometer ground-water monitoring locations (PZ-W1 and PZ-W2) located in the south ditch pilot wetland, were frozen at the time of gauging. No water quality parameters could be collected, however, at the request of Geomega, depths to ice were recorded for these locations.

SCOPE OF WORK

The following monitoring wells and surface water locations on the Wilmington site were sampled during the first quarter February 2004 event:

PCMP Wells		Surface Water Sample Locations
GW-10S	GW-43S	ISCO 1
GW-24	GW-78S	ISCO 3
GW-25	GW-79S	PZ17
GW-26	GW-201S	Plant B Vault*
GW-34S(R)	GW-202S	PW-SW1*
GW-34D	GW-202D	PW-SW2*
GW-35S	GW-CA1	
GW-39		
GW-42S		

*Indicates only Field parameters collected

Furthermore, field duplicate samples were collected from well locations GW-78S and GW-42S. Extra aliquots of sample were provided for a matrix spike/matrix spike duplicate (MS/MSD) to be performed on samples from GW-25.

Water samples were collected from each monitoring location for both field and laboratory analyses, except where noted. Analytical methods utilized for laboratory testing are shown in Tables 1 and 2. Prior to collection of ground-water, all monitoring wells were purged in accordance with EPA 1996 low stress (low flow) guidelines and the following field indicator parameter measurements were obtained: pH, SC, temperature, DO and ORP. The field parameter data were collected using a Horiba U-22 instrument equipped with a flow-through cell. In addition, a 0.45-micron pore diameter, in-line Teflon™ filter was used to field filter samples collected for dissolved metals. During the sampling activities flow rates were generally maintained at approximately 350 milliliters per minute. During the low-flow monitoring well purging, flow rates and ground-water indicator parameters were measured to monitor the stability of ground-water parameters. The stabilization criteria are included in the Quality Assurance Project Plan. Well purging was continued at each location until the field indicator parameters were stable and samples were subsequently collected. The low flow purging field parameter information at stabilization is presented in Table 3. Monitoring location GW-55S could not be sampled, because the ground-water in the well was frozen.

The purged ground-water from each monitoring well was collected in collapsible plastic containers and pursuant to the Massachusetts Contingency Plan (MCP) (310 CMR 40.0045), emptied back down the monitoring well subsequent to sample collection, or discharged to the ground surface when down-hole data loggers were present. Data loggers were noted in wells PZ-13, GW-35S, GW-CA1, GW-78S, and GW-76S.

Surface water samples were collected in laboratory supplied un-preserved bottles. These samples were acquired by submerging dedicated silastic ISCO® tubing through holes drilled in the ice. This procedure was used to reduce the entrapment of floating or suspended sediment in the sample by dis-allowing entrained turbidity from entering the sample bottles, and allow for the use of an in-line metals filter. Field indicator parameters (pH, SC, temperature, DO and ORP) were obtained at each location prior to sampling. The field parameter data were collected using a Horiba U-22 instrument equipped with a flow-through cell. In addition, a 0.45-micron pore diameter, in-line Teflon™ filter was used to field filter all samples collected for dissolved metal analysis. Final sampling field parameters are included in Table 4.

Ground-water and surface-water samples were collected in properly preserved laboratory-supplied containers, field filtered if appropriate according to the QAPP, and placed on ice for delivery to Severn Trent Laboratories (STL) under chain-of-custody procedures. The samples were delivered to the STL Westfield, MA facility for chemical analyses. Copies of the chain-of-custody documents are provided in Appendix A.

Ground-water levels were measured in each well location using an electronic water-level indicator prior to disturbance by the sampling process. Staff gauge measurements were taken manually by measuring water levels relating to a known staff gauge reference point. Ground-water and surface water level measurements were obtained from 64 of 75 monitoring well, piezometer and staff gauge locations. The remaining wells could not be gauged due to obstructions in or on the well casings, or ice and snow obscuring the locations and/or preventing access to the flush mount well locations. The ground-water and surface water levels obtained during this sampling event are summarized in Tables 5 and 6.

WELL RECONNAISSANCE

Site reconnaissance of the seventeen monitoring well locations in the PCMP was performed during the 1st Quarter program. Data loggers were observed in five monitoring wells: PZ-13, GW-35S, GW-CA1, GW-78S, and GW-76S, and monitoring well GW-55S was frozen. A Field Activity Summary Report (FAR) for both the PCMP sampling activities and Pilot Wetland assessment were prepared on February 23, 2004 and a copy of the FARs are included as Appendix B to this report.

ADDITIONAL SAMPLING ACTIVITIES

A pilot wetland system was installed along the South Ditch near the weir during the period of September 29 to October 2, 2003 by Geomega of Boulder, CO. In a memorandum dated November 6, 2003 Geomega requested that the wetland system be monitored periodically for water quality parameters and water levels from the two piezometers located within the wetland system (PZ-W1 and PZ-W2), from the Plant B concrete discharge vault, and two locations (PW-SW1, PW-SW2) located in the south ditch between the south ditch weir and pilot wetland. In addition, the flow rate of water discharging from the pilot wetland to the South Ditch was measured, along with the assessment of the extent of freezing conditions within the system.

The measurement of water quality parameters was conducted on February 2, 2004. During surface water sampling, purged water was pumped with dedicated sample tubing through a Horiba U-22

water quality instrument. At the time of sampling, the water within the wetland was frozen, so no water quality parameters could be collected from either wetland piezometer. Field parameter information is presented in Table 3. Water level measurement occurred coincident with the sampling of monitoring well GW-202S per the request of Geomega. No flow from the pilot wetland could be measured because of ice covering the discharge hose and check valve located in the south ditch center-line.

FIGURES

SEE FIGURE 1

PLANT B PROGRAM
FIRST QUARTER FEBRUARY 2004 SAMPLING EVENT REPORT

TABLES

Table 1
Post Construction Monitoring Plan Wells
Sampling Report Groundwater Analytical Parameters
First Quarter February, 2004
Olin-Wilmington

Analyte	Method of Analysis	Method PQLs	Units	PCMP Wells	PCMP/South Ditch Surface Water	Precision (RPD)	Accuracy (% Recovered)
Physical/Inorganic Parameters						(LCS)	(MS/MSD)
Ammonia-Nitrogen	LAC107061B	0.01	mg/l	X	X	80-120	74-125
Chloride	EPA 300.0	1	mg/l	X	X	80-120	77-116
Specific Conductivity	SM182510B	NA	umhos/cm	X	X	80-120	na
Sulfate	EPA 300.0	1	mg/l	X	X	80-120	74-125
Dissolved Metals							
Aluminum, dissolved	EPA 6010	100	ug/l	X	X	85-115	70-130
Chromium, dissolved	EPA 6010	10	ug/l	X	X	85-115	70-130

Prepared by: MAA
Checked by: EMA

Notes: NA - Not Applicable

Table 2
Post Construction Monitoring Plan
Surface Water Analytical Parameters
Event 67 February, 2004
Olin- Wilmington

Analyte	Analysis Method	Detection Limit (1)	Units
Physical/Inorganic Parameters			
Ammonia-Nitrogen	LAC10-107061B	0.01	mg/l
Nitrate	EPA 300 part A	0.05	mg/l
Nitrite	EPA 300 part A	0.01	mg/l
Chloride	EPA 300.0	1	mg/l
Specific Conductivity	SM182510B	NA	umhos/cm
Sulfate	EPA 300.0	1	mg/l
Metals			
Aluminum, Dissolved	EPA 6010	200	ug/l
Chromium, dissolved	EPA 6010	200	ug/l
Chromium, Total	EPA 6010	10	ug/l

NOTES:
(1) mg/L = milligrams per liter
(1) umhos = micromhos per centimeter
(1) NTU = nephelometric turbidity unit
(1) ug/L = micrograms per liter
Analysis methods, detection limits, precision and accuracy criteria are included in the QAPP 1999.
NA - Not applicable

Prepared by: MAA
Checked by: EMA

Table 3
Post Construction Monitoring Plan
First Quarter, February, 2004
Olin-Wilmington

Final Sampling Parameters

PCMP Monitoring Wells

Location	GW-10S	GW-24	GW-25	GW-26	GW-34S(R)	GW-34D	GW-35S	GW-39	GW-42S
Date	2/12/2004	2/12/2004	2/12/2004	2/12/2004	2/10/2004	2/10/2004	2/11/2004	2/10/2004	2/12/2004
Depth to Water (feet)	9.17	2.99	5.36	4.36	7.53	8.72	NA	3.19	3.44
pH (standard units)	4.58	7.40	6.55	6.14	5.93	6.08	7.68	5.40	5.43
Conductivity (µmhos/cm) (1)	184	711	785	822	125	274	707	659	303
Dissolved oxygen (mg/L)	6.49	7.01	4.38	0.00	3.94	4.61	5.74	4.80	0.00
Temperature (°Celcius)	6.60	8.36	8.10	6.84	7.80	10.40	7.70	5.30	8.53
Redox (millivolts)	141	-19	-52	-7	189	166	-191	204	15

PCMP Monitoring Wells

Location	GW-43S	GW-55S	GW-78S	GW-79S	GW-201S	GW-202S	GW-202D	GW-CA1
Date	2/12/2004	NS	2/2/2004	2/2/2004	2/10/2004	2/2/2004	2/2/2004	2/11/2004
Depth to Water (feet)	5.42	NS	4.72	3.46	3.78	6.81	6.24	NA
pH (standard units)	6.10	NS	5.53	6.42	6.40	6.86	6.60	6.92
Conductivity (µmhos/cm) (1)	1,260	NS	1,770	3,880	2,010	1,970	3,740	970
Dissolved oxygen (mg/L)	0.00	NS	7.09	2.48	5.00	0.00	5.91	3.70
Temperature (°Celcius)	8.72	NS	8.00	6.21	5.90	9.53	10.90	6.90
Redox (millivolts)	58	NS	143	-58	144	125	51	-47

PCMP Surface Water/Pilot Wetland Study Area

Location	1170-PZ17-67	1170-ISCO1-67	1170-ISCO2-67	1170-ISCO3-67	PZ-W1	PZ-W2	Plant B Vault	PW-SW1	PW-SW2
Date	2/2/2004	2/2/2004	NS	2/2/2004	2/2/2004	2/2/2004	2/2/2004	2/2/2004	2/2/2004
Sample Time	0950	0930	NS	1050	NS	NS	1010	1020	1030
Flow (ft/sec)	0	0	NS	0	NS	NS	0	0	0
Depth of Water (ft)	0.39 [2]	0.51 [2]	NS	0.43 [2]	NS	NS	NS	NS	NS
pH (standard units)	5.8	6.82	NS	6.68	NS	NS	7.99	5.20	5.72
Conductivity (µmhos/cm) (1)	2,860	705	NS	407	NS	NS	702	2510	2420
Dissolved oxygen (mg/L)	7.78	11.66	NS	13.58	NS	NS	17.89	6.13	11.32
Temperature (°Celcius)	0.81	-0.15	NS	1.06	NS	NS	1.22	3.99	0.2
Redox (millivolts)	62	-3	NS	63	NS	NS	-19	138	95

Notes: (1) micromhos per centimeter
NA - Not applicable
NS - Not Sampled due to ice conditions
(1) Specific conductance prevents water depth measurement
(2) Location frozen, depth below ice measured

Prepared by: JCN
Checked by:

Table 4
Surface Water Sampling and Monitoring
First Quarter, February 2004
Olin-Wilmington

Final Sampling Parameters

Monthly Surface Water Parameters						
Location			1170-PZ17-67	1170-ISCO1-67	1170-ISCO2-67	1170-ISCO3-67
Date			2/2/2004	2/2/2004	NS	2/2/2004
Sample Time			0950	0930	NS	1050
Flow (ft/sec)			0	0	NS	0
Depth of Water (ft)			0.39 [3]	0.51 [3]	NS	0.43 [3]
pH (standard units)			5.8	6.82	NS	6.68
Conductivity (µmhos/cm) (1)			2860	705	NS	407
Dissolved oxygen (mg/L)			7.78	11.66	NS	13.58
Temperature (°Celcius)			0.81	-0.15	NS	1.06
Redox (millivolts)			62	-3	NS	63

Notes:
(1) Micromhos per centimeter
(2) NA- Not applicable
(3) Depth below ice is approximate
(4) NS- Not sampled, frozen to substrate

Prepared by: JCN
Checked by:

TABLE 5
PCMP Synoptic Groundwater Elevations
First Quarter February, 2004
Olin-Wilmington

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
I.D.	(ft msl)				
GT-04-D	88.47	1	—	—	—
GT-04-S	86.36	1	—	—	—
GT-06-D	87.24	1	—	—	—
GT-06-S	87.27	1	—	—	—
GW-03-D	85.28		6.82	78.46	2/2/2004
GW-03-S	86.4		7.98	78.42	2/2/2004
GW-04	82.19		6.45	75.74	2/2/2004
GW-04-D	79.29		3.50	75.79	2/2/2004
GW-06-D	90.06		8.96	81.10	2/2/2004
GW-06-S	90.98		9.11	81.87	2/2/2004
GW-07	83.19	1	—	—	—
GW-08	82.54	TOC	4.96	77.58	2/2/2004
GW-10-S	89.1	TOC	9.20	79.90	2/2/2004
GW-11	87.22	1	—	—	—
GW-12	84.65		3.82	80.83	2/2/2004
GW-17-D	81.42	3	—	—	—
GW-17-S	82.07		4.22	77.85	2/2/2004
GW-18-D	88.92		12.90	76.02	2/2/2004
GW-18-S	89.6	4	—	—	—
GW-19-S	89.88	1	—	—	—
GW-19-D	89.76	1	—	—	—
GW-20	85.54		7.06	78.48	2/2/2004
GW-24	83.43		2.91	80.52	2/2/2004
GW-25	85.97		5.98	79.99	2/2/2004
GW-26	84.93		4.32	80.61	2/2/2004
GW-27-D	89.35	1	—	—	—
GW-27-S	89.28	1	—	—	—
GW-28-D	84.81		2.99	81.82	2/2/2004
GW-28-S	85.56		3.65	81.91	2/2/2004
GW-29-D	85.16		3.85	81.31	2/2/2004
GW-29-S	84.31		2.42	81.89	2/2/2004
GW-30-DR	87.03		6.55	80.48	2/2/2004
GW-32S	89.18		8.35	80.83	2/2/2004
GW-33-D	89.64	1	—	—	—
GW-33-S	89.9	1	—	—	—
GW-34-D	90.38		8.72	81.66	2/2/2004
GW-34-S (R)	89.13		7.52	81.61	2/2/2004
GW-35-D	88.6		8.02	80.58	2/2/2004
GW-35-S	88.51		7.95	80.56	2/2/2004
GW-36	85.72	1	—	—	—
GW-37	83.47	1	—	—	—
GW-38	86.96	1	—	—	—
GW-39	83.64		3.41	80.23	2/2/2004
GW-42-D	84.07	6			
GW-42-S	84.18	6			
GW-43-D	87.96		7.39	80.57	2/2/2004
GW-43-S	87.35		6.76	80.59	2/2/2004
GW-50-D	80.11		4.48	75.63	2/2/2004
GW-50-S	79.7		4.17	75.53	2/2/2004

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
I.D.	(ft msl)				
GW-51-D	84.55		7.48	77.07	2/2/2004
GW-51-S	84.62		6.72	77.90	2/2/2004
GW-54-S	88.85		5.97	82.88	2/2/2004
GW-55-D	81.95	7	1.91	80.04	2/2/2004
GW-55-S	81.7	7	1.52	80.18	2/2/2004
GW-56-D	82.82		6.02	76.80	2/2/2004
GW-56-S	83.07		6.22	76.85	2/2/2004
GW-68-D	90.15	6	—	—	—
GW-69-D	93.04		12.46	80.58	2/2/2004
GW-69-S	92.27		11.72	80.55	2/2/2004
GW-76-S	88.45		7.85	80.60	2/2/2004
GW-77-S	85.49	6	—	—	—
GW-78-S	84.89		4.72	80.17	2/2/2004
GW-79-S	81.54		3.49	78.05	2/2/2004
GW-201S	83.29		4.42	78.87	2/2/2004
GW-202S	86.97		6.81	80.16	2/2/2004
GW-202D	86.52		6.24	80.28	2/2/2004
GW-CA1	88.01		6.75	81.26	2/2/2004
GW-CA2	87.8		7.20	80.60	2/2/2004
GW-CA3D	89.86		9.25	80.61	2/2/2004
GW-CA3S	89.68		9.03	80.65	2/2/2004
GW-CA4S	87.74		7.35	80.39	2/2/2004
GW-LPB11	88.88		6.95	81.93	2/2/2004
PW-2	86.58		5.99	80.59	2/2/2004
PZ-11/IN	84.51	6	—	—	—
PZ-11/OUT	84.51	6	—	—	—
PZ-12/IN	84.04		3.45	80.59	2/2/2004
PZ-12/OUT	84.04		3.55	80.49	2/2/2004
PZ-14/IN	83.96	6	—	—	—
PZ14/OUT	83.96	6	—	—	—
PZ-15/IN	79.12	7	3.08	76.04	2/2/2004
PZ-15/OUT	79.12	7	3.09	76.03	2/2/2004
PZ-16R/IN	79.07	5	—	—	—
PZ-16R/OUT	79.07	5	—	—	—
PZ-17R/IN	79.5	7	0.31	79.19	2/2/2004
PZ-17R/OUT	79.5	7	1.10	78.40	2/2/2004
PZ-18R/IN	82.42	7	1.70	80.72	2/2/2004
PZ-18R/OUT	82.42	7	1.75	80.67	2/2/2004
SP-01	83.09	2	—	—	—
SP-02	84.24	2	—	—	—
SP-03	87.85		7.03	80.82	2/2/2004
SG-8	83	7	0.76	80.43	2/2/2004
SG-9	75.05	1	—	—	—
SG-10	82.4	1	—	—	—
SG-11	82.32	1	—	—	—
East Ditch SG	79.25	1	—	—	—
Old Weir SG	—	1	—	—	—
SG-14	81.1	7	0.96	78.73	2/2/2004
SG-16	82.8	7	0.94	80.41	2/2/2004

Notes:
(1) Well/staff guage removed or missing from site.
(2) Well paved over. Water level not obtained.
(3) Well has been inhabited by mice.
(4) Obstruction exists in well which prevented measurement.
(5) Not measured - cap rusted shut.
(6) Not measured due to ice or frozen conditons.
(7) Depth to Ice measured.
TOC- Water level measurement taken from Top of Casing, not top of riser.
Bold Text indicates location gauged during current Quarterly event.

Prepared by: JCN
Checked by: EMA

TABLE 6
Surface Water Sampling and Monitoring
Event 67 February, 2004
Olin-Wilmington

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
PZ-11/IN	84.51	(8)	---	---	2/2/2004
PZ-11/OUT	84.51	(8)	---	---	2/2/2004
PZ-12/IN	84.04	ICE	3.45	80.59	2/2/2004
PZ-12/OUT	84.04	ICE	3.55	80.49	2/2/2004
PZ-13/IN	---	---	---	---	---
PZ-13/OUT	---	---	---	---	---
PZ-14/IN	83.96	(8)	---	---	2/2/2004
PZ14/OUT	83.96	(8)	---	---	2/2/2004
PZ-15/IN	79.12	ICE	3.08	76.04	2/2/2004
PZ-15/OUT	79.12	ICE	3.09	76.03	2/2/2004
PZ-16R/IN	79.07	(7)	---	---	---
PZ-16R/OUT	79.07	(7)	---	---	---
PZ-17R/IN	79.5	ICE	0.31	79.19	2/2/2004
PZ-17R/OUT	79.5	ICE	1.1	78.4	2/2/2004
PZ-18R/IN	82.42	ICE	1.7	80.72	2/2/2004
PZ-18R/OUT	82.42	ICE	1.75	80.67	2/2/2004
SG-8	83	ICE	0.76	82.24	2/2/2004
East Ditch SG	79.25	(6)	---	---	---
SG-14	81.1	ICE	0.96	80.14	2/2/2004
SG-16	82.8	ICE	0.94	81.86	2/2/2004

Notes:
(1) Flow Present from Plant B concrete structure No. 1 NO
(2) Flow Present from Plant B concrete structure No.2 NO
(3) Flow present from Stop logs concrete structure No.2 NO
(4) Flow present from Detention pond NO
(5) Continuous flow along Ditch NO
(6) Well/staff gauge removed or missing from site
(7) Not measured cap rusted shut
(8) Ice present, piezometer bent by ice, requires resurvey.

Prepared by: JCN
Checked by: EMA

APPENDIX A

CHAINS OF CUSTODY

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT STL

07705

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: Mactec

Address:

Phone: Fax:

Project #: 63000 [illegible]

Project Manager: E. Axelrod

Work ID: DCMP

Contact:

Job#: Quote#: PO#:

Requested Turn Around Time

10 Business Day (Std) X

15 Business Day

Other

Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format

NPDES Drinking Water DEP Form(s)

RCRA MCP GW1/S1 MWRA Smart Rpt

Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested

Check analysis and specify method and analytes in comments section.

For example:

500-series for drinking water

600-series for waste water

8000-series for haz/solid waste

Use comments section to further define.

Comments (Special Instructions)

All diss. metals (N.C.) Fad Filtered

Sample Type Codes

WW-Wastawater DW-Drinking water SW-Surfacewater

LW-Labwater GW-Groundwater A-Air

S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 Aluminum	Semivoa 8270 Chloride	PCB / Pesticides Sulfate	EPH / VPH Specific	DRO / GRO Diss.	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-24	GW	SCN	2-12-04 0915	X		1	G			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						
GW-25	GW	MAA	2-12-04 9:35	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): MAA/SCN

Signature: [signature]

Relinquished by: MAA Date: 2-12-04 Time: 1300

Received by: Date: Time:

Relinquished by: Date: Time:

Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N

Temp @ receipt °C

Preservation/pH checked

By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT STL

07706

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N rica, MA 01862 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MADC

Address:

Phone: Fax:

Project #: 63000 30000

Project Manager: L. Ardwell

Work ID: Rup

Contact:

Job#: Quote: PO#:

Shaded areas for office use

Requested Turn Around Time

10 Business Day (Std) X

15 Business Day

Other

Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format

NPDES Drinking Water DEP Form(s)

RCRA MCP GW1/S1 MWRA Smart Rpt

Other MCP QA/QC Rpt

Analysis Requested

Check analysis and specify method and analytes in comments section.

For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

All D-5 dissolved metals (A/G) Field filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625/	Semivoa 8270/	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-25MS	GW	MAA	2-12-07 9:35	X		1	P			X																	
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						
GW-25MSD	GW	MAA	2-12-07 9:35	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): MAA

Signature:

Relinquished by: TW Date: 2-12-07 Time: 1300

Received by: Date: Time:

Relinquished by: Date: Time:

Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples iced? Y / N

Temp @ rec'd pt. °C

Preservation/pH checked

By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 07707

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD
N... rica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MACTIC
Address:
Phone: Fax:
Project #: 630003008
Project Manager: C. Arpland
Work ID: Pump
Contact:
Job#: Quote#: PO#:

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid wasts
Use comments section to further define.

Comments (Special Instructions)
All Dissolved Metals (Al, Cr) Field Filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Lebwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-26	GW	JCN	2-12-04 1030	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						
GW-105	GW	MAA	2-12-04 1110	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): CN/MAA
Signature:

Relinquished by: JN Date: 2-17-04 Time: 1300
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment:

STL-Westfield

Cooler? Y / N Samples iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

07702

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MACTEC
Address:
Phone: Fax:

Project #: 6300030008
Project Manager: E. Axelrod
Work ID: Pump
Contact:

JOB#: Quote: PO#:

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. Metals (Al, Fe)
Field Filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	Preservative: NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 Analytes	Semivoa 8270 (Ultra Low Level SIM)	PCB / Pesticides	EPH / VPH Specify	DRO / GRO Specify	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-34 S(R)	GW	JN	2-10-04 1035	1		1	P			X							X										
				1		1	P							X				X									
				1		1	P							T					X								
				1		1	P							T						X							
				1		1	P		X												X						
GW-34 D	GW	JN	2-10-04 1125	1		1	P			X							X										
				1		1	P							V				X									
				1		1	P							V					X								
				1		1	P							V						X							
				1		1	P		X												X						

Sampled by (print): JCN Signature:

Relinquished by: JCN Date: 2-10-04 Time: 1330 Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: STL-Westfield

Cooler? Y / N Sample Iced? Y / N
Temp @ receipt °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

S 1360

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

07714

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. [illegible]ca, MA 01882
(P) 978-687-1400
(F) 978-667-7871
STL-BILLERICA

Job#: [redacted] Quote: [redacted] PO#: [redacted]

Client: MACTEC Engineering and Consulting Inc.
Address: 107 Audubon Road Ste 301
Westfield MA 01880
Phone: 781 245 6606 Fax: 781 246 5060

Project #: 6300070008 / 10.03
Project Manager: L. Axelrod
Work ID:
Contact:

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs ___ 72 hrs ___ 48 hrs ___ 5 Dsy ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All DSS Metals (Al, Cr) Field Filtered

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-35S	GW	JCW/MAA	2-12-04 1515	X		1	1		X	X							X										
				X		1	1							X				X									
				X		1	1							X					X								
				X		1	1							X						X							
				X		1	1		X												X						
GW-CA1	GW	JCW/MAA	2-12-04 1635	X		1	1			X							X										
				X		1	1							X				X									
				X		1	1							X					X								
				X		1	1							X						X							
				X		1	1		X												X						

Sampled by (print): JCW/MAA
Signature: [signature]

Relinquished by: MAA Date: 2-12-04 Time: 1300
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment:

STL-Westfield

Cooler? Y / N Samples iced? Y / N
Temp @ receipt: ___ °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 07704

Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

149 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTEC Engineering & Consulting Inc
Address: 107 Audubon road Ste 301
Wakefield MA 01880
Phone: 781 245 6606 Fax: 781 646 5060

Project #: 6300070081
Project Manager: L. Ardrod
Work ID:
Contact:

Job#: [redacted] Quote#: [redacted] PO#: [redacted]

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs ___ 72 hrs ___ 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All DSS Metals (Al, Cr) Field Filtered

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-39	GW	[illegible]	2-11-04 1550	X		1	e			X							X										
				X		1	f							X				X									
				X		1	f							X					X								
				X		1	f							X						X							
				X		1	f		X												X						

Sampled by (print): SW/MAA
Signature:

Relinquished by: [signature] Date: 2-11-04 Time: 1100
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: ___ °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT STL

07708

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

North Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MMCTC

Address:

Phone: Fax:

Project #: 63203025

Project Manager: C. Nordvall

Work ID:

Contact:

Job#: Quote#: PO#:

Shaded areas for office use

Requested Turn Around Time: 10 Business Day (Std) X; 15 Business Day; Other; Rush TAT Requested: 24 hrs; 48 hrs; 72 hrs; 5 Day

Regulatory Classification / Special Report Format: NPDES; RCRA; Other; Drinking Water; MCP GW1/S1; DEP Form(s); MWRA Smart Rpt; MCP QA/QC Rpt

Analysis Requested: Check analysis and specify method and analytes in comments section. For example: 400 series for drinking water; 600 series for waste water; 8000 series for haz/solid waste. Use comments section to further define.

Comments (Special Instructions): All Dissolved Metals (All Dissolved Metals) Filtered

Sample Type Codes: WW-Wastewater; DW-Drinking water; SW-Surfacewater; LW-Labwater; GW-Groundwater; A-Air; S-Solid / Soil; SL-Sludge; O-Oil; Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	Preservative: NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / ORO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-42S	GW	JCN/MMA	2-12-04	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X																		
GW-42SDUP	GW	JCN/MMA	2-12-04	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): JCN/MMA

Signature:

Relinquished by: JCW Date: 2-12-04 Time: 1300

Received by: Date: Time:

Relinquished by: Date: Time:

Received by: Date: Time:

Method of shipment: STL-Westfield

Cooler? Y / N Samples Intact? Y / N

Temp @ receipt: °C

Preservation/pH checked

By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

07709

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. ...ica, MA 01882 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MACTEC Engineering & Consulting Inc.
Address: 107 Audubon Road Ste 301
Wakefield, MA 01880
Phone: 781 245 6606 Fax: 781 245 5060

Project #: 6300030009
Project Manager: E. Hadvel
Work ID: PCMP
Contact:

Job#: Quote#: PO#:

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Dissolved Metals (Al Cr) Feld Filtered

Requested Turn Around Time
10 Business Day (Std) A
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	POD / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-43S	GW	JCN/MM	2-12-04	X		1	P			X							X										
				X		1	P											X									
				X		1	P												X								
				X		1	P													X							
				X		1	P		X												X						

Sampled by (print): JCN/MM
Signature:

Relinquished by: MM Date: 2-13-04 Time: 1215
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

Page 1 of 5

White = Lab file Yellow = Report copy Pink = Customer copy

STL 2045-260 (12

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

0777

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7671 STL-BILLERICA

Client: MACTEC Engineering & Consulting Inc
Address: 107 Audubon Road Ste 301
WAKEFIELD, MA 01880
Phone: Fax:

Project #: 6300030008/10.03
Project Manager: E. Axelrod
Work ID: PCMP
Contact:

Job#: Quote#: PO#:

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. metals (Al, Cr) Field Filtered
Total Cr++ w/ Filtered

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
1170-1SC01-67	SW	JCN/MAA	2-2-04 0930	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P		X														X				
				X		1	P		X															X			

Sampled by (print): JCN/MAA
Signature:

Relinquished by: MAA Date: 2/2/04 Time: 1340
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

853 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

Langeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

10778

Job: Quote: PO#:

Client: MACTEC
Address:
Phone: Fax:

Project #: 6300030008/0.01
Project Manager: L.M.A.
Work ID: Pump
Contact:

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. metals (M), (V) filtered
total (V) not filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
1170-P217-67	SW	MM	2-2-04 1000	X						X							X										
				X										X				X									
				X										X					X								
				X										X						X							
				X										X							X						
				X										X								X					
				X										X									X				
				X					X																		
				X					X																		

Sampled by (print): SCP / MAA
Signature:

Relinquished by: MAA Date: 2/2/04 Time: 1340
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment: STL-Westfield

Cooler? Y / N Samples iced? Y / N
Temp @ rec'dpt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

10779

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MAITEC
Address:
Phone: Fax:

Project #: 63000 30008
Project Manager: E.M.A
Work ID: PCMP
Contact:

JOB#: QUOTE#: PO#:

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special instructions)
All D, SS
Metals (Pb, Cd)
Total Cr
unfiltered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
1170-15103-67	SW	JN/MAA	2-2-04 1050	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P												X								
				X		1	P													X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P																X				
				X		1	P																	X			

Sampled by (print): JN/MAA
Signature:
Relinquished by: MAA Date: 2/2/04 Time: 1340
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment:
STL-Westfield

Cooler? Y / N Samples Intact? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

Severn Trent Laboratories, Inc.

SEVERN TRENT STL

Chain of Custody Form

10781

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

Rangeway Road
N. ...ca, MA 01862
(P) 978-687-1400
(F) 978-687-7871
STL-BILLERICA

Client: MNAL
Address:
Phone: Fax:

Project #: 63000 3000.8
Project Manager: LMA
Work ID: Pump
Contact:

Job#: Quote#: PO#:

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
600-series for drinking water
500-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

All PISS [illegible]
Field Filtered (N, C)

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-78S	GW	JCN	2-2-01 1315	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X													
				X		1	P		X												X						
GW-78S DUP	GW	JCN	2-2-01 1315	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X						X							
				X		1	P							X							X						
				X		1	P		X												X						

Sampled by (print): JCN / MAA
Signature:

Relinquished by: MAA Date: 2/2/01 Time: 1340
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Sample Iced? Y / N
Temp@rec'd pt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL-0245-360

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

10774

Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

14 Rangeway Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTIC
Address:
Phone: Fax:

Project #: 6300030008
Project Manager: L. M. A
Work ID: PCMP
Contact:

Job#: Quote#: PO#:

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. Metals
Field Filtered (Al, C

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-79S	GW	MAA	2-2-04 1305	X		1	1			X							X										
				X		1	1							X				X									
				X		1	1							X					X								
				X		1	1							X						X							
				X		1	1		X												X						

Sampled by (print): SW/MAA
Signature:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
MAA	2/2/04	1340			

Method of shipment:

STL-Westfield

Cooler? Y / N Samples iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245 260 (12/02)

Severn Trent Laboratories, Inc.

SEVERN TRENT STL

07701

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Chain of Custody Form

Client: MACTL

Address:

Phone: Fax:

Project #: 6300030008

Project Manager: L. Kroll

Work ID: PCMP

Contact:

Job#: Quote: PO#:

Requested Turn Around Time

10 Business Day (Std): X
15 Business Day:
Other:

Rush TAT Requested: 24 hrs ___ 72 hrs ___ 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format

NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested

Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

All DSS. No HCl (Cl) 1d + 1 lev 2d

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	Preservative: NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
MW-2015	GW	JCN	2-10-04 1310	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X											X							

Sampled by (print): SCN Signature:

Relinquished by: SCN Date: 2-10-04 Time: 1330 Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: Time:

Method of shipment: STL-Westfield

Cooler? Y / N Samples Leak? Y / N
Temp@receipt ___ °C
Preservation/pH checked
By: Date:

Page 4 of 4

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT STL

10780

Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

#140 Langley Road
N. Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTEC

Address:

Phone: Fax:

Project #: 1300030008

Project Manager: EMA

Work ID: PCMP

Contact:

JOB#: Quote#: PO#:

Shaded areas for office use

Requested Turn Around Time

10 Business Day (Std) ✓
15 Business Day
Other

Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format

NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Analysis Requested

Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

Mn D.SS. Mn/Fe
(Mn,Fe) Field
T. Hard

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	Preservative: NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-2025	GW	JW/MM	2-2-01 1150	X						X							X										
				X										X				X									
				X										X					X								
				X										X						X							
				X					X												X						
GW-2027	GW	JW/MM	2-2-01 1155	X						X							X										
				X										X				X									
				X										X					X								
				X										X						X							
				X					X												X						

Sampled by (print): MM/JCW

Signature:

Relinquished by: MM Date: 2/2/01 Time: 1340

Received by: Date: Time:

Relinquished by: Date: Time:

Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N

Temp @ receipt: °C

Preservation/pH checked

By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

APPENDIX B

FIELD ACTIVITY SUMMARY REPORT (FAR) FOR THE FIRST QUARTER FEBRUARY 2004 SAMPLING OF PCMP WELLS

Olin Wilmington Post Construction Monitoring Program (PCMP) Ground and Surface Water Monitoring Program – February Sampling Event – 1st Quarter 2004

The First Quarter 2004 ground-water sampling event for the Post Construction Monitoring Program (PCMP) was conducted by MACTEC Engineering and Consulting, Inc. (MACTEC) scientists Jason C. Naiden (JCN) and Michael A. Apfelbaum (MAA). The First Quarter 2004 ground-water sampling for the PCMP Program was performed between February 2 and February 13, 2004, while synoptic water levels and selected surface water samples were collected on February 2, 2004 prior to the release of water from the Plant B treatment area.

The ground-water samples were collected according to EPA 1996 Low stress (low flow) guidelines. Samples were collected following the stabilization of field parameters including pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), temperature and specific conductivity (sc). Ground-water samples were collected and sent for laboratory analysis from the following 16 monitoring wells and 3 surface water locations:

GW-10S*	GW-78S*
GW-24*	GW-79S*
GW-25*	GW-201S*
GW-26*	GW-202S*
GW-34S(R)*	GW-202D*
GW-34D*	GW-CA1*
GW-35S*	1170-ISCO1-67**
GW-39*	1170-PZ17-67**
GW-42S*	1170-ISCO3-67**
GW-43S*	

* - Only PCMP analytes collected
**- PCMP Surface water analytes collected

The ground-water samples were transported by Severn Trent Laboratory (STL) courier to STL-Westfield, MA for one of the following two sets of analyses depending on matrix; 1) PCMP ground-water: chloride via EPA Method 300.0, sulfate via EPA Method 300.0, specific conductance (SC) via Method SM182510B, ammonia-nitrogen via Method LAC10-107061B and dissolved metals (Al, Cr) via EPA Method 200.7; and 2) Surface water: ammonia- nitrogen via Method LAC 10-107061B, chloride via EPA Method 300.0, nitrate via EPA Method 300.0 part A, nitrite via EPA Method 300.0 part A, sulfate via EPA Method 300.0, specific conductance (SC) via Method SM182510B, dissolved aluminum and chromium, via EPA Method 200.7, and total chromium via Method EPA 200.7.

Dissolved metals samples were field filtered with a dedicated Teflon™ in-line 0.45-micron pore diameter field filter.

Sampling and Gauging Observations:

- GW-18S contains an immovable obstruction at 11.0 ft bgs, preventing static gauging.
- PZ-16 was no longer firmly anchored into the sediment and requires replacement/ resurvey.
- Several flush mount monitoring well water levels were immeasurable due ice in or around the risers.
- Ground-water in GW-55S could not be sampled as it was frozen. Depths to ice were recorded in the synoptic water level round.
- Water levels in many wells were significantly higher or significantly lower from those recorded during the November 2003 sampling event.
- The south ditch remained ice covered between the South Ditch weir and ISCO2, during sampling activities.

Additional Project Information:

- QC Duplicate Samples were collected from GW-78S and GW-42S.
- Matrix spike/ Matrix spike duplicate samples were collected from GW-25.
- All samples were sent to STL-Westfield laboratory facilities via daily courier.
- All samples were received by the lab.
- The pilot wetland system installed by Geomega between September 29 and October 2, 2003 was monitored on February 2, 2003. The monitoring activities included the following: water level measurements from two piezometers within the wetland system, field parameters from water within the piezometer, measurement of surface water field parameters in the south ditch, a survey of the wetland area, and reporting on the extent of freezing.

Prepared by: JCN 2/17/04
Reviewed by: EMA 2/23/04

MACTEC

June 4, 2004

PN: 6300030008/10.03

Mr. Stephen G. Morrow, P.E.
Principal Environmental Specialist
Olin Corporation
Post Office Box 248
Charleston, Tennessee 37310

Subject: PCMP Well Sampling Report
Second Quarter May 2004 Sampling Event
Olin Corporation, Wilmington, Massachusetts

Dear Mr. Morrow:

MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to provide Olin Corporation (Olin) with this report summarizing the field activities relative to sampling and analysis of seventeen (17) Post Construction Monitoring Plan (PCMP) wells and four (4) surface water sampling locations. Fourteen (14) of the 17 sampled PCMP wells are South Ditch/Weir wells which have been incorporated into the PCMP sampling program per the Licensed Site Professional (LSP). The 14 South Ditch/Weir monitoring wells are associated with the man-made drainage system at Olin's Eames Street property in Wilmington, Massachusetts.

The purpose of the quarterly ground-water sampling and chemical analysis is to monitor concentrations of site-specific compounds of concern (COCs) in the selected wells and to evaluate ground-water elevations and flow direction. In addition, MACTEC monitored the South Ditch Pilot Wetland per the approved scope of work during the 1st Quarter program. This was conducted at the request of Geomega.

MACTEC personnel performed the sampling work in general accordance with the approved Quality Assurance Project Plan (QAPP), dated August 1999.

Please do not hesitate to contact Eric Axelrod or Jason Naiden at (781) 245-6606 if you have any questions.

Sincerely,
MACTEC Engineering and Consulting, Inc.

Jason Naiden
Staff Scientist

Eric M. Axelrod, LSP
Project Manager

M J Murphy

Michael Murphy
Sr. Principal Environmental Scientist

cc: Margret Hanley, MA LSP
Larry Welch, GEI
Dan Stone, Geomega
MACTEC Project File [P:\WS-CHEM\OLIN\Wilmington\2004QUARTERLYSAMPLING\2nd Quarter2004\PCMP\PCMPsamprptcvrltr2Q04.doc]

MACTEC Engineering and Consulting, Inc.
107 Audubon Road
Bldg. 2, Suite 301 • Wakefield, MA 01880
781-245-6606 • Fax: 781-246-5060

PCMP WELL SAMPLING REPORT
SECOND QUARTER MAY 2004 SAMPLING EVENT
OLIN CORPORATION
WILMINGTON, MASSACHUSETTS

INTRODUCTION

The purpose of the Post Construction Monitoring Plan (PCMP) surface and ground-water sampling and analysis activities is to monitor the concentrations of selected surface and ground-water constituents in select surface water and monitoring well locations and to collect ground-water levels over a portion of the Wilmington facility site.

This sampling summary report presents the field activities completed in association with the second quarter 2004 surface and ground-water sampling event for the PCMP Monitoring Program. The second quarter 2004 ground-water and surface water monitoring program included the sampling of 17 PCMP wells, the collection of surface water samples from four locations within the South Ditch, and the gauging of 70 monitoring wells, piezometers and staff gauges. The 17 monitoring wells were chosen and sampled to provide a representation of water quality over a portion of the Wilmington site. During groundwater sampling activities the purged groundwater was continuously monitored with a Horiba U-22 water quality instrument for pH, specific conductivity (SC), dissolved oxygen (DO), oxidation/reduction potential (ORP), and temperature. Upon stabilization of these parameters, groundwater samples were collected for laboratory analysis for pH, specific conductivity, chloride, ammonia-nitrogen, sulfate and dissolved aluminum and chromium. The wells were sampled between May 5 and May 21, 2004. Surface water samples were collected on Monday, May 10, 2004 before discharge from the Plant B treatment area to the south ditch occurred. Surface water samples were collected for laboratory analysis of ammonia-nitrogen, chloride, nitrate, nitrite, sulfate, specific conductance, dissolved aluminum and chromium and total chromium. The collection of synoptic water levels within wells associated with the PCMP Monitoring Program occurred on Friday, May 21, 2004.

SCOPE OF WORK

The following monitoring wells and surface water locations on the Wilmington site were sampled during the second quarter May 2004 event:

PCMP Wells		Surface Water Sample Locations
GW-10S	GW-43S	ISCO 1
GW-24	GW-55S	ISCO 2
GW-25	GW-78S	ISCO 3
GW-26	GW-79S	PZ17
GW-34S(R)	GW-201S	
GW-34D	GW-202S	
GW-35S	GW-202D	
GW-39	GW-CA1	
GW-42S		

Furthermore, field duplicate samples were collected from well locations GW-78S and GW-42S. Extra aliquots of sample were provided for a matrix spike/matrix spike duplicate (MS/MSD) to be performed on samples from GW-25.

Water samples were collected from each monitoring location for both field and laboratory analyses. Analytical methods utilized for laboratory testing are shown in Tables 1 (groundwater analytes) and 4 (surface water analytes). Prior to collection of groundwater, all monitoring wells were purged in accordance with EPA 1996 low stress (low flow) guidelines and the following field indicator parameter measurements were obtained: pH, SC, temperature, DO and ORP. The field parameter data were collected using a Horiba U-22 instrument equipped with a flow-through cell. In addition, a 0.45-micron pore diameter, in-line Teflon™ filter was used to field filter samples collected for dissolved metals. During the sampling activities flow rates were generally maintained at approximately 350 milliliters per minute. During the low-flow monitoring well purging, flow rates and groundwater indicator parameters were measured to monitor the stability of groundwater parameters. The stabilization criteria are included in the Quality Assurance Plan. Well purging was continued at each location until the field indicator parameters were stable and samples were subsequently collected. The low flow purging field parameter information at stabilization is presented in Table 2.

Surface water samples were collected in laboratory supplied bottles containing the appropriate preservative, as applicable. These samples were acquired using a peristaltic pump equipped with dedicated silastic tubing. The silastic sample tubing was submerged approximately one inch below the water surface with care taken to ensure the minimal entrainment of organic material into the sample bottles. Field indicator parameters (pH, SC, temperature, DO and ORP) were obtained at each location prior to sampling. The field parameter data were collected using a Horiba U-22 instrument equipped with a flow-through cell. In addition, a 0.45-micron pore diameter, in-line Teflon™ filter was used to field filter all samples collected for dissolved metal analysis. Field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples were collected at the ISCO1 location.

Final sampling field parameters recorded at PCMP surface water locations are included in Table 2. In addition, field parameters from two surface water locations (PW-SW1 and PW-SW2) within the South Ditch and designated as part of the Pilot Wetland Study Area are provided in Table 2.

Water samples were collected in laboratory-supplied containers containing appropriate preservative, field-filtered, if appropriate according to the QAPP, and placed on ice for delivery to Severn Trent Laboratories (STL) under chain-of-custody procedures. The samples were delivered to the STL Westfield, MA facility for chemical analyses. Copies of the chain-of-custody documents are provided in Appendix A.

The purged ground water from each monitoring well was collected in collapsible plastic containers and pursuant to the Massachusetts Contingency Plan (MCP) (310 CMR 40.0045), emptied back down the monitoring well subsequent to sample collection.

Ground-water levels were measured in each well location using an electronic water-level indicator prior to disturbance by the sampling process. Staff gauge measurements were taken manually by measuring water levels relating to a known staff gauge reference point. Ground water and surface water level measurements were obtained from 62 of 76 monitoring well, piezometer and staff gauge locations. The remaining wells were not able to be gauged due to obstructions in or on the well casings, the presence of parked vehicles over the flushmount well locations, or the

removal/destruction of the well, piezometer, or staff guage. The ground-water and surface water levels obtained during this sampling event are summarized in Tables 3 and 5, respectively.

WELL RECONNAISSANCE

Site reconnaissance of the seventy monitoring well locations in the PCMP was performed. GW-17D remains inhabited by mice. Data loggers were observed in three monitoring wells: GW-35S, GW-CA1, and GW-78S. A Field Activity Summary Report (FAR) for the post construction monitoring plan well sampling activities was prepared on May 25, 2004 and a copy of the FAR is included as Appendix B to this report.

TABLES

Table 1
Post Construction Monitoring Plan Wells
Sampling Report Contaminent of Concern
Second Quarter, May 2004
Olin-Wilmington

Analyte	Method of Analysis	Method PQLs	Units	PCMP Wells	PCMP/South Ditch Wells	Precision (RPD)	Accuracy (% Recovered)
Physical/Inorganic Parameters						(LCS)	(MS/MSD)
Ammonia-Nitrogen	LAC107061B	0.01	mg/l	X	X	80-120	74-125
Chloride	EPA 300.0	1	mg/l	X	X	80-120	77-116
Specific Conductivity	SM182510B	NA	umhos/cm	X	X	80-120	na
Sulfate	EPA 300.0	1	mg/l	X	X	80-120	74-125
Dissolved Metals							
Aluminum, dissolved	EPA 200.7	100	ug/l	X	X	85-115	70-130
Chromium, dissolved	EPA 200.7	10	ug/l	X	X	85-115	70-130

Prepared by: JCN
Checked by: EMA

Notes: NA - Not Applicable

Table 2
Post Construction Monitoring Plan
Second Quarter, May, 2004
Olin-Wilmington

Final Sampling Parameters

PCMP Monitoring Wells

Location	GW-10S	GW-24	GW-25	GW-26	GW-34S(R)	GW-34D	GW-35S	GW-39	GW-42S
Date	5/7/2004	5/7/2004	5/7/2004	5/20/2004	5/5/2004	5/5/2004	5/5/2004	5/20/2004	5/20/2004
Depth to Water (feet)	8.40	2.27	5.16	4.08	5.63	6.90	6.85	3.35	—
pH (standard units)	4.28	7.60	6.35	5.86	5.88	6.26	6.83	5.46	5.22
Conductivity (µmhos/cm) (1)	117	969	837	1,410	172	377	1,170	662	396
Dissolved oxygen (mg/L)	6.58	8.52	0.00	3.56	3.54	0.00	5.62	0.00	0.00
Temperature (°Celcius)	8.84	9.69	9.63	10.85	9.58	9.88	12.46	10.81	11.06
Redox (millivolts)	109	-69	-107	-57	99	43	-243	18	-41

PCMP Monitoring Wells

Location	GW-43S	GW-55S	GW-78S	GW-79S	GW-201S	GW-202S	GW-202D	GW-CA1
Date	5/20/2004	5/21/2004	5/10/2004	5/10/2004	5/20/2004	5/10/2004	5/10/2004	5/5/2004
Depth to Water (feet)	—	1.95	4.35	3.15	3.95	6.38	5.82	6.55
pH (standard units)	6.01	5.63	5.25	6.12	6.37	6.72	6.07	6.62
Conductivity (µmhos/cm) (1)	709	3,190	1,760	4,200	2,270	1,920	4,650	978
Dissolved oxygen (mg/L)	0.00	0.00	2.33	0.66	0.00	0.41	1.89	2.90
Temperature (°Celcius)	11.98	9.55	12.36	8.19	11.40	10.36	11.31	11.30
Redox (millivolts)	102	12	196	-118	64	91	63	2

PCMP Surface Water

Location	1170-PZ17-68	1170-ISCO1-68	1170-ISCO2-68	1170-ISCO3-68	PW-SW1	PW-SW2
Date	5/10/2004	5/10/2004	5/10/2004	5/10/2004	5/10/2004	5/10/2004
Sample Time	840	815	900	940	1100	1110.00
Flow (ft/sec)	0.04	0	0.03	0.18	—	—
Depth of Water (ft)	0.52	1.18	0.77	0.32	—	—
pH (standard units)	5.75	5.66	6.17	6.57	6.52	5.82
Conductivity (µmhos/cm) (1)	1,680	747	1,610	502	1,790	1,730
Dissolved oxygen (mg/L)	11.54	11.73	11.33	11.84	9.01	6.54
Temperature (°Celcius)	11.77	10.78	11.45	15.06	12.34	13.1
Redox (millivolts)	116	100	94	99	36	101

Notes: (1) micromhos per centimeter
na = not applicable
— not measured

Prepared by: MAA
Checked by: EMA

TABLE 3
PCMP Synoptic Groundwater Elevations
Second Quarter May, 2004
Olin-Wilmington

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
I.D.	(ft msl)				
GT-04-D	88.47	1	—	—	—
GT-04-S	86.36	1	—	—	—
GT-06-D	87.24	1	—	—	—
GT-06-S	87.27	1	—	—	—
GW-03-D	85.28		5.45	79.83	5/10/2004
GW-03-S	86.4	TOC	6.55	79.85	5/10/2004
GW-04	82.19		5.85	76.34	5/10/2004
GW-04-D	79.29		2.68	76.61	5/10/2004
GW-06-D	90.06		7.62	82.44	5/10/2004
GW-06-S	90.98		7.75	83.23	5/10/2004
GW-07	83.19	1	—	—	—
GW-08	82.54	TOC	4.40	78.14	5/10/2004
GW-10-S	89.1		7.98	81.12	5/10/2004
GW-11	87.22	1	—	—	—
GW-12	84.65		3.14	81.51	5/10/2004
GW-17-D	81.42	3	—	—	—
GW-17-S	82.07		3.30	78.77	5/10/2004
GW-18-D	88.92		11.01	77.91	5/10/2004
GW-18-S	89.6	4	—	—	—
GW-19-S	89.88	1	—	—	—
GW-19-D	89.76	1	—	—	—
GW-20	85.54		5.58	79.96	5/10/2004
GW-24	83.43		2.75	80.68	5/10/2004
GW-25	85.97		5.23	80.74	5/10/2004
GW-26	84.93		3.81	81.12	5/10/2004
GW-27-D	89.35	1	—	—	—
GW-27-S	89.28	1	—	—	—
GW-28-D	84.81		1.70	83.11	5/10/2004
GW-28-S	85.56		2.45	83.11	5/10/2004
GW-29-D	85.16		2.69	82.47	5/10/2004
GW-29-S	84.31		1.89	82.42	5/10/2004
GW-30-DR	87.03		5.61	81.42	5/10/2004
GW-32S	89.18	9	—	—	—
GW-33-D	89.64	1	—	—	—
GW-33-S	89.9	1	—	—	—
GW-34-D	90.38		7.26	83.12	5/10/2004
GW-34-S (R)	89.13		6.01	83.12	5/10/2004
GW-35-D	88.6		6.87	81.73	5/10/2004
GW-35-S	88.51	7	—	—	—
GW-36	85.72	1	—	—	—
GW-37	83.47	1	—	—	—
GW-38	86.96	1	—	—	—
GW-39	83.64		3.11	80.53	5/10/2004
GW-42-D	84.07	8	—	—	—
GW-42-S	84.18		3.21	80.97	5/10/2004
GW-43-D	87.96		6.85	81.11	5/10/2004
GW-43-S	87.35		6.20	81.15	5/10/2004
GW-50-D	80.11		3.70	76.41	5/10/2004
GW-50-S	79.97		3.48	76.49	5/10/2004

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
I.D.	(ft msl)				
GW-51-D	84.55		6.44	78.11	5/10/2004
GW-51-S	84.62		5.50	79.12	5/10/2004
GW-54-S	88.85		5.44	83.41	5/10/2004
GW-55-D	81.95		2.02	79.93	5/10/2004
GW-55-S	81.7		1.70	80.00	5/10/2004
GW-56-D	82.82		5.20	77.62	5/10/2004
GW-56-S	83.07		5.41	77.66	5/10/2004
GW-68-D	90.15	8	—	—	—
GW-69-D	93.04		11.96	81.08	5/10/2004
GW-69-S	92.27		14.19	78.08	5/10/2004
GW-76-S	88.45		9.80	78.65	5/10/2004
GW-77-S	85.49	9	—	—	—
GW-78-S	84.89		4.35	80.54	5/10/2004
GW-79-S	81.54		3.15	78.39	5/10/2004
GW-201S	83.29		3.34	79.95	5/10/2004
GW-202S	86.97		6.38	80.59	5/10/2004
GW-202D	86.52		5.82	80.70	5/10/2004
GW-CA1	88.01	7	—	—	—
GW-CA2	87.8		6.39	81.41	5/10/2004
GW-CA3D	89.86		8.44	81.42	5/10/2004
GW-CA3S	89.68		8.31	81.37	5/10/2004
GW-CA4S	87.74		6.31	81.43	5/10/2004
GW-LPB11	88.88	10	—	—	—
PW-2	86.58		5.10	81.48	5/10/2004
PZ-11/IN	84.51		3.35	81.16	5/10/2004
PZ-11/OUT	84.51		3.65	80.86	5/10/2004
PZ-12/IN	84.04		3.55	80.49	5/10/2004
PZ-12/OUT	84.04		3.65	80.39	5/10/2004
PZ-14/IN	83.96		3.41	80.55	5/10/2004
PZ14/OUT	83.96		3.45	80.51	5/10/2004
PZ-15/IN	79.12		3.29	75.83	5/10/2004
PZ-15/OUT	79.12		3.34	75.78	5/10/2004
PZ-16R/IN	79.07	5	—	—	—
PZ-16R/OUT	79.07	5	—	—	—
PZ-17R/IN	79.5	1	—	—	—
PZ-17R/OUT	79.5	1	—	—	—
PZ-18R/IN	82.42		1.99	80.43	5/10/2004
PZ-18R/OUT	82.42		1.90	80.52	5/10/2004
SP-01	83.09	2	—	—	—
SP-02	84.24	2	—	—	—
SP-03	87.85		6.38	81.47	5/10/2004
SG-8	83		0.67	82.33	5/10/2004
SG-9	75.05	1	—	—	—
SG-10	82.4	1	—	—	—
SG-11	82.32	1	—	—	—
East Ditch SG	79.25	1	—	—	—
Old Weir SG	—	1	—	—	—
SG-14	81.1	9	—	—	—
SG-16	82.8		0.96		5/10/2004

Notes:
(1) Well/staff guage removed or missing from site.
(2) Well paved over. Water level not obtained.
(3) Well has been inhabited by mice.
(4) Obstruction exists in well which prevented measurement.
(5) Not measured - cap rusted shut
(6) Not measured due to high water condition
(7) Datalogger located in well, measurement unable to be taken
(8) Vehicle parked above well, no measurement recorded
(9) Measurement not recorded
(10) Not measured due to location within area designated for excavation activities
TOC- Water level measurement taken from Top of Casing, not top of riser
Bold Text indicates location gauged during current Quarterly event

Prepared by: JCN
Checked by: MAA

Table 4
Post Construction Monitoring Plan
Surface Water Sampling
Event 68 May, 2004
Olin- Wilmington

Analyte	Analysis Method	Detection Limit (1)	Units
Physical/Inorganic Parameters			
Ammonia-Nitrogen	LAC10-107061B	0.01	mg/l
Nitrate	EPA 300 part A	0.05	mg/l
Nitrite	EPA 300 part A	0.01	mg/l
Chloride	EPA 300.0	1	mg/l
Specific Conductivity	SM182510B	NA	mmhos/cm
Sulfate	EPA 300.0	1	mg/l
Metals			
Aluminum, Dissolved	EPA 200.7	200	ug/l
Chromium, Dissolved	EPA 200.7	200	ug/l
Chromium, Total	EPA 200.7	10	ug/l

Prepared by: MAA
Checked by: JCN

NOTES:
(1) mg/L = milligrams per liter
(1) umhos = micromhos per centimeter
(1) NTU = nephelometric turbidity unit
(1) ug/L = micrograms per liter
Analysis methods, detection limits, precision and accuracy criteria are included in the QAPP 1999.
NA - Not applicable

TABLE 5
Surface Water Sampling and Monitoring
Event 68 May, 2004
Olin-Wilmington

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
PZ-11/IN	84.51		3.35	81.16	5/10/2004
PZ-11/OUT	84.51		3.65	80.86	5/10/2004
PZ-12/IN	84.04		3.55	80.49	5/10/2004
PZ-12/OUT	84.04		3.65	80.39	5/10/2004
PZ-13/IN	---	(8)	---	---	---
PZ-13/OUT	---	(8)	---	---	---
PZ-14/IN	83.96		3.41	80.55	5/10/2004
PZ14/OUT	83.96		3.45	80.51	5/10/2004
PZ-15/IN	79.12		3.29	75.83	5/10/2004
PZ-15/OUT	79.12		3.34	75.78	5/10/2004
PZ-16R/IN	79.07	(7)	---	---	---
PZ-16R/OUT	79.07	(7)	---	---	---
PZ-17R/IN	79.5	(6)	---	---	---
PZ-17R/OUT	79.5	(6)	---	---	---
PZ-18R/IN	82.42		1.99	80.43	5/10/2004
PZ-18R/OUT	82.42		1.90	80.52	5/10/2004
SG-8	83		0.67	82.33	5/10/2004
East Ditch SG	79.25	(8)	---	---	---
SG-14	81.1	(9)	---	---	---
SG-16	82.8		0.96	81.84	5/10/2004

Notes:

(1) Flow Present from Plant B concrete structure No. 1	No
(2) Flow Present from Plant B concrete structure No.2	Yes
(3) Flow present from Stop logs concrete structure No.2	Yes
(4) Flow present from Detention pond	Yes
(5) Continuous flow along Ditch	Yes
(6) Well/staff gauge removed or missing from site	
(7) Not measured cap rusted shut	
(8) Well/staff gauge needs to be resurveyed	
(9) Measurement not recorded	

Prepared by: MAA
Checked by: EMA

APPENDIX A

CHAINS OF CUSTODY

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14484

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD
N. Lo[illegible]a, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MACTEC E+C, Inc
Address: 107 Audubon Rd Bldg 2 Suite 301, Wakefield, MA 01880
Phone: (781) 245-6606 Fax:
Project #: 6500030008/10.03
Project Manager: Eric Axelrod
Work ID: PCMP
Contact: EMA

Job#: Quote#: PO#:

Requested Turn Around Time
10 Business Day (Std) ___ | Rush TAT Requested: 24 hrs ___ 72 hrs ___
15 Business Day ___ | 48 hrs ___ 5 Day ___
Other ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analyte on comments section.
For Sample:
600-series for drinking water
400-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All dissolved metals (Al, Cr) field filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 Ammonia	Semivoa 8270	PCB / Pesticides	EPH / VPH Chloride	DRO / GRO Dissolved	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-35S	GW	JCN LAS	1130 5/5/04	Y		1	P			X							X										
↓	↓	↓	↓	Y		1	P							X				X									
				Y		1	P							X					X								
				Y		1	P							X						X							
				Y		1	P		X												X						
GW-CA1	GW	JCN LAS	1255 5/5/04	Y		1	P			X							X										
↓	↓	↓	↓	Y		1	P							X				X									
				Y		1	P							X					X								
				Y		1	P							X						X							
				Y		1	P		X												X						

Sampled by (print): JCN
Signature: [illegible]

Relinquished by: 1330 Date: 5/5/04 Time: 1330
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: ___ °C
Preservation/pH checked
By: ___ Date: ___

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14483

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. E[illegible]a, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTEC E&C Inc.
Address: 107 Audubon Bldg 2 Suit 301
Wakefield, MA 01880
Phone: (781) 245-6606 Fax:

Project #: 1-300030008/10.03
Project Manager: Eric Axelrod
Work ID: PCMP
Contact: EMA

Job#: | Quote#: | PO#:

Requested Turn Around Time
10 Business Day (Std) ____
15 Business Day ____
Other ____
Rush TAT Raquested: 24 hrs ____ 72 hrs ____ 48 hrs ____ 5 Day ____

Regulatory Classification / Special Report Format
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All dissolved metals (Al, Cr) field filtered

Sample Type Codes
WW-Wastewater DW-Drinking watar SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 Ammonia	Semivoa 8270 Silicate	PCB / Pesticides	EPH / VPH Chloride	DRO / GRO Dissolved	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-34S(R)	GW	JCN LAS	5/5/04 1510	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						
GW-34D	GW	JCN LAS	5/5/04 1605	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): LAS JCN
Signature: Kaurin Atmitt

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
TAA	5/5/04	1620			

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: ____ °C
Preservation/pH checked
By: ____ Date: ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14470

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. E a, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Mactec
Address:
Phone: Fax:

Project #: 63000-30008 / 10.03
Project Manager:
Work ID: FCMP
Contact:

Job# Quote# PO#

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss Metals (Al, Cr) field filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-25 MSD	GW	CAS/SCN	5-7-04 1015	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						
GW-24	GW	CAS/SCN	5-7-04 1140	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): SCN/CAS
Signature:

Relinquished by: JCN Date: 5-7-04 Time: 1350
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler ? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14485

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD
N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: MACTEC E&C Inc
Address: 107 Audubon Rd Bldg 2 Suite 301 Wakefield, MA 01880
Phone: 781 245 6604 Fax:
Project #: 6300030008/10.03
Project Manager: Eric Axelrod
Work ID: PCMP
Contact: EMA

Job# | Quote# | PO#

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All dissolved metals (Al, Cr) field filtered

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs, 72 hrs, 48 hrs, 5 Day

Regulatory Classification / Special Report Format
NPDES, Drinking Water, DEP Form(s)
RCRA, MCP GW1/S1, MWRA Smart Rpt
Other, MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	~~Semivoa 625~~ Ammonia-N	~~Semivoa 8270~~ Sulfate	~~PCB / Pesticides~~ Specific Cond	~~EPH / VPH~~ Chloride	~~DRO / GRO~~ Dissolved Metals	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW 2S	GW	LAS JCN	5/7/04 1015	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						
GW 2S MS ~~HSD~~	GW	LAS JCN	5/7/04 1015	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X			P							X						X							
				X			P		X												X						

Sampled by (print): LAS JCN
Signature: Lauren A Smith

Relinquished by: ACA Date: 5/7/04 Time: 1350
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment:

STL-Westfield

Cooler ? Y / N Samplee Iced? Y / N
Temp @ receipt: ____ °C
Preservation/pH checked
By: ____ Date: ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14469

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. E a, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Mactec
Address:
Phone: Fax:

Project #: 6300030008/1001
Project Manager: E. MA.
Work ID: PCMP
Contact:

Job# Quote# PO#

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. metals (Al, Cr) field filtered

Requested Turn Around Time
10 Business Day (Std) ____ | Rush TAT Requested: 24 hrs ____ 72 hrs ____
15 Business Day ____ | 48 hrs ____ 5 Day ____
Other ____

Regulatory Classification / Special Report Format
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-105	GW	Jcn CAS	5-7-04 1300	1		1	1			X							X										
↓	↓	↓	↓	1		1	1							X				1									
				1		1	1							X					X								
				1		1	1							X						1							
				1		1	1		X												X						

Sampled by (print): Jcn CAS
Signature: [signature] Lauren A Smith

Relinquished by: Jcn Date: 5-7-04 Time: 1350
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: ____ °C
Preservation/pH checked
By: ____ Date: ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245-360 (12/02)

Seven Trent Laboratories, Inc.

Chain of Custody Form

STL SERVICES

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707

Billerica, MA 01821
978-667-1400
(F) 978-667-7871

Client: Master Engineering Planning Inc. Job #: 63002[illegible]/10.03

Address: 57 Audubon Road Ste 301 Project Manager: [illegible]

Wakefield, MA 01880 Work ID: Perm

Phone: [illegible] Fax: [illegible] Contact: LMA

Job#: Quote#: PO#:

Shaded area for office use

Comments (Special Instructions)

All DSS unless (A, C) filtered

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Requested Turn Around Time
15 Business Day ✓ Rush ____
10 Business Day ____ Other ____

Regulatory Classification – Please Specify
NPDES ____ Drinking Water ____ MCP Other ____
RCRA ____ MCP GW1 ____ Other ____

Sample Type Codes
WW - Wellwater W - Wastewater SW - Surfacewater LW - Labwater
RW - Raw Water GW - Groundwater PW - Public Water SO - Soil
S - Solid SL - Sludge O - Oil A - Air Z - Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic (P) or Glass (G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Other ____	4°C	OTHER	Volatiles (Aromatics & Halo. Cpd)	Semivolatiles	PCB & Pesticides	EPH & Cadmt	~~VPH~~ DSS metals	DRO/GRO (circle)	Oil & Grease	Metals	General Chemistry	Bacteriological	Other ____
GW-78S	GW	[illegible]	5-11-04 1715	X		1	P			X						X										
↓	↓	↓	↓	X		1	P							X			X									
				X		1	P							X				X								
				X		1	P							X					X							
				X		1	P		X											X					
GW-78S	GW	[illegible]	5-11 1715	X		1	P			X						X										
				X		1	P							X			X									
				X		1	P							X				X								
				X		1	P							X					X							
				X		1	P		X											X					

Sampled by (print): Jon MAH Signature: [signature]

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
MAH	5-11-04	1332			
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Method of shipment:

Cooler:
Temp @ rec'd:
Preservation/pH checked:
By: Date:

Page 1 of 6

White = Lab file Yellow = Report copy Pink = Customer copy
STL-8245 (1000)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL

10605

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTEC
Address:
Phone: Fax:
Project #: 6300030008
Project Manager:
Work ID: PCMC
Contact:

Job#: Quote#: PO#:

Shaded areas for office use

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All dissolved Metals (Al, Cr) Field-Filtered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivos 625	Semivos 8270	PCB / Pesticides	EPH / TPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-79S	GW	MAA/JCN	5-10-04 1800	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): MAA/JCN
Signature:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
MAA	5-11-04	1332			
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT STL 14486

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Billerica, MA 01862
(P) 978-687-1400
(F) 978-687-7871
STL-BILLERICA

Job# | Quote# | PO#

Client: Mactec Engineering and Consulting Inc.
Address: 107 Audubon Road Ste 301, Wakefield MA 01880
Phone: 781 245 0606 Fax: 781 245 5060

Project #: 63000300 08 / 10.03
Project Manager: L. Axelrod
Work ID: PCMP
Contact: L. M.A.

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs ___ 72 hrs ___ 48 hrs ___ 5 Day ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. Metals (Al, Cr) Field Filtered
Total Cr, unfiltered

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
1170-1SC01-68	SW	JCN MAA	5-10-04 0815	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P		X														X				
				X		1	P		X															X			

Sampled by (print): JCN / MAA
Signature: [signature]

Relinquished by: MAA Date: 5-10-04 Time: 1330
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:
STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: ___ °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy
STL8245-360 (12/02)

Client: Mactec
Address:
Phone: Fax:
Project #: 6300030008/10-03
Project Manager: PCM
Work ID:
Contact:

Job#: Quote#: PO#:

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. Metals (Al, Cr) Field Filled
Total Cr - unpl...

Requested Turn Around Time
10 Business Day (Std) X
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 / Ammonia	Semivoa 8270 / Nitrate	PCB / Pesticides / Nitrite	EPH / VPH / Chloride	DRO / GRO / Sulfate	Metals 6010 / 200.7 / Sp.	General Chemistry / Total	Bacteriological / Diss.	Toxicity	Oil & Grease / TOC	Other
1170-1SC01 DUP-68	SW	JCN/MAA	5-10-04 0815	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P							X									X				
				X		1	P		X															X			
				X		1	P		X																X		

Sampled by (print): JCN/MAA
Signature:

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
MAA	5-12-04	1330			
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Chain of Custody Form

TRENT STL 14474

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: Mactec

Address:

Phone: Fax:

Project #:

Project Manager:

Work ID:

Contact:

Job# Quote# PO#

Shaded areas for office use

Analysis Requested

Check analysis and specify method and analytes in comments section.

For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste

Use comments section to further define.

Comments (Special Instructions)

All DSS metals (Al, Cr) Field filtered

Total Cr. unfilt

Requested Turn Around Time

10 Business Day (Std) ____ Rush TAT Requested:
15 Business Day ____ 24 hrs ____ 72 hrs ____
Other ____ 48 hrs ____ 5 Day ____

Regulatory Classification / Special Report Format

NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
WW-Wastewater DW-Drinking weter SW-Surfacewater
W-Lebwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
1170-1SC01MS/MSD-68	SW	SCW MAA	5-10-04 0815			2	1			X							✓										
						2	P							X				X									
						2	P							X					X								
						2	P							X						X							
						2	P							X							X						
						2	P							X								X					
						1	P		X														X				
						2	P		X															X			

Sampled by (print): SW/MAA

Signature: [signature]

Relinquished by: MAA Date: 5-13-04 Time: 1330

Received by: Date: Time:

Relinquished by: Date: Time:

Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N

Temp @ receipt: ____ °C

Preservation/pH checked

By: ____ Date: ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT STL 14475

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Job# | Quote# | PO#

Client: Mitrice

Address:

Phone: Fax:

Project #: 63233 32004

Project Manager:

Work ID: PCMP

Contact:

Requested Turn Around Time

10 Business Day (Std) ✓ | Rush TAT Requested: 24 hrs ___ 72 hrs ___ 48 hrs ___ 5 Day ___

15 Business Day ___

Other ___

Regulatory Classification / Special Report Format

NPDES: ___ Drinking Water ___ DEP Form(s) ___

RCRA: ___ MCP GW1/S1 ___ MWRA Smart Rpt ___

Other: ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested

Check analysis and specify method and analytes in comments section.

For example:
- 500-series for drinking water
- 600-series for (waste) water
- 8000-series for haz/solid waste

Use comments section to further define.

Comments (Special Instructions)

All DSS metals (Cr, Cu, Pb, Ni, Zn) Total Cr

Sample Type Codes:
WW-Wastewater, DW-Drinking water, SW-Surfacewater, LW-Lebweter, GW-Groundwater, A-Air, S-Solid / Soil, SL-Sludge, O-Oil, Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
1170-P2-17-68	SN	MAA	5-12-09 0840	✓		1	P			X				X				X									
				X		1	P							X				X									
				X		2	P							X					X								
				X		1	P							X						X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P		X														X				
				X		2	P		X															X			

Sampled by (print): SCN/MAA

Signature: [signature]

Relinquished by: MAA Date: 5-12-09 Time: 1330

Received by: Date: Time:

Relinquished by: Date: Time:

Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler ? Y / N Samples Iced? Y / N

Temp @ receipt: ___ °C

Preservation/pH checked

By: ___ Date:

White = Lab file Yellow = Report copy Pink = Customer copy

45-36

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14489

Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD
N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: Maclec
Address:
Phone: Fax:
Project #:
Project Manager:
Work ID: PCMP
Contact:

Job# | Quote# | PO#

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
- 500-series for drinking water
- 600-series for waste water
- 8000-series for haz/solid waste

Use comments section to further define.

Comments (Special Instructions)
All DSS Metals Field Filled Al Cr
Total Cr Non-Cl

Requested Turn Around Time
10 Business Day (Std) ____ Rush TAT Requested:
15 Business Day ____ 24 hrs ____ 72 hrs ____
Other ____ 48 hrs ____ 5 Day ____

Regulatory Classification / Special Report Format
NPDES ____ Drinking Water ____ DEP Form(s) ____
RCRA ____ MCP GW1/S1 ____ MWRA Smart Rpt ____
Other ____ MCP QA/QC Rpt ____

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 Amanda N.a.	Semivoa 8270 Nitrite N.a.	PCB / Pesticides	EPH / VPH Sulfide	DRO / GRO Chloride	Metals 6010 / 200.7 Sodium	General Chemistry PH	Bacteriological DSS	Toxicity	Oil & Grease / TOC	Other
1170-15C02-68	SW	SCN MAA	5/10/04 0900	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	B							X						X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P		X														X				
				X		1	P		X															X			

Sampled by (print): SCN/MAA
Signature:

Relinquished by: MAA Date: 5/10/04 Time: 7330
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: ____ °C
Preservation/pH checked
By: ____ Date: ____

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14488

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Lawrence, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTEC
Address:
Phone: Fax:

Project #: 6300030008
Project Manager: Eric Axelrod
Work ID: PCMP
Contact:

Job# | Quote# | PO#

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Diss. Metals
CAl, Cr Field filtered
Total Cr, Unfiltered

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested:
24 hrs 72 hrs
48 hrs 5 Day

Regulatory Classification / Special Report Format 2
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625 Ammonia	Semivoa 8270 Nitrate	PCB / Pesticides Nitrite	EPH / VPH Sp. Cond.	DRO / GRO Sp. Cond.	Metals 6010 / 200.7 Sulfate	General Chemistry	Bacteriological Diss.	Toxicity	Oil & Grease / TOC	Other
1170-1SC03-68	SW	MAA/JCW	5-10-04 940	X		1	P			X							X										
				X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P							X							X						
				X		1	P							X								X					
				X		1	P		X														X				
				X		1	P		X															X			

Sampled by (print): MAA/JCW
Signature: [signature] [signature]

Relinquished by: MAA Date: 5-10-04 Time: 1330
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

15-360

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14475

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Billerica, MA 01862
(P) 978-687-1400
(F) 978-667-7871
STL-BILLERICA

Client: MACTEC
Address:
Phone: Fax:

Project #: 6300030008
Project Manager: Eric Axelroy
Work ID: PCMP
Contact:

Job# | Quote# | PO#

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All metals (Cr, Al) dissolved - field Filtered

Requested Turn Around Time
10 Business Day (Std) ✓
15 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundweter A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	~~Semivoa 625~~ Ammonia - Nitrogen	~~Semivoa 8270~~ Chloride	~~PCB / Pesticides~~ Specific Gravity	~~EPH / VPH~~ Sulfate	~~DRO / GRO~~ Disolved	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-202D	GW	MAA/JCW	5-10-04 1105	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): MAA/JCW
Signature: [signature]

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
MAA	5-10-04	1330			
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14472

Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

N. Billerica, MA 01862
(P) 978-667-1400
(F) 976-667-7871
STL-BILLERICA

Client: MACTEC
Address:
Phone: Fax:
Project #: 6300032008
Project Manager: Eric Axelrod
Work ID: PCMP
Contact:

Job# | Quote# | PO#

Requested Turn Around Time
10 Business Day (Std) ✓ | Rush TAT Requested: 24 hrs ___ 72 hrs ___ 48 hrs ___ 5 Day ___
15 Business Day ___
Other ___

Regulatory Classification / Special Report Format
NPDES ___ Drinking Water ___ DEP Form(s) ___
RCRA ___ MCP GW1/S1 ___ MWRA Smart Rpt ___
Other ___ MCP QA/QC Rpt ___

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)
All Dissolved Metals
Field - Filtered
(Al, Cr)

Sample Type Codes
WW-Wastewater DW-Drinking water SW-Surfacewater
LW-Labwater GW-Groundwater A-Air
S-Solid / Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4°C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivoa 625	Semivoa 8270	PCB / Pesticides	EPH / VPH	DRO / GRO	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-202S	GW	MAA/JCW	5-12-09 1150	X		1	P			X							X										
↓	↓	↓	↓	X		1	P							X				X									
				X		1	P							X					X								
				X		1	P							X						X							
				X		1	P		X												X						

Sampled by (print): MAA/JCW
Signature: [signature]

Relinquished by: MAA Date: 5-12-09 Time: 1330
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment: STL-Westfield

Cooler ? Y / N Samples Iced? Y / N
Temp @ receipt: ___ °C
Preservation/pH checked
By: ___ Date: ___

White = Lab file Yellow = Report copy Pink = Customer copy

STL8245-360 (12/02)

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT SERVICES

• 53 Southhampton Road, Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707
• 10 Rangeway Road Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871

Job# | Quote# | PO#

Client: Mueller Engineering and Consulting Inc Job #: 6300030008/10.03
Address: 117 Andover Road 56301 Project Manager: L. Marlowe
Billerica MA 01862 Work ID: Pump
Phone: 978-667-6606 Fax: 781-265-60 Contact:

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments (Special Instructions)

All D. SS. metals (Mn, Cr) Field Filtered

Requested Turn Around Time
15 Business Day: X Rush:
10 Business Day: Other:

Regulatory Classification – Please Specify
NPDES: Drinking Water: MCP Other:
RCRA: MCP GW1: Other:

Sample Type Codes
WW - Wellwater W - Wastewater SW - Surfacewater LW - Labwater
RW - Raw Water GW - Groundwater PW - Public Water SO - Soil
S - Solid SL - Sludge O - Oil A - Air Z - Other

Sample ID (Use one line per container. For volatiles, one line/analysis)	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic (P) or Glass (G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >2	Other	4°C	pH	Volatiles	Semivolatiles	PCB & Pesticides	EPH	VPH	DRO/GRO (circle)	Oil & Grease	Metals	General Chemistry	Bacteriological	Other
GW-20IS	GW	JCN	5-20-04 1435	X		1	P			X						X										
↓	↓	↓	↓	X		1	X							X			X									
				X		1	P							X				X								
				X		1	P							X					X							
				X		1	P		X											X					
GW-26	GW	JCN	5-20-04 1600	X		1	P			X						X										
				X		1	P							X			X									
				X		1	P							X				X								
				X		1	P							X					X							
↓	↓	↓	↓	X		1	P		X											X						

Sampled by (print): JCN Signature:
Relinquished by: JCN Date: 5-21-04 Time: Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: Time:
Method of shipment: Laboratory:

Cooler #:
Temp @ receipt:
Preservation/pH checked
By: Date:

White – Lab file Yellow – Report copy Pink – Customer copy

Severn Trent Laboratories, Inc.

Chain of Custody Form

SEVERN TRENT SERVICES

• 53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707

• 149 Rangeway Road
Billerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871

Job#: | Quote#: | PO#:

Client: Mactec
Address:
Phone: Fax:

Job #:
Project Manager:
Work ID: DCMP
Contact:

Requested Turn Around Time
15 Business Day X Rush
10 Business Day Other

Regulatory Classification – Please Specify
NPDES Drinking Water MCP Other N
RCRA MCP GW1 Other

Sample Type Codes
WW - Wellwater W - Wastewater SW - Surfacewater LW - Labwater
RW - Raw Water GW - Groundwater PW - Public Water SO - Soil
S - Solid SL - Sludge O - Oil A - Air Z - Other

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments
(Special Instructions)
All Diss. metals (N/C) Field Filtered

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic (P) or Glass (G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Other	4°C	pH	Volatiles/Ammonia	Semivolatiles Sulfate	~~PCB & Pesticides~~ Chloride	EPH Sp. Conductivity	~~VPH~~ Diss. metals	DRO/GRO (circle)	Oil & Grease	Metals	General Chemistry	Bacteriological	Other
GW-37	GW	JCN	5-20-04	X		1	1			X						X										
				X		1	P							X			X									
				X		1	P							X				X								
				X		1	P							X					X							
				X		1	P		X											X						
GW-55S	GW	JCN	5-21-04 0930	X		1	1			X						X										
				X		1	1							X			X									
				X		1	1							X				X								
				X		1	1							X					X							
				X		1	1		X											X						

Sampled by (print): JCN
Signature:
Relinquished by: JCN Date: 5-21-04 Time: 1015
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:
Method of shipment:

Cooler #
Temp @ receipt
Preservation/pH checked
By Date

White = Lab file Yellow = Report copy Pink = Customer copy
3245

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT STL 14396

•53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707
STL-WESTFIELD

•14[illegible] Jungeway Road
N. E[illegible]a, MA 01862
(P) 978-667-1400
(F) 978-667-7871
STL-BILLERICA

Client: Mactec Engineering & Consulting Inc.
Address: 100 Morscher Road Ste 301
[illegible] Rockland MA 02370
Phone: Fax:

Project #: 6300030008 / 10.03
Project Manager: E. Axelrod
Work ID: Pump
Contact:

Job#: Quote#: PO#:

Requested Turn Around Time
10 Business Day (Std) X
5 Business Day
Other
Rush TAT Requested: 24 hrs 72 hrs 48 hrs 5 Day

Regulatory Classification / Special Report Format
NPDES Drinking Water DEP Form(s)
RCRA MCP GW1/S1 MWRA Smart Rpt
Other MCP QA/QC Rpt

Shaded areas for office use

Analysis Requested
Check analysis and specify method and enalytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid wasts
Use comments section to further define.

Comments (Special Instructions)

All Diss. metals (Al, Cr) Field Filtered

Sample Type Codes:
WW-Wastewater DW-Drinking water SW-Surfacewater
W-Labwater GW-Groundwater A-Air
S-Solid/Soil SL-Sludge O-Oil Z-Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic(P) or Glass(G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Na2S2O3	None / 4° C	Volatiles 524 / 624	Volatiles 8260 / 8021	Semivol 625	Semivol 8270 (Ultra Low)	PCB / Pesticides (Ultra Low)	EPH / VPH (Ultra Low)	DRO / GRO	Diss. Metals	Metals 6010 / 200.7	General Chemistry	Bacteriological	Toxicity	Oil & Grease / TOC	Other
GW-42S	GW	JCN	5-20-04 1120	X		1	1			X							X											
				X		1	1							X				X										
				X		1	1							X					X									
				X		1	1							X						X								
				X		1	1		X												X							
GW-42S DUP	GW	JCN	5-20-04 1120	1		1	1			X							X											
				1		1	1							X				X										
				1		1	1							X					X									
				1		1	1							X						X								
				1		1	1		X												X							

Sampled by (print): JCN
Signature:

Relinquished by: JCN Date: 5-20-04 Time: 1320
Received by: Date: Time:
Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

STL-Westfield

Cooler? Y / N Samples Iced? Y / N
Temp @ receipt: °C
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

STL 8245 350 (12/02)

Severn Trent Laboratories, Inc.
Chain of Custody Form

SEVERN TRENT SERVICES

53 Southampton Road
Westfield, MA 01085
(P) 413-572-4000
(F) 413-572-3707

Rangeway Road
Jerica, MA 01862
(P) 978-667-1400
(F) 978-667-7871

Job# | Quote# | PO#

Client: Moclec
Address: 107 Audubon Road
Westfield MA 01085
Phone: Fax:

Job #: 6300030008 / 10.03
Project Manager:
Work ID: PCMP
Contact:

Shaded areas for office use

Analysis Requested
Check analysis and specify method and analytes in comments section.
For example:
500-series for drinking water
600-series for waste water
8000-series for haz/solid waste
Use comments section to further define.

Comments
(Special Instructions)

All Diss. Metals (Al, Cr) Field Filtered

Requested Turn Around Time
15 Business Day X Rush
10 Business Day Other

Regulatory Classification – Please Specify
NPDES Drinking Water MCP Other
RCRA MCP GW1 Other

Sample Type Codes
WW - Wellwater W - Wastewater SW - Surfacewater LW - Labwater
RW - Raw Water GW - Groundwater PW - Public Water SO - Soil
S - Solid SL - Sludge O - Oil A - Air Z - Other

Sample ID	Sample Type	Sampler's Initials	Date / Time Collected	Grab	Comp.	# Containers	Plastic (P) or Glass (G)	NaHSO4/MeOH	HNO3 to pH <2	H2SO4 to pH <2	HCl to pH <2	NaOH to pH >12	Other	4°C	pH	Volatiles Ammonia	Semivolatiles Chloride	PCB & Pesticides Sulfide	EPH Sp. Cond. Lit.	VPH Diss. Metals	DRO/GRO (circle)	Oil & Grease	Metals	General Chemistry	Bacteriological	Other
GW-43S	GW	JCN	5-22-04	X		1	P									X										
				X		1	P										X									
				X		1	P											X								
				X		1	P												X							
				X		1	P													X						

Sampled by (print): JCN
Signature:

Relinquished by: JCN Date: 5-22-04 Time: 1320
Received by: Date: Time:

Relinquished by: Date: Time:
Received by: Date: Time:

Method of shipment:

Copies:
Temp. @ receipt:
Preservation/pH checked
By: Date:

White = Lab file Yellow = Report copy Pink = Customer copy

APPENDIX B

FIELD ACTIVITY SUMMARY REPORT (FAR) FOR THE SECOND QUARTER MAY 2004
SAMPLING OF PCMP WELLS

Olin Wilmington Post Construction Monitoring Program (PCMP) Ground and Surface Water Monitoring Program – May Sampling Event – 2nd Quarter 2004

The Second Quarter 2004 ground-water sampling event for the Post Construction Monitoring Program (PCMP) was conducted by MACTEC Engineering and Consulting, Inc. (MACTEC) scientists Jason C. Naiden (JCN), Lauren A. Smith (LAS), and Michael A. Apfelbaum (MAA). The Second Quarter 2004 ground-water sampling for the PCMP Program was performed between May 5 and 21, 2004, while synoptic water levels and surface water samples were collected on May 10, 2004 prior to the release of water from the Plant B treatment area.

The groundwater samples were collected according to EPA 1996 Low stress (low flow) guidelines. Samples were collected following the stabilization of field parameters including pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), temperature and specific conductivity (sc). Groundwater samples were collected and sent for laboratory analysis from the following 17 monitoring wells and 4 surface water locations:

GW-10S	GW-78S
GW-24	GW-79S
GW-25	GW-CA1
GW-26	GW-201S
GW-34S(R)	GW-202S
GW-34D	GW-202D
GW-35S	1170-ISCO1-68*
GW-39	1170-ISCO2-68*
GW-42S	1170-ISCO3-68*
GW-43S	1170-PZ17-68*
GW-55S	

*- PCMP Surface water analytes collected at these four locations, PCMP groundwater analytes analyzed for all other locations. Refer to the additional project information for QA/QC sample collection

The ground-water samples were transported by Severn Trent Laboratory (STL) courier to STL-Westfield, MA for one of the following two sets of analyses depending on matrix; **1) PCMP groundwater**: chloride via EPA Method 300.0, sulfate via EPA Method 300.0, specific conductance (SC) via Method SM182510B, ammonia-nitrogen via Method LAC10-107061B and dissolved metals (Al, Cr) via EPA Method 6010; and **2) Surface water**: ammonia- nitrogen via Method LAC 10-107061B, chloride via EPA Method 300.0, Nitrate via EPA Method 300.0 part A, Nitrite via EPA Method 300.0 part A, sulfate via EPA Method 300.0, specific conductance (SC) via Method SM182510B, dissolved aluminum and chromium, via EPA Method 200.7, and total chromium via Method EPA 200.7.

Dissolved metals samples were field filtered with a dedicated Teflon™ in-line 0.45-micron pore diameter field filter.

Sampling and Gauging Observations:

- GW-18S contains an immovable obstruction at 11.0 ft bgs, preventing static gauging.
- GW-17D remains inhabited by mice, preventing water level measurement.
- A datalogger has been deployed in GW-10S by GEI Consultants, Inc.
- Two well gauging locations could not be gauged due to high water, and vehicular obstructions. Refer to accompanying Table 1.
- Water levels were generally higher (1-1.5 ft) than those exhibited during the February 2004 event.

Additional Project Information:

- QC Duplicate Samples were collected from GW-78S and GW-42S.
- Matrix spike/ Matrix spike duplicate samples were collected from GW-25.
- QC Duplicate and Matrix spike/ Matrix spike duplicate samples were collected from 1170-ISCO1-68.
- All samples were sent to STL-Westfield laboratory facilities via daily courier.
- All samples were received by the lab.

Prepared by: MAA 05/25/04
Reviewed by: EMA 05/28/04

TABLE 1
PCMP Synoptic Groundwater Elevations
Second Quarter May, 2004
Olin-Wilmington

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
I.D.	(ft msl)				
GT-04-D	88.47	1	—	—	—
GT-04-S	86.36	1	—	—	—
GT-06-D	87.24	1	—	—	—
GT-06-S	87.27	1	—	—	—
GW-03-D	85.28		5.45	79.83	5/10/2004
GW-03-S	86.4	TOC	6.55	79.85	5/10/2004
GW-04	82.19		5.85	76.34	5/10/2004
GW-04-D	79.29		2.68	76.61	5/10/2004
GW-06-D	90.06		7.62	82.44	5/10/2004
GW-06-S	90.98		7.75	83.23	5/10/2004
GW-07	83.19	1	—	—	—
GW-08	82.54	TOC	4.40	78.14	5/10/2004
GW-10-S	89.1		7.98	81.12	5/10/2004
GW-11	87.22	1	—	—	—
GW-12	84.65		3.14	81.51	5/10/2004
GW-17-D	81.42	3	—	—	—
GW-17-S	82.07		3.30	78.77	5/10/2004
GW-18-D	88.92		11.01	77.91	5/10/2004
GW-18-S	89.6	4	—	—	—
GW-19-S	89.88	1	—	—	—
GW-19-D	89.76	1	—	—	—
GW-20	85.54		5.58	79.96	5/10/2004
GW-24	83.43		2.75	80.68	5/10/2004
GW-25	85.97		5.23	80.74	5/10/2004
GW-26	84.93		3.81	81.12	5/10/2004
GW-27-D	89.35	1	—	—	—
GW-27-S	89.28	1	—	—	—
GW-28-D	84.81		1.70	83.11	5/10/2004
GW-28-S	85.56		2.45	83.11	5/10/2004
GW-29-D	85.16		2.69	82.47	5/10/2004
GW-29-S	84.31		1.89	82.42	5/10/2004
GW-30-DR	87.03		5.61	81.42	5/10/2004
GW-32S	89.18	9	—	—	—
GW-33-D	89.64	1	—	—	—
GW-33-S	89.9	1	—	—	—
GW-34-D	90.38		7.26	83.12	5/10/2004
GW-34-S (R)	89.13		6.01	83.12	5/10/2004
GW-35-D	88.6		6.87	81.73	5/10/2004
GW-35-S	88.51	7	—	—	—
GW-36	85.72	1	—	—	—
GW-37	83.47	1	—	—	—
GW-38	86.96	1	—	—	—
GW-39	83.64		3.11	80.53	5/10/2004
GW-42-D	84.07	8	—	—	—
GW-42-S	84.18		3.21	80.97	5/10/2004
GW-43-D	87.96		6.85	81.11	5/10/2004
GW-43-S	87.35		6.20	81.15	5/10/2004
GW-50-D	80.11		3.70	76.41	5/10/2004
GW-50-S	79.97		3.48	76.49	5/10/2004

WELL/SG- ID	Reference Elevation	Notes	Depth To Water	Corrected Elevation	Measured Date
I.D.	(ft msl)				
GW-51-D	84.55		6.44	78.11	5/10/2004
GW-51-S	84.62		5.50	79.12	5/10/2004
GW-54-S	88.85		5.44	83.41	5/10/2004
GW-55-D	81.95		2.02	79.93	5/10/2004
GW-55-S	81.7		1.70	80.00	5/10/2004
GW-56-D	82.82		5.20	77.62	5/10/2004
GW-56-S	83.07		5.41	77.66	5/10/2004
GW-68-D	90.15	8	—	—	—
GW-69-D	93.04		11.96	81.08	5/10/2004
GW-69-S	92.27		14.19	78.08	5/10/2004
GW-76-S	88.45	TOC	9.80	78.65	5/10/2004
GW-77-S	85.49	9	—	—	—
GW-78-S	84.89		4.35	80.54	5/10/2004
GW-79-S	81.54		3.15	78.39	5/10/2004
GW-201S	83.29		3.34	79.95	5/10/2004
GW-202S	86.97		6.38	80.59	5/10/2004
GW-202D	86.52		5.82	80.70	5/10/2004
GW-CA1	88.01	7	—	—	—
GW-CA2	87.8		6.39	81.41	5/10/2004
GW-CA3D	89.86		8.44	81.42	5/10/2004
GW-CA3S	89.68		8.31	81.37	5/10/2004
GW-CA4S	87.74		6.31	81.43	5/10/2004
GW-LPB11	88.88	10	—	—	—
PW-2	86.58		5.10	81.48	5/10/2004
PZ-11/IN	84.51		3.35	81.16	5/10/2004
PZ-11/OUT	84.51		3.65	80.86	5/10/2004
PZ-12/IN	84.04		3.55	80.49	5/10/2004
PZ-12/OUT	84.04		3.65	80.39	5/10/2004
PZ-14/IN	83.96		3.41	80.55	5/10/2004
PZ14/OUT	83.96		3.45	80.51	5/10/2004
PZ-15/IN	79.12		3.29	75.83	5/10/2004
PZ-15/OUT	79.12		3.34	75.78	5/10/2004
PZ-16R/IN	79.07	5	—	—	—
PZ-16R/OUT	79.07	5	—	—	—
PZ-17R/IN	79.5	1	—	—	—
PZ-17R/OUT	79.5	1	—	—	—
PZ-18R/IN	82.42		1.99	80.43	5/10/2004
PZ-18R/OUT	82.42		1.90	80.52	5/10/2004
SP-01	83.09	2	—	—	—
SP-02	84.24	2	—	—	—
SP-03	87.85		6.38	81.47	5/10/2004
SG-8	83		0.67	82.33	5/10/2004
SG-9	75.05	1	—	—	—
SG-10	82.4	1	—	—	—
SG-11	82.32	1	—	—	—
East Ditch SG	79.25	1	—	—	—
Old Weir SG	—	1	—	—	—
SG-14	81.1	9	—	—	—
SG-16	82.8		0.96		5/10/2004

Notes:
(1) Well/staff guage removed or missing from site.
(2) Well paved over. Water level not obtained.
(3) Well has been inhabited by mice.
(4) Obstruction exists in well which prevented measurement.
(5) Not measured - cap rusted shut
(6) Not measured due to high water condition
(7) Datalogger located in well, measurement unable to be taken
(8) Vehicle parked above well, no measurement recorded
(9) Measurement not recorded
(10) Not measured due to location within area designated for excavation activities
TOC- Water level measurement taken from Top of Casing, not top of riser
Bold Text indicates location gauged during current Quarterly event

Prepared by: MAA
Checked by: RAR

Appendix F

Temporary Cap Quarterly Inspection Reports 2004 and Annual Analysis of Post-Construction Monitoring Plan Data (Geomega)

GEI Consultants, Inc.

June 9, 2004
Project 97598

1021 Main Street
Winchester, MA 01890-1970
781•721•4000
781•721•4073 Fax

Mr. Christopher Pyott
Environmental Analyst
Department of Environmental Protection
Bureau of Waste Site Cleanup
One Winter Street
Boston, MA 02108

Dear Mr. Pyott:

Re: Temporary Cap Inspection Report, First Quarter 2004
Olin Wilmington Property
51 Eames Street, Wilmington, MA
RTN 3-0471

The following letter presents the results of the quarterly cap inspection performed by GEI for the Containment Area Temporary Cap installed at 51 Eames Street, Wilmington, Massachusetts (the Property). More information regarding the installation of the Containment Wall and the original Temporary Cap is in GEI's *Status Report No. 2, Part 2 Construction-Related Release Abatement Measure (RAM)*, dated August 28, 2001. Improvements were made to the Temporary Cap in 2003 and were described in GEI's *Temporary Cap Inspection Report, Second Quarter 2003*, dated May 29, 2003.

Background

Following the installation of the subsurface Containment Wall, the Containment Area was temporarily capped with 6-mil reinforced polyethylene sheeting. Seams between sheets were overlapped at least 3 feet and held in place with rows of gravel-filled bags. In December 2000, one capping sheet was installed over the south-central Containment Area around the temporary Catch Basin. In April 2001, four additional sheets were installed and the Temporary Cap was completed and covered the Containment Area. In June 2001, an approximately 15-foot-wide gravel roadbed was installed over the eastern and southern perimeter of the Temporary Cap to allow vehicle access to the Bioremediation Cell at the southwest corner of the Property.

As reported in *Status Report No. 2*, areas of the Temporary Cap had begun to show signs of degradation as of June 2001, presumably due to exposure to sunlight and the outdoor environment. The degradation was manifested as a blistering and separation of the layers of the 2-ply material. At that time, the material remained intact and the performance of the

Temporary Cap had not been significantly compromised. GEI proposed to perform quarterly inspections to assess long-term stability of the Temporary Cap material.

Olin submitted the *Part 2 Construction-Related RAM, Modification No. 11* to DEP on November 18, 2002, describing proposed modifications to the Temporary Cap. The modifications included: installation of an 8-mil layer of polyethylene material over the existing cap material, ballasting the new material with sandbags on a grid pattern to minimize potential wind damage, and sewing seams between sheets to reduce potential leakage. The cap improvements were completed in April 2003.

Inspection and Maintenance Results

On Wednesday, March 3, 2004, GEI field personnel performed a visual inspection of the Temporary Cap surface. Photographs taken during the inspection are enclosed. In general, the Temporary Cap material was intact. The condition of the cap was similar to that observed on November 28, 2003, as described in GEI's *Temporary Cap Inspection Report, Fourth Quarter 2003,* dated January 15, 2004. The following observations were noted during the first quarter 2004 cap inspection:

- No punctures, tears, blisters, or separation of the new cap material are observed.
- The sewn seams using ultraviolet (UV) -resistant thread are intact.
- The UV-resistant sandbags show no sign of degrading and appear adequate to ballast the cap material.
- The gravel ballast placed along the perimeter of the cap remains in place.
- Penetrations due to bollards or monitoring wells that were previously clamped or taped around the bollard/well were reinforced with Transit-Seal Tape (which resists degradation) a week prior to the inspection.
- Water generally flows in the direction of the central catch basin. Some pools of water are observed on the cap.

Future Recommendations

The Temporary Cap appears to be in good condition. We do not recommend any maintenance activities for the first quarter of 2004.

Inspection Schedule

The next Temporary Cap inspection is scheduled for the second quarter of 2004.

Limitations

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No warranty, expressed or implied, is made.

A copy of this report will be included in the *Part 2 Construction-Related RAM Status Report No. 8 and/or Completion Report,* which will be submitted to DEP by August 2004.

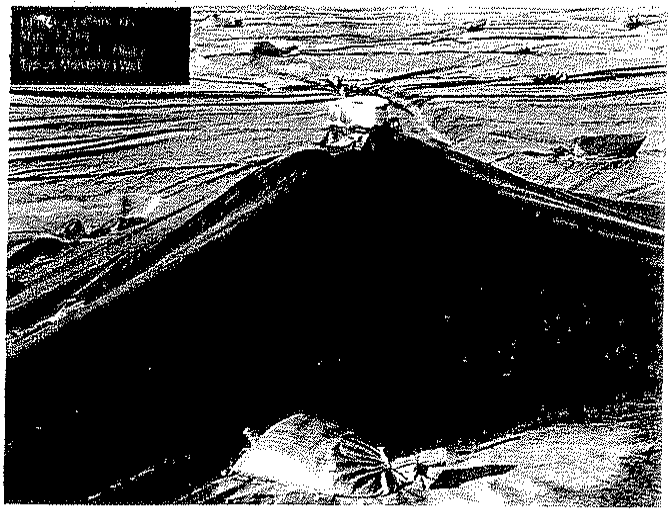
Please contact me at 781.721.4104 if you have any questions regarding the enclosed material.

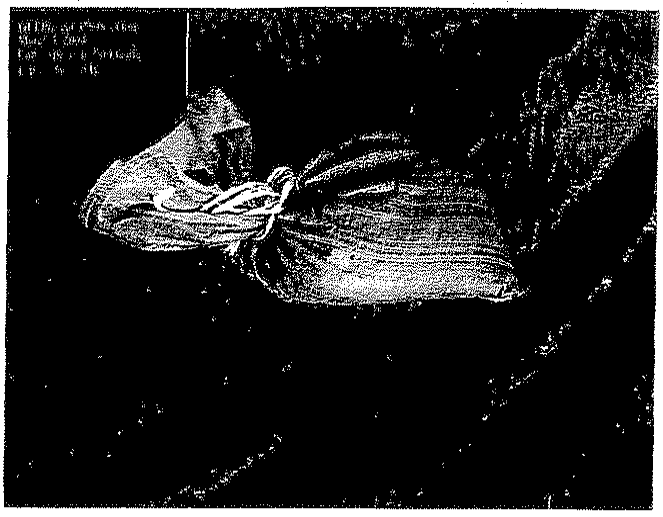
Sincerely,

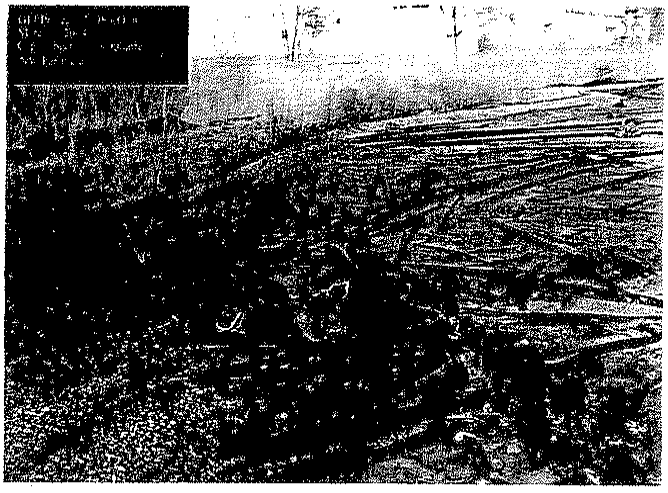
GEI CONSULTANTS, INC.

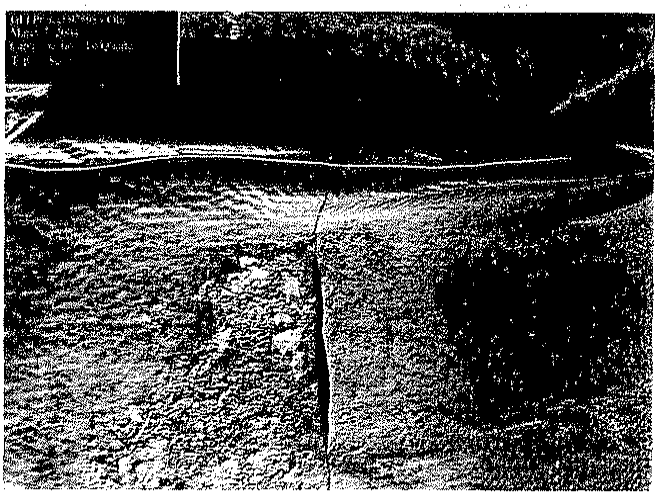
Laurence J. Welch Jr.
Project Professional

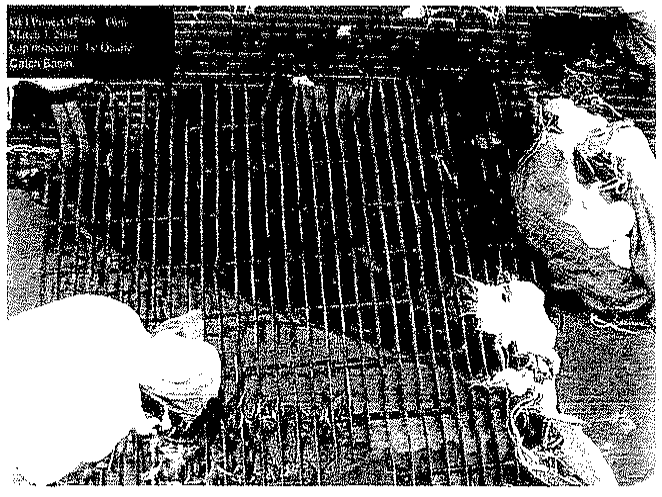
KJC/JDV/LJW:lek
Enclosures
c: Margret Hanley, SHD
Steve Morrow, Olin
Al Pierce, Olin







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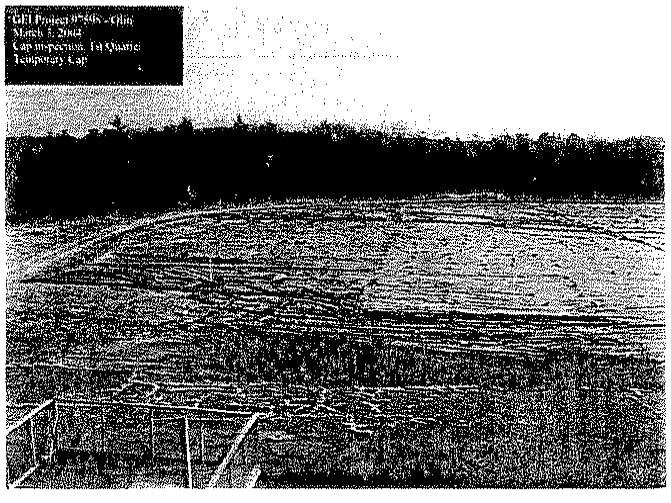
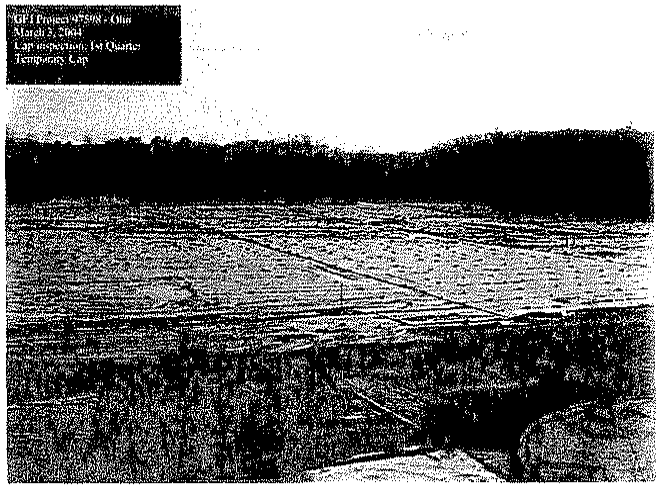

March 3, 2004
Temporary Cap


March 3, 2004
Temporary Cap

GEI Consultants, Inc.

June 9, 2004
Project 97598

1021 Main Street
Winchester, MA 01890-1970
781•721•4000
781•721•4073 Fax

Mr. Christopher Pyott
Environmental Analyst
Department of Environmental Protection
Bureau of Waste Site Cleanup
One Winter Street
Boston, MA 02108

Dear Mr. Pyott:

Re: Temporary Cap Inspection Report, Second Quarter 2004
Olin Wilmington Property
51 Eames Street, Wilmington, MA
RTN 3-0471

The following letter presents the results of the quarterly cap inspection performed by GEI for the Containment Area Temporary Cap installed at 51 Eames Street, Wilmington, Massachusetts (the Property). More information regarding the installation of the Containment Wall and the original Temporary Cap is contained in GEI's *Status Report No. 2, Part 2 Construction-Related Release Abatement Measure (RAM)*, dated August 28, 2001. Improvements were made to the Temporary Cap in 2003 and were described in GEI's *Temporary Cap Inspection Report, Second Quarter 2003*, dated May 29, 2003.

Background

Following the installation of the subsurface Containment Wall, the Containment Area was temporarily capped with 6-mil reinforced polyethylene sheeting. Seams between sheets were overlapped at least 3 feet and held in place with rows of gravel-filled bags. In December 2000, one capping sheet was installed over the south-central Containment Area, around the temporary Catch Basin. In April 2001, four additional sheets were installed and the Temporary Cap was completed and covered the Containment Area. In June 2001, an approximately 15-foot-wide gravel roadbed, was installed over the eastern and southern perimeter of the Temporary Cap to allow vehicle access to the Bioremediation Cell at the southwest corner of the Property.

As reported in *Status Report No. 2*, areas of the Temporary Cap had begun to show signs of degradation as of June 2001, presumably due to exposure to sunlight and the outdoor environment. The degradation was manifested as a blistering and separation of the layers of the 2-ply material. At that time, the material remained intact and the performance of the

Temporary Cap had not been significantly compromised. GEI proposed to perform quarterly inspections to assess long-term stability of the Temporary Cap material.

Olin submitted the *Part 2 Construction-Related RAM, Modification No. 11* to DEP on November 18, 2002, describing proposed modifications to the Temporary Cap. The modifications included: installation of an 8-mil layer of polyethylene material over the existing cap material, ballasting the new material with sandbags on a grid pattern to minimize potential wind damage, and sewing seams between sheets to reduce potential leakage. The cap improvements were completed in April 2003.

Inspection and Maintenance Results

On Monday, May 24, 2004, GEI field personnel performed a visual inspection of the Temporary Cap surface. Photographs taken during the inspection are attached. In general, the Temporary Cap material was intact. The condition of the cap was similar to that observed on March 3, 2004, as described in GEI's *Temporary Cap Inspection Report, First Quarter 2004,* dated June 1, 2004. The following observations were noted during the second quarter 2004 cap inspection:

- No punctures, tears, blisters, or separation of the new cap material are observed.
- The sewn seams using ultraviolet (UV) -resistant thread are intact.
- Most of the UV-resistant sand bags show no sign of degrading and appear adequate to ballast the cap material. Minor tears in a few sandbags were observed, possibly from degradation or animal activity.
- The gravel ballast placed along the perimeter of the cap remains in place.
- Penetrations due to bollards or monitoring wells that were previously clamped or taped around the bollard/well were reinforced with Transit-Seal Tape (which resists degradation). Some of the Transit-Seal Tape appeared to be coming off select bollards, particularly on the West Side.
- Water was actively flowing into the central catch basin. Some pools of water are observed on the cap.

Future Recommendations

The Temporary Cap appears to be in good condition. We recommend resealing the cap to bollards/wells with Transit-Seal Tape as necessary to prevent leakage of the cap. This recommendation will be forwarded to Olin maintenance personnel.

Inspection Schedule

The next Temporary Cap inspection is scheduled for the third quarter of 2004.

Limitations

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No warranty, expressed or implied, is made.

A copy of this report will be included in the *Part 2 Construction-Related RAM Status Report No. 8 and/or Completion Report,* which will be submitted to DEP by August 2004.

Please contact me at 781.721.4104 if you have any questions regarding the enclosed material.

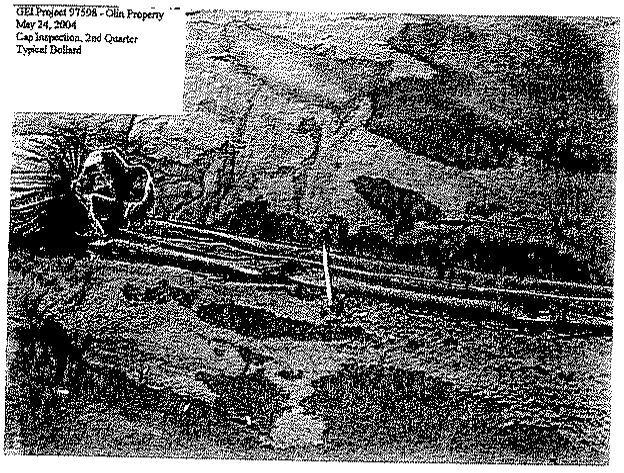
Sincerely,

GEI CONSULTANTS, INC.

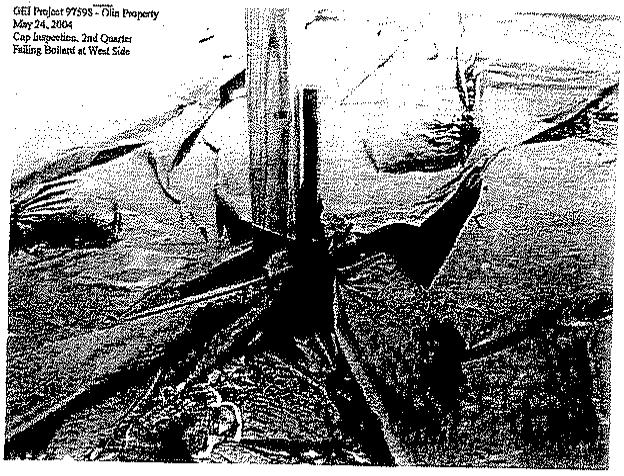
Laurence J. Welch Jr.
Project Professional

KJC/JDV/LJW:lek
Enclosures
c: Margret Hanley, SHD
Steve Morrow, Olin
Al Pierce, Olin

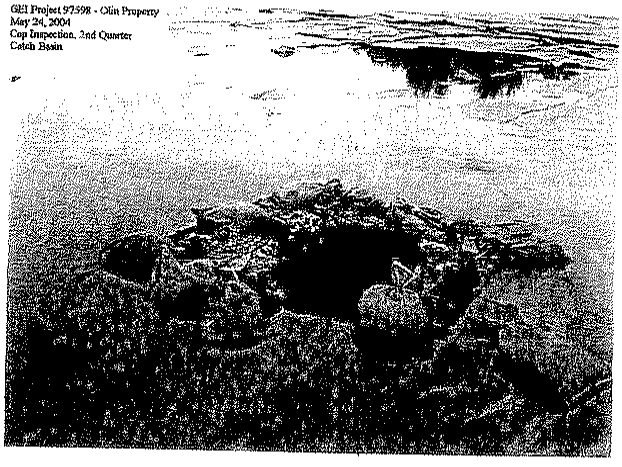
GEI Project 97598 - Olin Property
May 24, 2004
Cap Inspection, 2nd Quarter
Typical Bollard



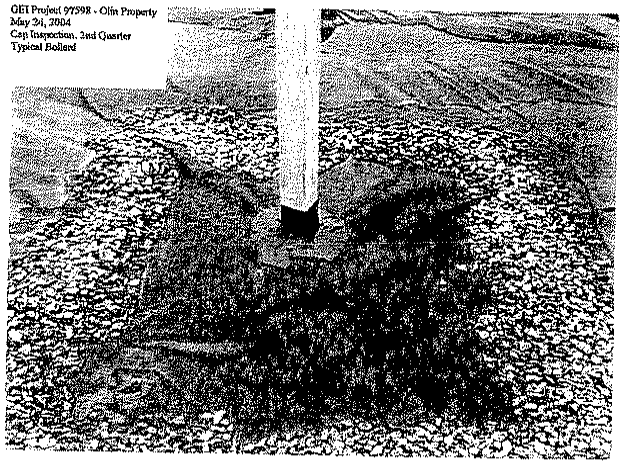
GEI Project 97598 - Olin Property
May 24, 2004
Cap Inspection, 2nd Quarter
Failing Bollard at West Side



GEI Project 97598 - Olin Property
May 24, 2004
Cap Inspection, 2nd Quarter
Catch Basin

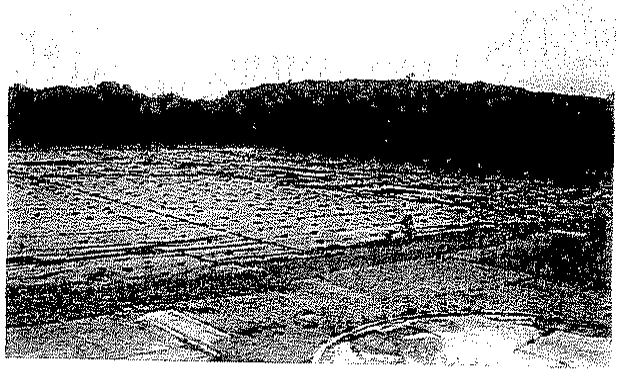


GEI Project 97598 - Olin Property
May 24, 2004
Cap Inspection, 2nd Quarter
Typical Bollard



GEI Project 97598 - Olin Property
May 24, 2004
Cap Inspection, 2nd Quarter
Cap Inspection

GEI Project 97598 - Olin Property
May 24, 2004
Cap Inspection, 2nd Quarter
Cap Inspection



Executive Summary

Executive Summary

This report describes Geomega's analysis of Post-Construction Monitoring Plan (PCMP) data for the 51 Eames Street Property (the "Property") in Wilmington, MA, during the time period July 2003 through March 2004. The objectives of the analysis were to:

- determine whether the containment structure (slurry wall and temporary cap) continues to act as an effective hydrologic barrier to the flow of on-property dense, aqueous-phase liquid (DAPL) and its associated "diffuse-zone" groundwater,
- evaluate whether or not there were any changes since June 2003 in solute concentrations in groundwater in the vicinity of the containment structure and in surface water in the South Ditch, and
- calculate the groundwater and solute mass flux from the containment area for comparison with estimated quantities used in the Focused Feasibility Study (GEI 2000a).

In addition, a statistical evaluation was performed to substantiate the proposed reduction in groundwater-quality sampling frequency (from quarterly to semiannually) recommended in PCMP Status Report #7.

Time series graphs of observed water levels from periodic monitoring show that groundwater elevations to the north (upgradient), west, and south (downgradient) of the containment area continued to fluctuate within historical limits during the current monitoring period. Meanwhile, there has been little variability in groundwater elevations within the containment structure since the temporary cap was completed in April 2001, resulting in consistently low horizontal hydraulic gradients within the wall. Fluctuating and generally upward or downward vertical hydraulic gradients observed to the north and south of the containment structure are attenuated within the wall, where vertical gradients have remained near zero since the temporary cap was completed. The relatively flat water levels and consistently low horizontal and vertical gradients within the containment structure suggest that the containment area is satisfactorily isolated from external conditions.

Improving trends in water quality have become apparent west of the containment structure. Recent shallow groundwater levels of ammonia, chloride, sulfate, and specific conductance in that area are 25% to 45% lower than average levels between February 1996 and June 2003. The pH levels in groundwater wells north and west of the containment structure are consistent with historical data and show no changing trends.

Groundwater and surface water south of the containment structure generally show increasing trends in COC concentrations and specific conductance during the current monitoring period. The apparent change in shallow groundwater and surface water quality in the South Ditch is attributed to a shift in the location of the stream-capture divide between the Ephemeral Ditch and the South Ditch, as shown using groundwater modeling results, rather than being the result of leakage or failure of the containment structure.

Groundwater discharge rates from the containment structure and through the equalization window were calculated on the basis of the minimum, maximum, and average horizontal hydraulic gradients from several different well pairs. Discharge rates averaged on a monthly basis were calculated to be between 0.002 and 0.026 gallons per minute during the current monitoring period, and are consistent with the range of discharge rates estimated for previous times. Solute mass flux through the equalization window was calculated on the basis of the combined concentrations of key COCs (ammonia, chloride, sulfate, and dissolved chromium) measured in a monitoring well located within the equalization window (GW-CA1). Solute mass fluxes based on average hydraulic gradients were calculated to range from approximately 0.005 to 0.08 pound per day (lb/d) during the current monitoring period. (Solute mass flux estimates for previous times have ranged between 0 and 0.6 lb/d.)

Selected wells were instrumented with dataloggers in December 2001 to collect water level, specific conductance, and pH data. Previous PCMP data analyses examined groundwater elevations recorded by the dataloggers in relation to daily precipitation measurements to identify differences between responses within the containment structure and equalization window and in the area immediately outside of the containment structure. For the current monitoring period, responses and relationships recorded by the dataloggers continued to be

consistent with those observed during previous times. The water-level behaviors continued to show that:

- there is minor leakage through the temporary cap,
- groundwater flow through the equalization window is almost always directed outward from the containment area to the OPWD, and
- the slurry wall and temporary cap are providing effective hydraulic containment.

Statistical methods recommended by the U.S. Environmental Protection Agency and others were used to quantitatively analyze groundwater-quality data to substantiate the reduction in groundwater-quality sampling frequency (from quarterly to semiannually) proposed in PCMP Status Report #7. Based upon the results of the statistical evaluation, the general behavior of COC concentrations at six of the ten PCMP groundwater-quality monitoring locations considered in this report is described as "stable/improving," while the behavior at three locations is described as "unstable/not improving." (The remaining location is uncategorized because of the uncertainties associated with a small dataset.) Those locations showing generally stable/improving conditions are mostly located west and north of the containment structure, while those locations showing generally unstable/not improving conditions are typically located south of the containment structure (consistent with the findings of the routine PCMP data analysis).

Based on the current understanding of water quality conditions in the PCMP area-of-interest derived from routine data analyses and the focused statistical evaluation, it is recommended that quarterly sampling be continued at the three PCMP groundwater monitoring locations currently showing unstable/not improving conditions. Meanwhile, the sampling frequency at the remaining PCMP groundwater monitoring locations can be reduced from quarterly to semiannually without compromising the integrity or effectiveness of the PCMP monitoring program.

Table of Contents

Table of Contents

1 Introduction 1

2 Groundwater Elevations and Hydraulic Gradients 3

2.1 Groundwater Elevations and Horizontal Gradients 3

2.2 Vertical Gradients 4

3 Groundwater and Surface Water Quality Data 6

3.1 North and West of Containment Area 6

3.2 South of Containment Area 7

4 Groundwater and Solute Mass Flux Through Equalization Window 9

5 Datalogger Measurements 11

5.1 Relationship of Groundwater Elevations to Precipitation 11

5.2 Relationships of Specific Conductance and pH to COC Concentration 12

6 Statistical Evaluation 13

6.1 Overview of Methods 13

6.2 Assessing Deviations 14

6.3 Assessing Temporal Trends 16

6.4 Results of the Statistical Tests 17

6.5 Implications for Proposed Reduction in PCMP Groundwater Sampling Frequency 19

7 Conclusions 20

8 References 22

Appendix A: Shewhart/CUSUM Control Charts

List of Tables

1. Wells Used for PCMP Analyses
2. Vertical Gradients in Deep/Shallow PCMP Well Pairs
3. Summary of Historical and Current Water Quality Data
4. Horizontal Gradients in Vicinity of Equalization Window
5. Groundwater and Chemical Mass Fluxes Through Equalization Window
6. Results of the Shewhart/CUSUM Control Chart Tests
7. Results of the Kendall Tests for Trend

List of Figures

1. Post-Construction Monitoring Plan (PCMP) location map.
2. Water levels for PCMP wells on August 11, 2003.
3. Water levels for PCMP wells on October 9, 2003.
4. Water levels for PCMP wells on February 2, 2004.
5. Groundwater elevations vs. time north of containment structure.
6. Groundwater elevations vs. time west of containment structure.
7. Groundwater elevations vs. time south of containment structure.
8. Groundwater elevations vs. time inside containment structure – historical.
9. Groundwater elevations vs. time inside containment structure – recent.
10. Groundwater elevations vs. time in equalization window.
11. Vertical gradient in groundwater wells GW-6D & -6S.
12. Vertical gradient in groundwater wells GW-29D & -29S.
13. Vertical gradient in groundwater wells GW-34D & -34S/34Sr.
14. Vertical gradient in groundwater wells GW-202D & -202S.
15. Vertical gradient in groundwater wells GW-55D & -55S.
16. Vertical gradient in groundwater wells GW-35D & -35S.
17. Vertical gradient in groundwater wells GW-CA3D & -CA3S.
18. Ammonia in groundwater north and west of containment structure.
19. Chloride in groundwater north and west of containment structure.
20. Sulfate in groundwater north and west of containment structure.
21. Dissolved chromium in groundwater north and west of containment structure.
22. Specific conductance in groundwater north and west of containment structure.
23. pH in groundwater west of containment structure.
24. Ammonia in groundwater and surface water south of containment structure.
25. Chloride in groundwater and surface water south of containment structure.
26. Sulfate in groundwater and surface water south of containment structure.
27. Dissolved chromium in groundwater and surface water south of containment structure.
28. Specific conductance in groundwater and surface water south of containment structure.
29. pH in groundwater and surface water south of containment structure.
30. Simulated flow paths in South Ditch prior to construction (April 1999).

31. Simulated flow paths in South Ditch post-construction (April 2003).
32. Precipitation and water levels at instrumented wells.
33. Specific conductance and combined COCs at GW-CA1.
34. Specific conductance and combined COCs at GW-78S.
35. Specific conductance and combined COCs at GW-79S.
36. pH and combined COCs at GW-CA1.
37. pH and combined COCs at GW-78S.
38. pH and combined COCs at GW-79S.

Text

1 Introduction

This report describes Geomega's analysis of Post-Construction Monitoring Plan (PCMP) data for the 51 Eames Street Property (the "Property") in Wilmington, MA, during the time period July 2003 through March 2004. The objectives of the analysis were to:

- determine whether the containment structure (slurry wall and temporary cap) continues to act as an effective hydrologic barrier to the flow of on-property dense, aqueous-phase liquid (DAPL) and its associated "diffuse-zone" groundwater,
- evaluate whether or not there were any changes since June 2003 in solute concentrations in groundwater in the vicinity of the containment structure and in surface water in the South Ditch, and
- calculate the groundwater and solute mass flux from the containment area for comparison with estimated quantities used in the Focused Feasibility Study (GEI 2000a).

The analysis involved:

- evaluation of groundwater elevations and hydraulic gradients in and around the containment structure,
- examination of analytical results for key chemicals of concern (COCs) and physical parameters in surface water and in selected monitoring wells near the containment structure,
- computation of groundwater and solute mass fluxes through the equalization window at the top of the containment structure,
- comparison of the responses of water levels measured by dataloggers in the equalization window and in nearby wells inside and outside of the containment structure to daily precipitation data, and
- continued assessment of the potential relationships between combined COC concentrations (sum of ammonia, chloride, sulfate, and chromium concentrations) in groundwater samples and datalogger measurements of groundwater pH and specific conductance.

In addition, a statistical evaluation was performed to substantiate the proposed reduction in groundwater-quality sampling frequency (from quarterly to semiannually)

recommended in PCMP Status Report #7 (GEI 2004). The statistical evaluation was requested by the Massachusetts Department of Environmental Protection (MADEP) in a letter to Olin Corporation (Olin) dated June 8, 2004.

Figure 1 shows the locations of monitoring wells and surface water sampling points considered in this report, and the various elements for which the wells and surface water sampling points were used are indicated on Table 1. The sampling points used in this analysis are a subset of all of the PCMP sampling locations/media, which now include additional monitoring points besides those initially approved for the PCMP.[1] The sampling points considered in this report (herein referred to as the "PCMP monitoring points") are concentrated on the containment area and upper (remediated) portion of the South Ditch, and constitute the same subset of points that has been used in previous PCMP data analyses (Geomega 2002a, 2002b, 2003a, 2003b).

Detailed information on the installation and construction of the containment structure and temporary cap are presented in RAM Status Reports No. 1 and No. 2 (GEI 2000b, 2001). Temporary cap inspection reports are presented in subsequent RAM Status Reports (GEI 2002a, 2002c, 2003a, 2003b, 2004).

[1] Additional monitoring points have been added to the PCMP in recent years as a result of consolidating other similar and overlapping monitoring programs (e.g., South Ditch Weir and Off-Property West Ditch Study Area). The MADEP's approvals of the initial PCMP scope and subsequent revisions to the PCMP are catalogued in GEI (2004, Section 5.1), which also lists all of the current PCMP locations by media type (Table 1).

2 Groundwater Elevations and Hydraulic Gradients

2.1 Groundwater Elevations and Horizontal Gradients

Contours of shallow groundwater elevation based on quarterly monitoring data (Figures 2, 3, and 4) show that during the current monitoring period (July 2003 to March 2004) the water table surface was about 6 to 8 feet higher near GW-54S in the northwestern part of the Property than it was at GW-50S, in the southeastern part of the Property. The same general difference in groundwater elevations was observed in previous years. The recorded range of head differences corresponds to a horizontal hydraulic gradient of approximately 0.005 ft/ft, with flow directed from northwest to southeast across the Property. In contrast, the horizontal hydraulic gradient across the containment area remained essentially flat during the current monitoring period, as it has been since 2001.

The low horizontal gradients observed within the containment structure are the result of minor infiltration of precipitation through the temporary cap, which typically causes shallow groundwater flow out of the equalization window toward the Off-Property West Ditch (OPWD). The consistently low horizontal gradient within the containment structure indicates that there is virtually no movement of groundwater (or DAPL) within the containment area. Water level response within the containment structure is evaluated further using datalogger measurements compared to precipitation, as discussed below (Section 5.1).

Groundwater and surface water elevations measured during the current monitoring period are posted on Figures 2, 3, and 4. There were a few instances of suspected erroneous water levels during this period, including GW-76S and GW-202D sampled on 8/11/03, GW-25 sampled on 10/9/03, and GW-30DR sampled 2/2/04. Not only are these water levels substantially different from nearby water levels, they are also inconsistent with historical water level behaviors at those wells.

Ignoring the suspected erroneous data points, groundwater elevations to the north (upgradient), west, and south (downgradient) of the containment area (Figures 5 through 7, respectively) continued to fluctuate within historical limits during the current monitoring period. Meanwhile, groundwater elevations within the containment structure (Figure 8) fluctuated only minimally relative to groundwater elevations outside of the containment area (excluding the suspected erroneous measurement at GW-30DR). Figure 9 shows that there has been little variability in groundwater elevations within the containment structure since the temporary cap was completed, and what little variability there was initially after the cap was installed has since decayed. The current monitoring period shows all water levels inside the containment structure to be within 0.2 to 0.3 feet of each other and tracking consistently (Figure 9). The two monitoring wells located within the equalization window (GW-CA1 and GW-CA2) also continue to show virtually identical water levels throughout their period of record (Figure 10).

2.2 Vertical Gradients

Groundwater elevation measurements in well couplet GW-6D/6S, located north (upgradient) of the containment structure, continued to show strong downward vertical gradients during the current monitoring period (Figure 11). Well couplet GW-29D/29S shows a generally near-zero vertical gradient in recent sampling events, which is different from the strong downward vertical gradient measured prior to construction of the temporary cap (Figure 12). Historically, well couplet GW-34D/34S also demonstrated a consistently downward vertical gradient (Figure 13), although not as strong as at the GW-6 and GW-29 well pairs. The first measurement from replacement well GW-34SR (in December 2001) suggested a change from a downward vertical gradient to an upward gradient; however, subsequent measurements indicated a change to a near-zero vertical gradient, which persisted with the most recent data (Figure 13). Well couplet GW-202D/202S, located near the southwest corner of the containment area and the South Ditch weir, has shown near-zero upward and downward vertical gradients, with the exception of the suspected erroneous data point at GW-202D on 8/11/03 (Figure 14). Well couplet GW-55D/55S, located south (downgradient) of the containment structure,

has historically fluctuated between upward and downward vertical gradients (Figure 15); however, since construction of the containment area, small downward gradients are more typical.

In contrast to the fluctuating and generally upward or downward vertical gradients observed to the north and south of the containment structure, vertical gradients in well couplet GW-35D/35S within the containment structure have been dampened substantially and have remained near zero since the temporary cap was completed in April 2001 (Figure 16). (Note that the strong upward gradient shown on 5/20/02 reflects the use of a suspected erroneous data point for GW-35D, and therefore is considered to be invalid.) Elsewhere within the containment area, well couplet GW-CA3D/CA3S has shown little variability and essentially zero vertical gradient throughout its period of record (Figure 17).

A summary of the vertical gradients observed through time in well pairs proximal to the containment area is presented on Table 2.

3 Groundwater and Surface Water Quality Data

3.1 North and West of Containment Area

Shallow groundwater quality in the areas immediately north and west of the containment structure remained within historical limits during the current monitoring period. In light of the most recent data, slightly improving trends in water quality are discernable at monitoring locations on the west side of the containment structure (Figures 18 through 23). The improvement in water quality west of the containment structure is supported by a comparison of average, maximum, and minimum values for historical (February 1996 through June 2003) and recent (July 2003 through March 2004) time periods; average ammonia, chloride, and sulfate concentrations west of the containment structure show a decrease of 25% to 45% in the current monitoring period, and specific conductance has decreased by 30%, compared to average levels between February 1996 and June 2003 (Table 3). Although average chromium concentrations in groundwater west of the containment structure are the same in historical and recent time periods, the maximum observed chromium concentration has decreased from 1.3 mg/L (measured 1/19/00 at GW-34D) to 0.01 mg/L (measured 2/12/04 at GW-25). In general, data from the current monitoring period show a decrease in maximum COC concentration compared to prior years (Table 3).

COC concentrations inside the equalization window (i.e., at GW-CA1) are consistent with historical data and exhibit no apparent trends. Groundwater quality at GW-34SR and GW-34D, north of the containment structure, is also within historical limits; however, a slight decreasing trend in sulfate and chloride can be seen in both the shallow and deep wells (Figure 18 to 23).

The pH levels in groundwater wells north and west of the containment area are consistent with historical data and show no changing trends (Figure 23). The average pH level (6.2) of the PCMP wells north and west of the containment area was the same over the current monitoring period as it was during the historical period of record (Table 3).

3.2 South of Containment Area

On average, PCMP groundwater monitoring locations south of the containment structure show increasing concentrations of COCs when the most recent data are considered (Table 3). Specifically, ammonia, chloride, and sulfate concentrations and specific conductance (Figures 24, 25, 26, and 28, respectively) appear to be rising at groundwater wells GW-202S and GW-79S. Meanwhile, at GW-78S, a relatively high concentration of dissolved chromium (Figure 27) was observed in groundwater during the most recent sampling round, although ammonia, chloride, and sulfate concentrations and specific conductance at GW-78S remained within historical limits with showed no apparent trends.

Surface water quality was variable along the South Ditch during the current monitoring period. At ISCO1 and ISCO2, which are located at the extreme upstream and downstream ends of the South Ditch, respectively, observed fluctuations in the recent data are, for the most part, consistent with historical observations and do not suggest changing water-quality conditions. However, ammonia, chloride, chromium, and sulfate concentrations and specific conductance (Figures 24, 25, 26, 27, and 28, respectively) appear to be rising in South Ditch surface water at SD-17, which is located below the weir approximately 200 feet downstream of ISCO1.

The pH of both groundwater and surface water south of the containment structure has remained fairly stable and within historical limits (Figure 29); the average pH over the current monitoring period was 6.3, which is comparable to the historical average value of 6.1 (Table 3).

The apparent change in water quality in the vicinity of the South Ditch may be attributed to a shift in the pattern of groundwater discharge to the South Ditch and the Ephemeral Ditch. Specifically, the location of the stream-capture divide between the two ditches appears to have shifted northward since the containment structure and new weir have

been in place, as evidenced by groundwater flow model particle tracking results[2] (cf. Figures 30 and 31). Installation of the containment structure and new weir have resulted in generally higher groundwater levels in the vicinity of the South Ditch/OPWD confluence than those that were maintained by the former weir.[3] As a result, lower concentration groundwater from the area of GW-39 and GW-77S, which previously discharged into the South Ditch (Figure 30) and provided dilution with relatively cleaner (i.e., less concentrated) water, is now deflected and captured by the Ephemeral Ditch instead (Figure 31). Consequently, COC concentrations are inferred to be generally increasing in the vicinity of the South Ditch because there is now less dilution by cleaner groundwater, which resulted from a change in subsurface/surface hydraulic conditions associated with the containment structure and new weir.

In any event, COC concentrations south of the containment area are still generally lower than those observed prior to remediation (cf. Figures 24 through 29). Thus, completion of the containment wall and other on-property remedial activities continue to have a beneficial impact on water-quality conditions in the PCMP area-of-interest.

[2] The recently updated Olin Site groundwater flow model (Geomega 2003c) was utilized to perform forward particle tracking in the South Ditch area for simulated flow conditions in April 1999 (pre-construction period) and April 2003 (post-construction).
[3] The former weir was in a state of disrepair and had been compromised prior to remediation in 2000-01.

4 Groundwater and Solute Mass Flux Through Equalization Window

The groundwater discharge flow rate through the equalization window was calculated from Darcy's law by using locally observed horizontal hydraulic gradients, the known cross-sectional flow area of the window, and an estimated hydraulic conductivity value of 28 ft/d (GEI 2001) for natural soils upgradient and downgradient of the window. Horizontal hydraulic gradients have been calculated from monthly water level measurements collected between March 2001 and February 2004 (Table 4).

Groundwater discharge rates through the equalization window were calculated on the basis of the minimum, maximum, and average horizontal hydraulic gradients from several different well pairs (Tables 4 and 5). Discharge rates averaged on a monthly basis were calculated to be between 0.002 and 0.026 gallons per minute (gpm) during the current monitoring period. Although groundwater flow typically is directed from the containment structure out through the equalization window and toward the OPWD (see Section 5.1 below), there are periods when computed horizontal gradients based on the available well pairs suggest that the flow direction might be reversed (i.e., the negative gradients shown on Table 4). For those time periods and well pairs, the minimum gradient across the equalization window was assigned a value of zero for the purpose of calculating mass flux out of the containment structure. The most recent calculations of discharge for the July 2003 to March 2004 time period are consistent with the range of discharge rates estimated for previous times (Table 5).

Solute mass flux through the equalization window was calculated on the basis of the combined concentrations of key COCs (ammonia, chloride, sulfate, and dissolved chromium) measured in monitoring well GW-CA1, which is located within the window. This "total" concentration was then multiplied by the previously determined groundwater discharge rate for the month corresponding to sample collection to calculate the solute mass flux from the containment structure.

Monthly averaged solute mass fluxes through the equalization window were calculated to range from approximately 0.005 to 0.08 pound per day (lb/d) during the current monitoring period (Table 5). The lowest average value during the current monitoring period is below the previously reported range of average values (0.01 to 0.2 lb/d), while the highest average value during the current monitoring period is within the historical range.

Overall, the calculated solute mass fluxes through the equalization window are substantially less than the combined solute flux of key COCs (~5.3 lb/d) that was previously predicted by Geomega (2000) and conservatively used in the Focused Feasibility Study (GEI 2000a). The difference is partly due to the current groundwater discharge rates, which are lower than formerly assumed, and because the previous calculation of solute fluxes conservatively assumed that loading from the overlying soil column (solute leaching from infiltration of precipitation) does not diminish with time.

5 Datalogger Measurements

Five wells were instrumented with dataloggers in December 2001 to collect water level, specific conductance, and pH data. Originally, sensors were installed in GW-10S (located outside and north of the equalization window), GW-78S and GW-79S (located south of the containment structure along the South Ditch), GW-CA1 (within the equalization window), and GW-35S (within the containment structure). Water levels were measured in all of the instrumented wells, while wells GW-78S, GW-79S, and GW-CA1 were also used to measure pH and specific conductance up until 9/3/2003.[4] Over the years the dataloggers have been moved around to accommodate different observational needs. During the current reporting period, dataloggers were deployed in wells GW-35S, GW-76S, GW-78S, and GW-CA1.

The datalogger water level measurements are considered to be more reliable for determining groundwater flow directions than horizontal gradients computed on the basis of periodic, but infrequent, water level measurements in well pairs spanning the equalization window area.

5.1 Relationship of Groundwater Elevations to Precipitation

Previous PCMP data analyses have examined groundwater elevations recorded by the dataloggers in relation to daily precipitation measurements to identify differences between responses within the containment structure and in the area immediately outside of the containment structure. Because the results of those analyses are documented elsewhere (Geomega 2002b and 2003a), they are not reiterated here. Instead, we note that responses and relationships recorded during the current monitoring period continued to be consistent with those observed over the previous three years (Figure 32).[5]

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[4] During the current monitoring period (and henceforth) the dataloggers are only being used to monitor water levels.

[5] Interestingly, the greatest daily rainfall total recorded since December 2001 (5 inches measured on 4/1/04) appears to have caused only a very minor and brief change in the direction of the hydraulic gradient in the containment area (Figure 32; water level at GW-CA1 temporarily rises above the water level at GW-35S immediately following the event).

In summary, the water level behaviors recorded by the dataloggers continued to show that:

- there is minor leakage through the temporary cap,
- groundwater flow through the equalization window is almost always directed outward from the containment area to the OPWD, and
- the slurry wall and temporary cap are providing effective hydraulic containment.

5.2 Relationships of Specific Conductance and pH to COC Concentration

Previous PCMP data analyses also compared available measurements of specific conductance and pH from datalogger-instrumented wells with analytical results from periodic sampling events to assess the possibility and reliability of using datalogger measurements to monitor shorter timeframe variations in groundwater quality. Again, the details of those analyses, including a discussion of anomalous behaviors, are documented elsewhere (Geomega 2002b and 2003a) and, therefore, are not repeated here. In summary, a reasonably good correlation was found to exist between the combined COC concentrations and specific conductance data from the instrumented wells (Figures 33 to 35). However, the relationship between COC concentrations and pH was not as favorable (Figures 36 to 38). Thus, specific conductance appears to be more useful than pH as an indicator of groundwater quality.

6 Statistical Evaluation

In PCMP Status Report #7, Olin proposed to decrease the frequency of all PCMP groundwater quality sampling from quarterly to semiannually (GEI 2004).[6] The MADEP responded to that proposal with a request for additional information to determine if a reduction in groundwater sampling frequency is warranted (MADEP 2004). Specifically, MADEP stipulated that a "statistical analysis" be performed and submitted to justify the proposed reduction in sampling frequency. The following statistical evaluation provides the additional specific information that MADEP requested.

6.1 Overview of Methods

The statistical methods used in this analysis are the same as those applied in the annual "Western Bedrock Valley Statistical Report" (e.g., Geomega 2004). For completeness, and to facilitate understanding of the results of the present analysis, descriptions of the individual statistical tests are provided below.

Briefly, a series of routine tests were applied to determine whether statistically significant changes have occurred in the observed concentration data:

1. At each groundwater monitoring location and for every monitored parameter considered in this report, recent data were compared to historical background concentrations from that location by using a combination of Shewhart/CUSUM control charts. Data from 3rd Quarter 2001 (immediately post-construction) through 4th Quarter 2002 were used as the historical background. If the background period data exhibited a significant trend, the trend was removed prior to calculating the background statistics. This method was used both as an initial screen for outliers and as an indicator of trend.

2. The Kendall test for trend (Gilbert 1987; Gibbons 1994) was applied at each groundwater monitoring location considered in this report to test for significant

changes over time in every parameter. The results of the trend tests were considered along with the results of the Shewhart/CUSUM control chart tests to identify any statistically significant changes that might be occurring.

These methods have been recommended to quantitatively analyze the results of long-term groundwater monitoring programs and to determine if evolving groundwater quality meets or exceeds numerical standards or risk-based criteria (Gibbons 1994; Starks 1989; USEPA 1989, 1992).

6.2 Assessing Deviations

The use of Shewhart and CUSUM quality control charts for intrawell statistical comparisons has been recommended by both the U.S. Environmental Protection Agency (USEPA 1992) and others (Starks 1989; Gibbons 1994). This suite of tests is applicable when there is a background period of record with no impacts at the well. If there are indications of impacts (i.e., changing concentrations) during the background period, the trends can be removed prior to calculating the background statistics, and the tests will remain sensitive to any continuing trends.

When used in conjunction with each other, the Shewhart and CUSUM charts represent a statistically robust tool to determine whether PCMP solute concentrations are increasing or decreasing, either on a short-term or long-term basis. The tool works best when both charts are used together because there are instances when the CUSUM chart will not provide an accurate depiction of data trends, while on other occasions the Shewhart chart will not provide the sensitivity required to depict a true shift in the mean.

6.2.1 Shewhart Chart Method

The Shewhart Control Chart compares the analytical results relative to the background mean and is very sensitive to sudden changes in parameter concentration. An Upper Control Limit (UPCL) and a Lower Control Limit (LCL) were calculated from

[6] Note that a reduction in sampling frequency was only proposed for groundwater monitoring locations, and did not include surface water locations.

$$UPCL = x + Zs \tag{1}$$

and

$$LCL = x - Zs \tag{2}$$

where x is the background mean, s is the background standard deviation, and Z is used to establish the upper and lower percentage points of the normal distribution. If a trend was observed in the background data, the trend was removed and the standard deviation calculated using the residuals, which removes the bias in the standard deviation produced by the trend (Gibbons 1994).

For groundwater monitoring programs with small background populations, setting $Z = 4.5$ results in a 95% confidence limit, as established by statistical power analyses based on Monte Carlo simulations for multiple comparisons (Starks 1989; USEPA 1992; Gibbons 1994). After the control limits are established, results for each sampling event are plotted sequentially so that variations in results relative to the background mean are apparent, as are any exceedances of the control limits.

6.2.2 CUSUM Chart Method

The CUSUM Chart tracks gradual changes in parameter concentration relative to background conditions. Background-normalized data are used to calculate changes in concentration relative to the background mean. The differences are summed at each event and plotted relative to the mean, the Upper Decision Boundary (UDB), and the Lower Decision Boundary (LDB). The UDB and LDB are set at $\pm 4.5s$, respectively. The Upper and Lower Cumulative Sums are calculated from

$$U_i = \max[0, (z_i - k) + U_{i-1}] \tag{3}$$

and

$$L_i = \max[0, (-z_i - k) + L_{i-1}], \tag{4}$$

respectively, where $z_i = (r_i - x)/s$, r_i is the current sample value and k is selected to be one-half the size of a difference worth detecting. A value of $k = 1$ is recommended for groundwater monitoring applications (USEPA 1989). The CUSUM chart accumulates changes in concentration relative to the background mean in standard deviation units. For example, if a concentration is 1.5 standard deviations above the background mean, the CUSUM value for that result will show an increase of 1.5 from the previous value. As with the Shewhart Chart, if a trend existed in the background data, it was removed before calculating the standard deviation.

For each constituent, the CUSUM chart is split, showing both the Upper Sum and the Lower Sum. In most detection monitoring programs, only the Upper Sum is displayed. However, for this analysis it is important to monitor both Upper and Lower Sums to check for either an increase or a decrease in solute concentration.

6.2.3 Control Chart Decision Criteria

In normal use, a control chart "exceedance" has occurred if the data displayed in either the Shewhart or CUSUM charts are above the allowable limits (the UPCL or UDB, respectively). Shewhart chart exceedances occur when there are sudden changes in the data. Hence, this test can be used to screen for outliers. Meanwhile, a data trend can occur that does not trigger a Shewhart chart exceedance. The CUSUM chart, by accumulating small changes in concentrations relative to the background mean, is very sensitive to gradual changes that may not be apparent in a simple time series plot. Thus, a CUSUM chart exceedance signifies the detection of a trend that is not due to isolated outlier data.

6.3 Assessing Temporal Trends

The Kendall test is used to evaluate the statistical significance of temporal trends. It is a nonparametric test based on ranking of a set of variables. One advantage of this method is that the test is not adversely affected by missing data or irregular sampling intervals (Gilbert 1987).

The Kendall test is based on the sum of the signs of the differences among all of the values in the data being tested. For this evaluation, the test was performed by using the function "kendall.trend.test" in *EnvironmentalStats for S-Plus* (Millard 1998), which computes the Z-statistic and p-value. A high positive or negative value for Z indicates a positive or negative trend (a Z value of ± 1.64 indicates significance). The p-value indicates whether the slope of the trend is significant, with $p<0.05$ corresponding to a significant slope.

6.4 Results of the Statistical Tests

6.4.1 Shewhart/CUSUM Charts

The combined Shewhart/CUSUM control charts for all parameters (ammonia, chloride, dissolved chromium, specific conductance, sulfate, and pH) at the PCMP monitoring locations[7] are provided in Appendix A. The background means, standard deviations, and statistical test results are summarized on Table 6. Of the 60 tests performed (six parameters at 10 locations), 8 resulted in CUSUM-only exceedances (3 of which indicated declining trends; i.e., an exceedance of the LDB) and 7 produced both Shewhart and CUSUM exceedances. There were both Shewhart and CUSUM exceedances for three of the six parameters at GW-202S. There were two monitoring locations (GW-10S and GW-34D) with either no exceedances or only exceedances associated with declining trends.

6.4.2 Kendall Tests for Trend

Of the 60 temporal-trend tests performed for the entire post-construction period-of-record (3rd Quarter 2001 through 1st Quarter 2004), 10 (17%) had significant increasing trends and 8 tests (13%) had significant decreasing trends (Table 7). Five of the ten groundwater monitoring locations (GW-10S, GW-34D, GW-34SR, GW-78S, and GW-CA1) showed either no trends or only decreasing trends for all six parameters.

[7] Note that location GW-CA2 had insufficient background and recent data to perform the statistical tests. Hence, there are no control charts for that monitoring point. Also, location GW-76S has a limited number of background data points (3 or 4) and only 1 or 2 new data points. Thus, the tests for this location are less reliable than for other locations and their results should be interpreted accordingly.

6.4.3 Summary

Based upon the results of the statistical evaluation described above (and listed on Tables 6 and 7), the general behavior of COC concentrations in groundwater at the PCMP monitoring locations can be generally described as either "stable/improving" or "unstable/not improving."[8] Those locations showing generally stable/improving conditions include:

- GW-10S – no control chart exceedances, and a statistically significant decreasing trend for ammonia;
- GW-24 – only a CUSUM control chart exceedance for chloride, and no statistically significant trends for any parameter;
- GW-34D – CUSUM LDB exceedances (indicates declining trend) for chloride, specific conductance, and sulfate, and statistically significant decreasing trends for specific conductance and sulfate;
- GW-34SR – CUSUM LDB (declining-trend) exceedance for chloride, and statistically significant decreasing trends for chloride, specific conductance, and sulfate;
- GW-78S – control chart exceedances for dissolved chromium (only), and no statistically significant trends for any parameter;
- GW-CA1 – only a CUSUM exceedance for ammonia, and a statistically significant decreasing trend for specific conductance.

Those locations showing generally unstable/not improving conditions include:

- GW-25 – control chart exceedances for both dissolved chromium and pH (declining), and statistically significant increasing trends for chloride and dissolved chromium, and decreasing trend for pH;
- GW-202S – control chart exceedances for ammonia, chloride, specific conductance, and sulfate, and statistically significant increasing trends for specific conductance and sulfate;
- GW-79S –a CUSUM control chart exceedance for specific conductance, and statistically significant increasing trends for ammonia, specific conductance, and sulfate;

[8] GW-76S cannot be categorized as either stable/improving or deteriorating based on results of the statistical evaluation (CUSUM exceedance for ammonia and statistically significant increasing trends for dissolved chromium and specific conductance) because of the uncertainty in those results due to the limited data set available for that location.

In general, these results agree with the previously stated observation that groundwater quality conditions are improving in the area west of the containment structure, while at the same time COC concentrations appear to be rising at monitoring locations south of the containment area. (The exceptions to this are GW-25, which is exhibiting unstable/not improving conditions according to the statistical evaluation even though it is located west of the containment structure, and GW-78S, which is showing relatively stable conditions while being located south of the containment structure.) Thus, the overall picture of groundwater quality conditions that is emerging is supported by the findings of both the routine PCMP data analysis and this statistical evaluation.

6.5 Implications for Proposed Reduction in PCMP Groundwater Sampling Frequency

Slightly declining groundwater and surface water quality conditions in the vicinity of the upper South Ditch are evident in the new data from the current monitoring period. In light of these recent findings, it now appears to be inappropriate to implement a reduction in sampling frequency at all of the PCMP groundwater monitoring locations at this time.

Based on the current understanding of water quality conditions in the PCMP area-of-interest, as discussed above, it is recommended that quarterly sampling be continued at the three PCMP groundwater monitoring locations currently showing deteriorating conditions (GW-25, GW-202S, and GW-79S). The sampling frequency at the six groundwater monitoring locations showing stable/improving conditions (GW-10S, GW-24, GW-34D, GW-34SR, GW-78S, and GW-CA1) and at GW-76S can be reduced from quarterly to semiannually without compromising the integrity or effectiveness of the PCMP monitoring program. Likewise, the remaining PCMP groundwater monitoring locations (GW-26, GW-35S, GW-39, GW-42S, GW-43S, GW-55S, GW-201S, and GW-202D)—for which water quality data have been collected but not analyzed in this or previous reports—should also be sampled semiannually because they are not the primary locations upon which the periodic PCMP data evaluations are based.

7 Conclusions

Based on the data set compiled since March 2001 under the PCMP, and on the observations, analyses, and interpretations described in this and prior reports, it is apparent that:

- The containment structure continues to act as an effective hydrologic barrier to the horizontal and vertical flow of on-Property DAPL-affected groundwater;

- Improving trends in water quality are apparent west of the containment structure. (GW-25 is the only exception to this general pattern.) Ammonia, chloride, sulfate, and specific conductance measured in groundwater wells west of the containment structure show a decrease in average levels of 25% to 45% during the current monitoring period, compared to average conditions between February 1996 and June 2003. The pH of groundwater north and west of the containment area is consistent with historical data and currently shows no systematic change.

- Groundwater and surface water south of the containment structure (with the exception of GW-78S and ISCO1) show increasing trends in COC concentrations for most parameters during the current monitoring period. Average COC concentrations during the current monitoring period are higher than those measured during the historical period of record (February 1996 through June 2003), although the maximum concentrations during the current monitoring period were consistently less than those previously observed. GW-78S and ISCO1 continue to show fluctuating concentrations that are typically within historical limits.

- The recently apparent change in water quality in the vicinity of the South Ditch may be attributed to a shift in the pattern of groundwater discharge to the South Ditch and the Ephemeral Ditch, as evidenced by groundwater flow model particle-tracking results. COC concentrations are inferred to be generally increasing in the vicinity of the South Ditch because a contribution of cleaner groundwater that formerly provided dilution for the upper South Ditch is now captured instead by the Ephemeral Ditch, due to changes in subsurface/surface hydraulic conditions associated with the containment structure and new weir. In any event, COC concentrations south of the containment area are still generally lower than those observed prior to remediation. Thus, completion of the containment wall and other on-property remedial activities continue to have a beneficial impact on water-quality conditions in the PCMP area-of-interest.

- Average monthly solute mass fluxes through the equalization window were calculated to range from approximately 0.005 to 0.08 lb/d during the current monitoring period. The lowest average value during the current monitoring period

is below the previously reported range of average values (0.01 to 0.2 lb/d), while the highest average value during the current monitoring period is within the historical range. Overall, the calculated solute mass fluxes through the equalization window are substantially less than the combined solute flux of key COCs (~5.3 lb/d) that was previously predicted by Geomega (2000) and conservatively used in the Focused Feasibility Study (GEI 2000a).

- A statistical evaluation of PCMP groundwater quality data (requested by MADEP) found that COC concentrations at the PCMP monitoring locations considered in this report could be generally described as either "stable/improving" or "unstable/not improving." Those locations showing generally stable/improving conditions (GW-10S, GW-24, GW-34D, GW-34S, GW-78S, and GW-CA1) are mostly located west and north of the containment structure (with the exception of GW-78S, which is to the south), while those locations showing generally unstable/not improving conditions (GW-25, GW-79S, and GW-202S) are typically located south of the containment structure (with the exception of GW-25, which is to the west).

- Based on the current understanding of water quality conditions in the PCMP area-of-interest, it is recommended that quarterly sampling be continued at the three PCMP groundwater monitoring locations currently showing deteriorating conditions (GW-25, GW-202S, and GW-79S). The sampling frequency at the six groundwater monitoring locations showing stable/improving conditions (GW-10S, GW-24, GW-34D, GW-34SR, GW-78S, and GW-CA1) and at GW-76S can be reduced from quarterly to semiannually without compromising the integrity or effectiveness of the PCMP monitoring program. The remaining PCMP groundwater monitoring locations (GW-26, GW-35S, GW-39, GW-42S, GW-43S, GW-55S, GW-201S, and GW-202D) should also be sampled semiannually instead of quarterly because they are not the primary locations upon which the periodic PCMP data evaluations are based.

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Tables

Table 1. Monitoring Points Used for PCMP Analyses

Well[1]	Groundwater Elevations and Contours	Vertical Gradients	Groundwater and Surface Water Chemistry	Mass Flux Through Window	Equipped with Data Logger
GW-10S	X		X		X[3]
GW-15	X				
GW-17D	X				
GW-17S	X				
GW-201S	X				
GW-202D	X	X			
GW-202S	X	X	X		
GW-24	X		X	X	
GW-25	X		X		
GW-28D	X				
GW-28S	X				
GW-29D	X	X			
GW-29S	X	X			
GW-30DR	X				
GW-32S	X				
GW-34D	X	X	X		
GW-34S		X			
GW-34Sr	X	X	X		
GW-35D	X	X			
GW-35S	X	X		X	X
GW-39	X				
GW-42D	X				
GW-42S	X				
GW-43D	X				
GW-43S	X				
GW-50D	X				
GW-50S	X				
GW-54D	X				
GW-54S	X				
GW-55D	X	X			
GW-55S	X	X			
GW-56D	X				
GW-56S	X				
GW-6D	X	X			
GW-6S	X	X			
GW-76S			X[2]	X	X
GW-77S	X				
GW-78S	X		X		X
GW-79S	X		X		
GW-CA1	X		X		X
GW-CA2	X		X	X	
GW-CA3D	X	X			
GW-CA3S	X	X			
GW-CA4S	X				
GW-LPB-11	X				
ISCO1			X		
ISCO2			X		
PW-2	X				
PZ-16R	X				
PZ-16RSW			X		
PZ-17R	X				
PZ-18R	X				
SD-17			X		

Notes:

[1]Well locations shown on Figure 1.

[2]Periodic monitoring of groundwater chemistry ceased at GW-76S after 8/19/03.

[3]Datalogger reinstalled (removed on 4/17/03) in GW-10S in mid-April 2004.

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
GW-29D & S	59.8	74.9	9/30/91	81.36	81.56	0.0132
			8/14/92	80.30	81.93	0.1079
			9/3/92	80.38	81.71	0.0881
			1/7/93	81.56	83.04	0.0980
			4/21/93	81.69	82.97	0.0848
			4/18/94	81.38	82.68	0.0861
			7/20/94	79.68	80.82	0.0755
			8/30/94	80.16	81.78	0.1073
			9/28/94	81.14	82.76	0.1073
			10/28/94	80.26	81.91	0.1093
			2/1/95	81.18	82.53	0.0894
			5/2/95	80.84	82.14	0.0861
			7/18/95	79.67	80.83	0.0768
			10/9/95	78.80	82.24	0.2278
			1/31/96	81.66	82.95	0.0854
			4/30/96	81.42	82.91	0.0987
			7/29/96	80.72	82.25	0.1013
			10/22/96	82.66	83.12	0.0305
			1/24/97	80.37	82.30	0.1278
			4/22/97	81.67	83.02	0.0894
			9/11/97	77.87	79.76	0.1252
			11/12/97	79.65	82.15	0.1656
			12/4/97	80.55	82.48	0.1278
			2/19/98	82.00	83.19	0.0788
			4/7/98	81.34	82.75	0.0934
			5/13/98	82.21	83.13	0.0609
			8/6/98	80.73	82.08	0.0894
			8/5/99	79.18	80.96	0.1179
			11/4/99	80.91	82.61	0.1126
			1/25/00	80.88	82.80	0.1272
			5/5/00	81.65	82.91	0.0834
			8/9/00	82.73	82.23	-0.0331
			11/7/00	80.77	82.30	0.1013
			2/14/01	80.83	82.31	0.0980
			5/2/01	82.14	82.83	0.0457
			5/4/01	82.08	82.69	0.0404
			6/4/01	81.63	82.26	0.0417
			7/2/01	81.91	82.51	0.0397
			8/6/01	81.47	82.11	0.0424
			8/16/01	81.55	81.94	0.0258
			9/5/01	80.92	81.13	0.0139
			10/1/01	80.58	80.69	0.0073
			10/31/01	81.96	81.47	-0.0325
			11/12/01	80.18	80.68	0.0331
			12/10/01	80.03	81.44	0.0934
			1/7/02	80.9	82.05	0.0762
			2/5/02	81.33	82.32	0.0656
			2/25/02	81.51	82.27	0.0503

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
			3/25/02	81.76	82.31	0.0364
			4/22/02	81.72	82.09	0.0245
			5/20/02	82.58	82.49	-0.0060
			5/5/03	82.3	82.38	0.0053
			8/11/03	81.99	82.02	0.0020
			10/9/03	81.6	81.53	-0.0046
			2/2/04	81.31	81.89	0.0384
GW-34D & S	60.3	73.1	9/30/91	81.32	81.47	0.0117
			8/14/92	80.34	80.41	0.0055
			9/3/92	80.46	80.50	0.0031
			1/7/93	81.63	81.79	0.0125
			4/21/93	81.90	82.10	0.0156
			4/18/94	81.59	81.78	0.0148
			7/20/94	79.89	79.99	0.0078
			8/30/94	80.41	80.56	0.0117
			9/28/94	81.37	81.50	0.0102
			10/28/94	80.47	80.59	0.0094
			2/1/95	81.45	81.50	0.0039
			10/9/95	79.11	79.17	0.0047
			4/30/96	81.63	81.79	0.0125
			4/7/98	81.38	81.51	0.0102
			1/19/00	81.19	81.43	0.0188
GW-34D & Sr		77.8	12/10/01	79.03	78.17	-0.0491
			1/7/02	80.87	81.02	0.0086
			2/5/02	81.78	81.73	-0.0029
			2/25/02	81.77	81.72	-0.0029
			3/25/02	82.14	82.13	-0.0006
			4/22/02	82.14	82.09	-0.0029
			5/20/02	83.18	83.19	0.0006
			8/12/02	80.96	80.87	-0.0051
			11/4/02	80.89	80.88	-0.0006
			2/3/03	81.97	81.93	-0.0023
			5/5/03	82.92	82.87	-0.0029
			8/11/03	82.32	82.3	-0.0011
			10/9/03	81.13	81.13	0.0000
			2/2/04	81.66	81.61	-0.0029
GW-35D & S	52.3	73.1	9/30/91	81.41	81.48	0.0034
			8/14/92	80.46	80.21	-0.0120
			9/3/92	80.64	80.55	-0.0043
			1/7/93	81.72	81.77	0.0024
			4/21/93	81.95	82.15	0.0096
			5/2/95	81.18	81.16	-0.0010
			7/18/95	80.03	79.96	-0.0034
			10/9/95	79.23	78.98	-0.0120
			1/31/96	82.12	82.47	0.0168
			5/1/96	81.70	81.77	0.0034
			7/29/96	81.04	80.92	-0.0058

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
			10/22/96	83.05	83.27	0.0106
			1/24/97	80.71	80.70	-0.0005
			4/22/97	82.09	82.42	0.0159
			9/11/97	78.25	78.42	0.0082
			11/12/97	79.74	79.42	-0.0154
			2/19/98	81.99	82.50	0.0245
			4/7/98	81.32	81.84	0.0250
			5/13/98	82.19	83.04	0.0409
			8/5/98	80.73	81.00	0.0130
			8/5/99	79.22	79.48	0.0125
			11/4/99	80.94	81.42	0.0231
			1/25/00	81.30	81.29	-0.0005
			5/5/00	81.70	82.09	0.0188
			8/9/00	80.87	83.15	0.1096
			11/7/00	82.95	81.02	-0.0928
			3/2/01	81.18	81.22	0.0019
			5/2/01	81.40	80.98	-0.0202
			5/4/01	81.11	81.19	0.0038
			7/2/01	81.12	81.23	0.0053
			8/6/01	80.90	80.95	0.0024
			8/16/01	81.12	81.19	0.0034
			9/5/01	80.33	80.44	0.0053
			10/1/01	80.31	80.34	0.0014
			10/31/01	79.83	80.09	0.0125
			11/12/01	79.86	79.92	0.0029
			12/10/01	78.62	78.79	0.0082
			1/7/02	80.63	80.65	0.0010
			2/5/02	81.14	NA	
			2/25/02	81.05	81.1	0.0024
			3/25/02	81	NA	
			4/22/02	81.11	NA	
			5/20/02	83.85	81.63	-0.1067
			8/12/02	80.14	80.16	0.0010
			11/4/02	80.19	80.21	0.0010
			2/3/03	80.84	81	0.0077
			5/5/03	81.29	81.38	0.0043
			8/11/03	81.15	NA	
			10/9/03	80.42	80.51	0.0043
			2/2/04	80.58	80.56	-0.0010
GW-55D & S	64.7	72.3	9/30/91	79.85	79.95	0.0132
			8/14/92	79.03	78.95	-0.0105
			9/3/92	79.85	78.59	-0.1658
			1/7/93	80.08	79.94	-0.0184
			4/21/93	80.05	79.95	-0.0132
			4/18/94	80.03	79.94	-0.0118
			7/20/94	77.57	77.49	-0.0105
			8/30/94	78.70	78.59	-0.0145
			9/28/94	79.99	79.90	-0.0118

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
			10/28/94	79.25	79.16	-0.0118
			5/2/95	79.84	79.75	-0.0118
			7/18/95	77.82	77.68	-0.0184
			10/9/95	78.81	78.67	-0.0184
			5/1/96	79.98	79.96	-0.0026
			5/21/96	80.15	79.86	-0.0382
			6/3/96	79.76	79.65	-0.0145
			6/18/96	79.06	78.86	-0.0263
			7/29/96	79.68	79.43	-0.0329
			10/22/96	80.11	80.07	-0.0053
			11/12/96	79.96	79.87	-0.0118
			12/3/96	80.14	80.09	-0.0066
			1/7/97	79.99	79.89	-0.0132
			4/16/97	80.01	79.96	-0.0066
			4/23/97	80.02	79.95	-0.0092
			4/30/97	80.07	79.89	-0.0237
			9/11/97	76.73	76.63	-0.0132
			2/19/98	80.26	80.37	0.0145
			4/7/98	80.17	80.06	-0.0145
			5/13/98	80.15	80.23	0.0105
			8/5/98	79.17	79.20	0.0039
			8/5/99	77.33	77.38	0.0066
			11/5/99	80.03	80.02	-0.0013
			1/25/00	79.91	80.00	0.0118
			5/5/00	80.06	80.18	0.0158
			8/9/00	79.21	79.22	0.0013
			11/9/00	79.82	79.83	0.0013
			5/1/01	79.89	79.96	0.0092
			5/4/01	80.12	79.49	-0.0829
			6/4/01	79.89	80.01	0.0158
			8/6/01	79.65	79.62	-0.0039
			8/16/01	78.38	79.75	0.1803
			9/5/01	78.46	78.53	0.0092
			10/1/01	77.81	77.92	0.0145
			11/12/01	77.95	78.11	0.0211
			12/10/01	77.88	78.03	0.0197
			1/7/02	79.53	79.69	0.0211
			2/5/02	80.3	80.51	0.0276
			2/25/02	79.84	80.01	0.0224
			3/25/02	79.91	80.04	0.0171
			4/22/02	79.82	79.96	0.0184
			5/20/02	80.49	80.19	-0.0395
			8/12/02	77.3	77.36	0.0079
			11/4/02	79.1	79.19	0.0118
			2/3/03	80.14	80.25	0.0145
			5/5/03	79.96	80.05	0.0118
			8/11/03	80.59	79.78	-0.1066
			10/9/03	78.27	78.33	0.0079

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
			2/2/04	80.04	80.18	0.0184
GW-6D & S	64.6	76.3	9/30/91	81.66	82.22	0.0479
			8/14/92	80.27	79.87	-0.0342
			9/3/92	80.47	80.98	0.0436
			1/7/93	82.11	82.77	0.0564
			4/21/93	82.32	83.17	0.0726
			4/18/94	82.02	82.92	0.0769
			7/20/94	79.78	80.34	0.0479
			8/30/94	80.36	80.67	0.0265
			9/28/94	81.62	81.80	0.0154
			10/28/94	80.52	80.99	0.0402
			2/1/95	81.66	82.45	0.0675
			10/9/95	79.22	79.60	0.0325
			5/1/96	81.92	82.75	0.0709
			10/22/96	83.51	84.44	0.0795
			4/22/97	82.48	83.79	0.1120
			12/4/97	81.01	81.31	0.0256
			2/19/98	82.49	83.33	0.0718
			4/7/98	81.59	82.50	0.0778
			5/13/98	82.63	83.94	0.1120
			8/6/98	80.55	81.09	0.0462
			8/4/99	79.16	78.64	-0.0444
			11/4/99	81.01	80.56	-0.0385
			1/19/00	81.47	81.87	0.0342
			5/5/00	81.95	81.83	-0.0103
			5/2/01	82.25	83.00	0.0641
			5/4/01	82.05	82.90	0.0726
			5/15/01	81.67	82.44	0.0658
			5/22/01	81.34	82.12	0.0667
			5/29/01	81.07	82.27	0.1026
			6/1/01	81.16	81.87	0.0607
			6/4/01	81.57	81.97	0.0342
			6/11/01	81.16	81.79	0.0538
			6/12/01	81.26	81.80	0.0462
			6/18/01	81.71	81.88	0.0145
			6/20/01	81.73	82.06	0.0282
			6/25/01	81.71	82.10	0.0333
			7/2/01	81.90	82.14	0.0205
			8/6/01	81.28	81.53	0.0214
			8/16/01	81.53	81.82	0.0248
			9/5/01	80.58	81.17	0.0504
			10/1/01	80.16	80.62	0.0393
			11/12/01	79.74	80.09	0.0299
			12/10/01	79.58	79.85	0.0231
			1/7/02	80.57	80.71	0.0120
			2/5/02	81.29	81.45	0.0137
			2/25/02	81.43	81.71	0.0239
			3/25/02	81.75	82.15	0.0342

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
			4/22/02	81.68	82.18	0.0427
			8/12/02	79.91	81.06	0.0983
			11/4/02	80.34	80.66	0.0274
			2/3/03	81.57	82.17	0.0513
			5/5/03	82.31	83.09	0.0667
			8/11/03	81.48	82.06	0.0496
			10/9/03	80.36	80.93	0.0487
			2/2/04	81.1	81.87	0.0658
GW-CA3D & S	72.7	82.5	3/2/01	81.23	81.23	0.0000
			5/2/01	81.33	81.34	0.0010
			5/4/01	81.36	81.00	-0.0367
			5/15/01	81.04	81.03	-0.0010
			5/22/01	80.64	80.63	-0.0010
			5/29/01	80.71	80.71	0.0000
			6/1/01	80.66	80.66	0.0000
			6/4/01	80.90	80.91	0.0010
			6/11/01	80.77	80.77	0.0000
			6/12/01	80.87	80.88	0.0010
			6/18/01	81.03	81.03	0.0000
			6/20/01	81.22	81.21	-0.0010
			6/25/01	81.13	81.13	0.0000
			7/2/01	81.21	81.19	-0.0020
			8/6/01	80.96	79.97	-0.1010
			8/16/01	81.18	81.17	-0.0010
			9/5/01	80.45	80.43	-0.0020
			10/1/01	80.34	80.37	0.0031
			10/31/01	79.88	79.90	0.0020
			11/12/01	79.91	79.90	-0.0010
			12/10/01	78.68	78.68	0.0000
			1/7/02	80.69	80.69	0.0000
			2/5/02	81.85	81.24	-0.0622
			2/25/02	81.06	81.03	-0.0031
			3/25/02	81.1	81.07	-0.0031
			4/22/02	81.41	81.08	-0.0337
			5/20/02	81.89	81.51	-0.0388
			8/12/02	80.34	79.97	-0.0378
			11/4/02	80.24	80.23	-0.0010
			2/3/03	80.94	80.92	-0.0020
			5/5/03	81.46	81.42	-0.0041
			8/11/03	81.21	81.21	0.0000
			10/9/03	80.44	80.32	-0.0122
			2/2/04	80.61	80.65	0.0041
GW-202D & S	67.5	77.2	12/10/01	79.77	79.80	0.0031
			1/7/02	80.40	80.37	-0.0031
			2/5/02	80.62	80.61	-0.0010
			2/25/02	80.55	80.54	-0.0010
			2/26/02	80.55	80.54	-0.0010
			3/25/02	80.89	80.55	-0.0351

Table 2. Vertical Gradients in Deep/Shallow PCMP Well Pairs

Well Pair	Midpoint Elevation of Deep Well Screen[1]	Midpoint Elevation of Shallow Well Screen[1]	Date Sampled	GW Elevation in Deep Well[1]	GW Elevation in Shallow Well[1]	Vertical Gradient[2] (ft/ft)
			4/22/02	80.57	80.57	0.0000
			5/20/02	80.40	81.33	0.0959
			8/12/02	79.68	79.66	-0.0020
			9/9/02	79.30	79.30	0.0000
			11/4/02	79.97	79.88	-0.0092
			2/3/03	80.48	80.49	0.0010
			5/5/03	80.62	80.56	-0.0061
			8/11/03	77.54	80.53	0.3051
			10/9/03	80.17	80.08	-0.0092
			2/2/04	80.28	80.16	-0.0122

Notes:

1) Elevations in feet MSL.

2) Vertical gradient calculated as GW elevation in shallow well minus GW elevation in deep well divided by distance between midpoint elevations of screened intervals.

3) NA = not available

4) [ ] = Suspected erroneous data point.

Table 3. Summary of Historical and Current Water Quality Data

West and North of Containment Structure

		Historical (February 1996 to June 2003)		Current[1] (July 2003 to March 2004)	
Ammonia	Average	41		23	
	Max.	410	GW-34D	87	GW-24
	Min.	0	GW-10S	0	GW-10S
Chloride	Average	30		23	
	Max.	280	GW-34D	70	GW-25
	Min.	2	GW-34SR	2	GW-34SR
Sulfate	Average	203		135	
	Max.	2800	GW-34D	252	GW-25
	Min.	11	GW-10S	29	GW-34SR
Dissolved Chromium	Average	0.01		0.01	
	Max.	1.30	GW-34D	0.01	GW-25
	Min.	0.00	multiple wells	0.00	GW-34SR
Specific Conductance	Average	782		549	
	Max.	5800	GW-10S	1030	GW-CA1
	Min.	59	GW-10S	135	GW-34SR
pH	Average	6.2		6.2	
	Max.	8.0	GW-24	7.4	GW-24
	Min.	3.2	GW-10S	4.6	GW-10S

South of Containment Structure

		Historical (February 1996 to June 2003)		Current[1] (July 2003 to March 2004)	
Ammonia	Average	41		75	
	Max.	301	GW-79S	202	GW-79S
	Min.	0	ISCO1	11	ISCO1
Chloride	Average	93		96	
	Max.	462	GW-79S	284	SD-17
	Min.	10	GW-78S	31	ISCO1
Sulfate	Average	358		614	
	Max.	2110	GW-79S	1630	GW-79S
	Min.	19	ISCO1	11	ISCO1
Dissolved Chromium	Average	0.04		0.17	
	Max.	0.59	GW-79S	1.33	SD-17
	Min.	0.00	multiple wells	0.00	GW-202S
Specific Conductance	Average	1372		2027	
	Max.	5350	GW-79S	7860	GW-79S
	Min.	224	ISCO1	152	ISCO1
pH	Average	6.1		6.3	
	Max.	7.7	GW-79S	6.9	GW-79S
	Min.	4.5	GW-78S	5.1	ISCO1

1. Based on quarterly sampling events on 8/19/03, 11/25/03, and 2/12/04

Table 4. Horizontal Gradients in Vicinity of Equalization Window

	Water Level Elevation (ft)				Hydraulic Gradient[1] (ft/ft)				
Date	GW-24	GW-35S	GW-76S	GW-CA1	24 - 35S	CA1 - 35S	76S - 35S	24 - CA1	76S - CA1
3/14/01	81.05	81.36	81.02	81.2	0.0012	0.0010	0.0012	0.0012	0.0015
4/5/01	81.35	82.14	81.32	81.62	0.0030	0.0032	0.0030	0.0020	0.0024
5/1/01	80.74	80.98	80.89	80.91	0.0009	0.0004	0.0003	0.0014	0.0002
6/4/01	80.51	NA	NA	80.78	NA	NA	NA	0.0025	NA
7/2/01	80.91	81.23	81.03	81.12	0.0012	0.0005	0.0007	0.0019	0.0010
8/6/01	80.63	80.95	79.73	80.8	0.0012	0.0008	0.0045	0.0015	0.0096
9/5/01	80.11	80.44	80.28	80.34	0.0013	0.0006	0.0006	0.0019	0.0005
10/1/01	79.89	80.34	80.06	80.11	0.0017	0.0013	0.0010	0.0019	0.0005
11/12/01	79.82	79.92	79.87	79.9	0.0004	0.0001	0.0002	0.0007	0.0004
12/10/01	79.78	78.79	79.79	78.72	-0.0038	0.0003	-0.0037	-0.0086	-0.0094
1/7/02	80.49	80.65	80.53	80.555	0.0006	0.0006	0.0004	0.0005	0.0002
2/25/02	80.71	81.1	82.01	81.004	0.0015	0.0006	-0.0033	0.0024	-0.0090
3/25/02	80.75	NA	80.91	81.01	NA	NA	NA	0.0021	0.0009
4/22/02	80.78	NA	80.81	80.929	NA	NA	NA	0.0012	0.0011
5/20/02	81.27	81.63	82.04	81.36	0.0014	0.0016	-0.0015	0.0007	-0.0061
8/12/02	79.67	80.16	79.71	79.949	0.0019	0.0012	0.0017	0.0023	0.0021
9/9/02	78.82	NA	78.79	78.97	NA	NA	NA	0.0012	0.0016
11/4/02	79.55	80.21	79.9	79.9	0.0025	0.0018	0.0011	0.0029	0.0000
2/3/03	80.78	81	80.89	81.121	0.0008	-0.0007	0.0004	0.0028	0.0021
5/5/03	80.82	81.38	81.45	81.276	0.0022	0.0006	-0.0003	0.0038	-0.0015
8/11/03	80.79	85.36?[2]	85.80?[2]	80.92	NA	NA	NA	0.0011	NA
10/9/03	79.97	80.51	NA	80.69	0.0021	-0.0010	NA	0.0059	NA
2/2/04	80.52	80.56	80.60	80.58	0.0002	-0.0001	-0.0001	0.0005	-0.0002

Well Pair	Distance Between Wells (ft)
24 - 35S	259.09
35S - CA1	172.10
35S - 76S	272.65
24 - CA1	121.50
CA1 - 76S	112.30

Notes:

[1]Calculated hydraulic gradient is positive for outward flow from the containment area.

[2]Water levels are questionable compared to deep and nearby wells, thus were not used in gradient calculations.

Table 5. Groundwater and Chemical Mass Fluxes Through Equalization Window

Groundwater Flux Calculation:

Date	Horizontal Gradient[1] (ft/ft) Minimum	Maximum	Average	GW-CA1 Water Level (ft)	Height of Water[2] h (ft)	Volumetric Flow Rate[3] (ft^3/d) Minimum	Maximum	Average	(gpm) Minimum	Maximum	Average
3/14/01	0.0010	0.0015	0.0012	81.19	2.69	2.98	4.56	3.67	0.015	0.024	0.019
4/5/01	0.0020	0.0032	0.0027	81.59	3.09	6.84	11.06	9.44	0.036	0.057	0.049
5/1/01	0.0002	0.0014	0.0006	80.91	2.41	0.48	3.78	1.75	0.002	0.020	0.009
6/4/01	0.0025	0.0025	0.0025	80.81	2.31	6.39	6.39	6.39	0.033	0.033	0.033
7/2/01	0.0005	0.0019	0.0011	81.14	2.64	1.55	5.60	3.17	0.008	0.029	0.016
8/6/01	0.0008	0.0096	0.0035	80.81	2.31	2.10	24.88	9.12	0.011	0.129	0.047
9/5/01	0.0005	0.0019	0.0010	80.34	1.84	1.10	3.90	2.01	0.006	0.020	0.010
10/1/01	0.0005	0.0019	0.0013	80.12	1.62	0.97	3.43	2.35	0.005	0.018	0.012
11/12/01	0.0001	0.0007	0.0003	79.91	1.41	0.09	1.17	0.54	0.000	0.006	0.003
12/10/01	0.0000	0.0003	0.0001	78.73	0.23	0.00	0.09	0.02	0.000	0.000	0.000
1/7/02	0.0002	0.0006	0.0005	80.56	2.06	0.51	1.42	1.09	0.003	0.007	0.006
2/25/02	0.0000	0.0024	0.0009	81.31	2.81	0.00	7.62	2.82	0.000	0.040	0.015
3/25/02	0.0009	0.0021	0.0015	81.01	2.51	2.50	6.02	4.26	0.013	0.031	0.022
4/22/02	0.0011	0.0012	0.0011	80.93	2.43	2.88	3.34	3.11	0.015	0.017	0.016
5/20/02	0.0000	0.0016	0.0007	81.36	2.86	0.00	5.03	2.37	0.000	0.026	0.012
8/12/02	0.0012	0.0023	0.0018	79.95	1.45	1.99	3.73	2.98	0.010	0.019	0.015
11/4/02	0.0000	0.0029	0.0017	79.90	1.40	0.00	4.52	2.62	0.000	0.023	0.014
2/3/03	0.0000	0.0028	0.0012	81.12	2.62	0.00	8.24	3.59	0.000	0.043	0.019
5/5/03	0.0000	0.0038	0.0013	81.28	2.78	0.00	11.67	4.05	0.000	0.061	0.021
8/11/03	0.0011	0.0011	0.0011	80.97	2.47	2.94	2.94	2.94	0.015	0.015	0.015
10/9/03	0.0000	0.0059	0.0020	80.69	2.19	0.00	14.54	4.91	0.000	0.075	0.026
2/2/04	0.0000	0.0005	0.0001	80.58	2.08	0.00	1.21	0.31	0.000	0.006	0.002

Chemical Mass Flux Calculation:

Date	GW-CA1 Conc.[4] (mg/l)	Chemical Mass Flux[5] (kg/d) Minimum	Maximum	Average	(lb/d) Minimum	Maximum	Average
5/24/01	338.0	0.0046	0.0362	0.0167	0.0101	0.0797	0.0369
8/14/01	369.0	0.0220	0.2600	0.0953	0.0485	0.5733	0.2101
11/13/01	385.0	0.0010	0.0128	0.0059	0.0022	0.0281	0.0131
2/26/02	376.0	0.0000	0.0811	0.0300	0.0000	0.1788	0.0663
4/22/02	328.0	0.0268	0.0310	0.0289	0.0590	0.0683	0.0637
5/21/02	258.9	0.0000	0.0368	0.0174	0.0000	0.0813	0.0383
8/14/02	195.3	0.0110	0.0206	0.0165	0.0243	0.0455	0.0364
11/5/02	371.1	0.0000	0.0475	0.0276	0.0000	0.1047	0.0608
2/6/03	340.2	0.0000	0.0794	0.0346	0.0000	0.1750	0.0763
5/13/03	345.8	0.0000	0.1143	0.0397	0.0000	0.2520	0.0875
8/19/03	287.3	0.0239	0.0239	0.0239	0.0527	0.0527	0.0527
12/1/03	266.1	0.0000	0.1095	0.0370	0.0000	0.2415	0.0816
2/11/04	261.0	0.0000	0.0089	0.0023	0.0000	0.0197	0.0051

Notes:

[1] Horizontal gradient range and average calculated from values listed on Table 3. Minimum gradients that were negative (implying inward-directed flow) were assigned a value of zero for the purpose of calculating mass flux out of the window.

[2] Height of water (h) calculated as GW-CA1 water level minus elevation of base of window (78.5 ft).

[3] Volumetric flow rate Q calculated from Q = KAj (Darcy's Law), where
K = hydraulic conductivity (assumed to be 28 ft/d for natural soils upgradient and downgradient of window),
A = cross-sectional area of flow = width of window (40 ft) times height of water above base of window (h), and
j = horizontal hydraulic gradient.

[4] GW-CA1 concentration calculated as sum of ammonia, chloride, sulfate, and dissolved chromium constituent concentrations.

[5] Mass flux calculated as volumetric flow rate during respective month multiplied by GW-CA1 concentration.

Table 6. Results of the Shewhart/CUSUM Control Chart Tests

Well	Parameter	Background Statistics N	Mean	St Dev	Max	Exceedance	Units
GW-10S	Ammonia	6	0.93	0.88	2.21	N	mg/l
	Chloride	6	32.5	24.8	66.4	N	mg/l
	Chromium, Dissolved	6	0.0093	0.0127	0.0320	N	mg/l
	Specific Conductance	6	321	229	717	N	umhos/cm
	Sulfate	6	90.9	82.0	256.0	N	mg/l
	pH	6	4.33	0.57	4.74	N	mg/l
GW-202S	Ammonia	4	37.97	26.10	57.00	Y(B)	mg/l
	Chloride	4	52.6	12.3	64.9	Y(C)	mg/l
	Chromium, Dissolved	4	0.0060	0.0120	0.0240	N	mg/l
	Specific Conductance	4	1350	67	1430	Y(B)	umhos/cm
	Sulfate	4	437.3	39.4	492.0	Y(B)	mg/l
	pH	4	6.70	0.32	7.03	N	mg/l
GW-24	Ammonia	6	44.89	20.22	81.00	N	mg/l
	Chloride	6	26.0	1.6	28.0	Y(C)	mg/l
	Chromium, Dissolved	6	NA	NA	0	N	mg/l
	Specific Conductance	6	688	164	869	N	umhos/cm
	Sulfate	6	153.6	47.9	220.0	N	mg/l
	pH	6	7.22	0.32	7.49	N	mg/l
GW-25	Ammonia	6	33.98	12.51	50.00	N	mg/l
	Chloride	6	17.9	11.9	64.0	N	mg/l
	Chromium, Dissolved	6	0.0004	0.0010	0.0025	Y(B)	mg/l
	Specific Conductance	6	681	166	875	N	umhos/cm
	Sulfate	6	158.0	53.3	230.0	N	mg/l
	pH	6	6.67	0.08	6.80	Y(B-)	mg/l
GW-34D	Ammonia	4	11.26	8.27	19.00	N	mg/l
	Chloride	4	7.0	0.5	7.5	Y(B-)	mg/l
	Chromium, Dissolved	5	0.0066	0.0068	0.0150	N	mg/l
	Specific Conductance	4	370	30	411	Y(C-)	umhos/cm
	Sulfate	4	89.8	9.7	104.0	Y(C-)	mg/l
	pH	4	6.02	0.06	6.07	N	mg/l
GW-34SR	Ammonia	2	0.54	0.22	0.69	N	mg/l
	Chloride	4	8.3	5.2	14.3	N	mg/l
	Chromium, Dissolved	4	0.0013	0.0025	0.0050	N	mg/l
	Specific Conductance	4	249	75	361	N	umhos/cm
	Sulfate	4	51.0	21.4	82.7	N	mg/l
	pH	4	6.12	0.05	6.17	Y(C-)	mg/l
GW-76S	Ammonia	4	15.58	3.31	20.00	Y(C)	mg/l
	Chloride	3	10.1	4.2	15.0	N	mg/l
	Chromium, Dissolved	4	NA	NA	0	N	mg/l
	Specific Conductance	3	431	156	609	N	umhos/cm
	Sulfate	3	133.3	41.6	180.0	N	mg/l
	pH	3	6.25	0.04	6.28	N	mg/l
GW-78S	Ammonia	11	39.82	19.47	89.80	N	mg/l
	Chloride	11	32.0	36.2	139.0	N	mg/l
	Chromium, Dissolved	11	0.0798	0.0289	0.1350	Y(B)	mg/l
	Specific Conductance	11	1117	177	1431	N	umhos/cm
	Sulfate	11	512.3	136.7	780.0	N	mg/l
	pH	8	5.09	0.65	6.60	N	mg/l

Table 6. Results of the Shewhart/CUSUM Control Chart Tests

Well	Parameter	Background Statistics N	Mean	St Dev	Max	Exceedance	Units
GW-79S	Ammonia	11	77.68	67.19	188.00	N	mg/l
	Chloride	11	134.2	50.3	205.0	N	mg/l
	Chromium, Dissolved	10	0.0237	0.0194	0.0730	N	mg/l
	Specific Conductance	11	2638	1304	4360	Y(C)	umhos/cm
	Sulfate	11	859.5	453.2	1500.0	N	mg/l
	pH	10	6.20	0.47	6.74	N	mg/l
GW-CA1	Ammonia	8	15.94	1.90	19.00	Y(C)	mg/l
	Chloride	10	16.7	2.1	19.3	N	mg/l
	Chromium, Dissolved	10	0.0076	0.0057	0.0160	N	mg/l
	Specific Conductance	10	989	197	1160	N	umhos/cm
	Sulfate	10	289.3	59.2	360.0	N	mg/l
	pH	9	6.73	0.13	6.89	N	mg/l
GW-CA2	Ammonia	0	NA	NA	NA	NA	NA
	Chloride	0	NA	NA	NA	NA	NA
	Chromium, Dissolved	3	NA	NA	0	N	mg/l
	Specific Conductance	0	NA	NA	NA	NA	NA
	Sulfate	0	NA	NA	NA	NA	NA
	pH	0	NA	NA	NA	NA	NA

Notes: NA = not applicable
N = no exceedance
Y(B) = both Shewhart and CUSUM exceedances
Y(C) = CUSUM exceedance only
minus sign (-) indicates exceedance of lower control limit

Table 7. Results of the Kendall Tests for Trend

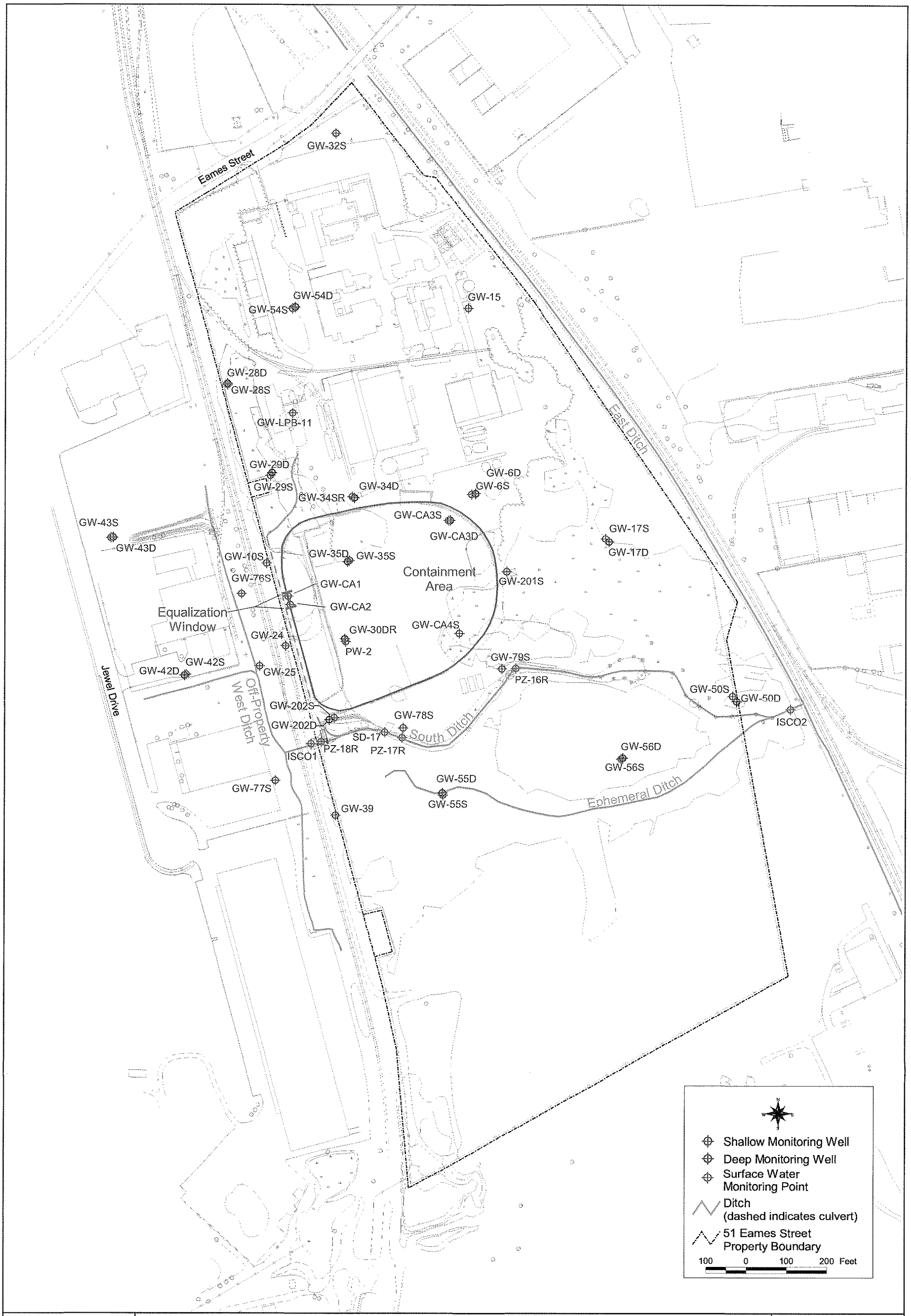
Well	Parameter	N	Max	Z	p	Trend
GW-10S	Ammonia	11	2.205	-2.125699	0.033528	Y-
	Chloride	11	66.4	0.1557	0.87627	N
	Chromium, Dissolved	11	0.032	-0.637242	0.523967	N
	Specific Conductance	11	717	0.3114	0.755497	N
	Sulfate	11	256	0	1	N
	pH	11	4.74	0.234261	0.814783	N
GW-202S	Ammonia	9	158	1.563858	0.117851	N
	Chloride	9	94	1.146829	0.251452	N
	Chromium, Dissolved	9	0.024	0	1	N
	Specific Conductance	9	1770	2.189401	0.028568	Y+
	Sulfate	9	748	1.980887	0.047604	Y+
	pH	9	7.03	-0.105409	0.916051	N
GW-24	Ammonia	11	87.3	0.934199	0.350201	N
	Chloride	11	30.6	-0.934199	0.350201	N
	Chromium, Dissolved	8	0	NaN	NaN	Y+
	Specific Conductance	11	869	0.622799	0.533417	N
	Sulfate	11	220	0.1557	0.87627	N
	pH	11	7.49	-0.467099	0.640429	N
GW-25	Ammonia	11	71.3	-1.089899	0.275758	N
	Chloride	11	69.9	2.179797	0.029273	Y+
	Chromium, Dissolved	11	0.014	3.284283	0.001022	Y+
	Specific Conductance	10	947	0.357771	0.720515	N
	Sulfate	11	252	0.469956	0.638386	N
	pH	11	6.8	-1.712698	0.086768	Y-
GW-34D	Ammonia	9	21	0.7298	0.465512	N
	Chloride	9	7.5	-1.467599	0.142213	N
	Chromium, Dissolved	10	0.015	0.093116	0.925812	N
	Specific Conductance	9	411	-2.306227	0.021098	Y-
	Sulfate	9	104	-2.189401	0.028568	Y-
	pH	9	6.18	0.938315	0.348083	N
GW-34SR	Ammonia	7	0.7	1.063376	0.287611	N
	Chloride	9	14.3	-2.814945	0.004879	Y-
	Chromium, Dissolved	9	0.005	-0.193649	0.846451	N
	Specific Conductance	9	361	-3.231973	0.001229	Y-
	Sulfate	9	82.7	-1.772373	0.076333	Y-
	pH	9	6.34	-1.355344	0.175308	N
GW-76S	Ammonia	6	28.9	1.127204	0.259656	N
	Chloride	4	15	0.339683	0.734095	N
	Chromium, Dissolved	6	0.006	1.80395	0.071239	Y+
	Specific Conductance	4	631	1.698416	0.089429	Y+
	Sulfate	4	182	1.019049	0.30818	N
	pH	6	6.33	0	1	N
GW-78S	Ammonia	16	89.8	0.225113	0.821892	N
	Chloride	16	139	0.630955	0.52807	N
	Chromium, Dissolved	16	0.242	1.215608	0.224134	N
	Specific Conductance	16	1540	0	1	N
	Sulfate	16	798	0.045023	0.964089	N
	pH	13	6.6	1.041033	0.29786	N

Table 7. Results of the Kendall Tests for Trend

Well	Parameter	N	Max	Z	p	Trend
GW-79S	Ammonia	16	217	1.845923	0.064903	Y+
	Chloride	16	257	0.225113	0.821892	N
	Chromium, Dissolved	15	0.073	0.04967	0.960385	N
	Specific Conductance	16	7860	2.206103	0.027377	Y+
	Sulfate	16	1630	1.802729	0.071431	Y+
	pH	15	7.73	1.493172	0.135392	N
GW-CA1	Ammonia	13	24.35	0	1	N
	Chloride	15	22.4	0.346835	0.728715	N
	Chromium, Dissolved	15	0.016	1.473518	0.140611	N
	Specific Conductance	15	1160	-2.229654	0.02577	Y-
	Sulfate	15	360	-1.583589	0.113287	N
	pH	14	6.92	-0.932061	0.351305	N

Notes: N = no significant trend
Y+ = significant increasing trend
Y- = significant decreasing trend

Figures

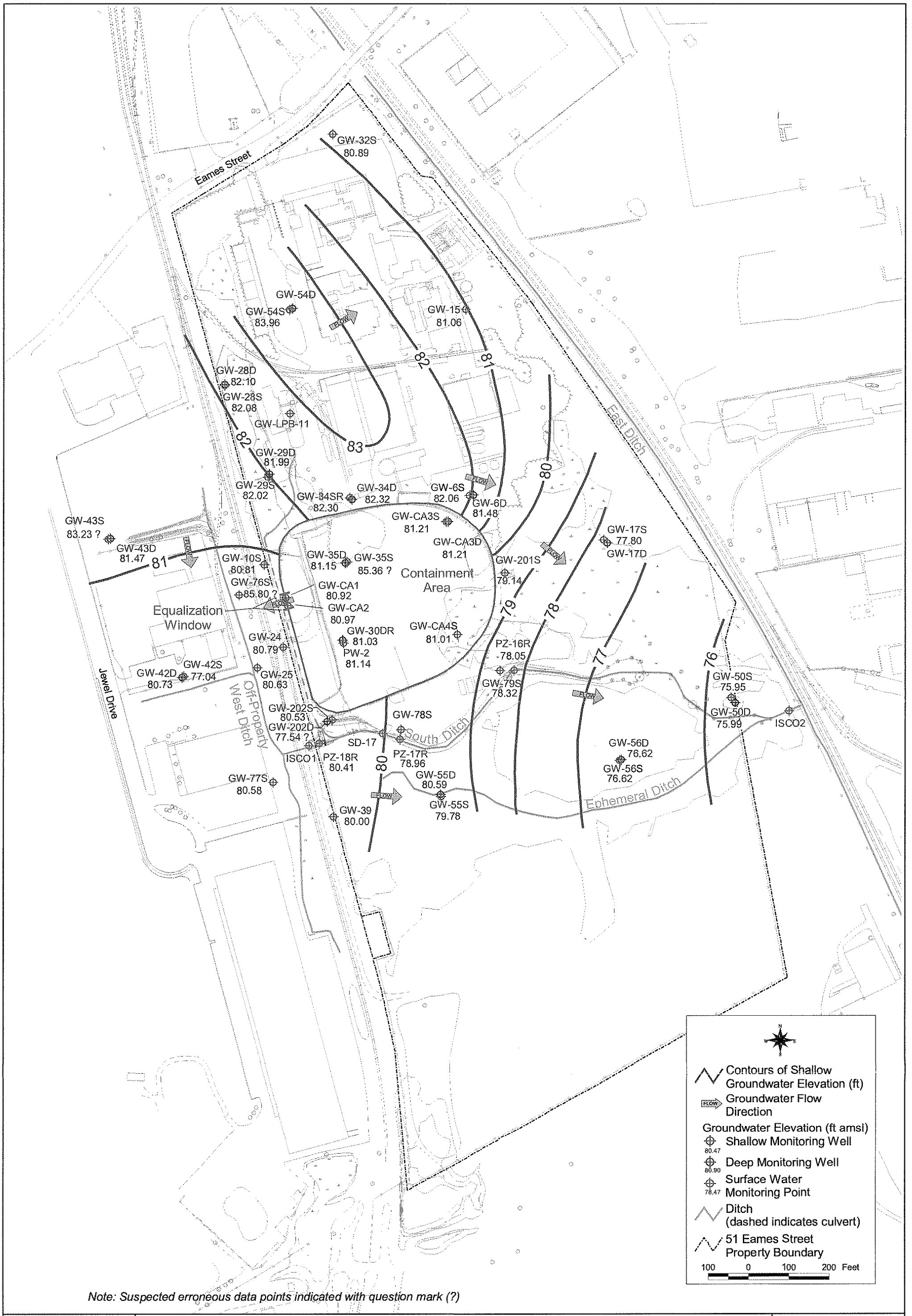


Generation Date: 8/30/04

Figure 1. Post-Construction Monitoring Plan (PCMP) location map.

Geomega

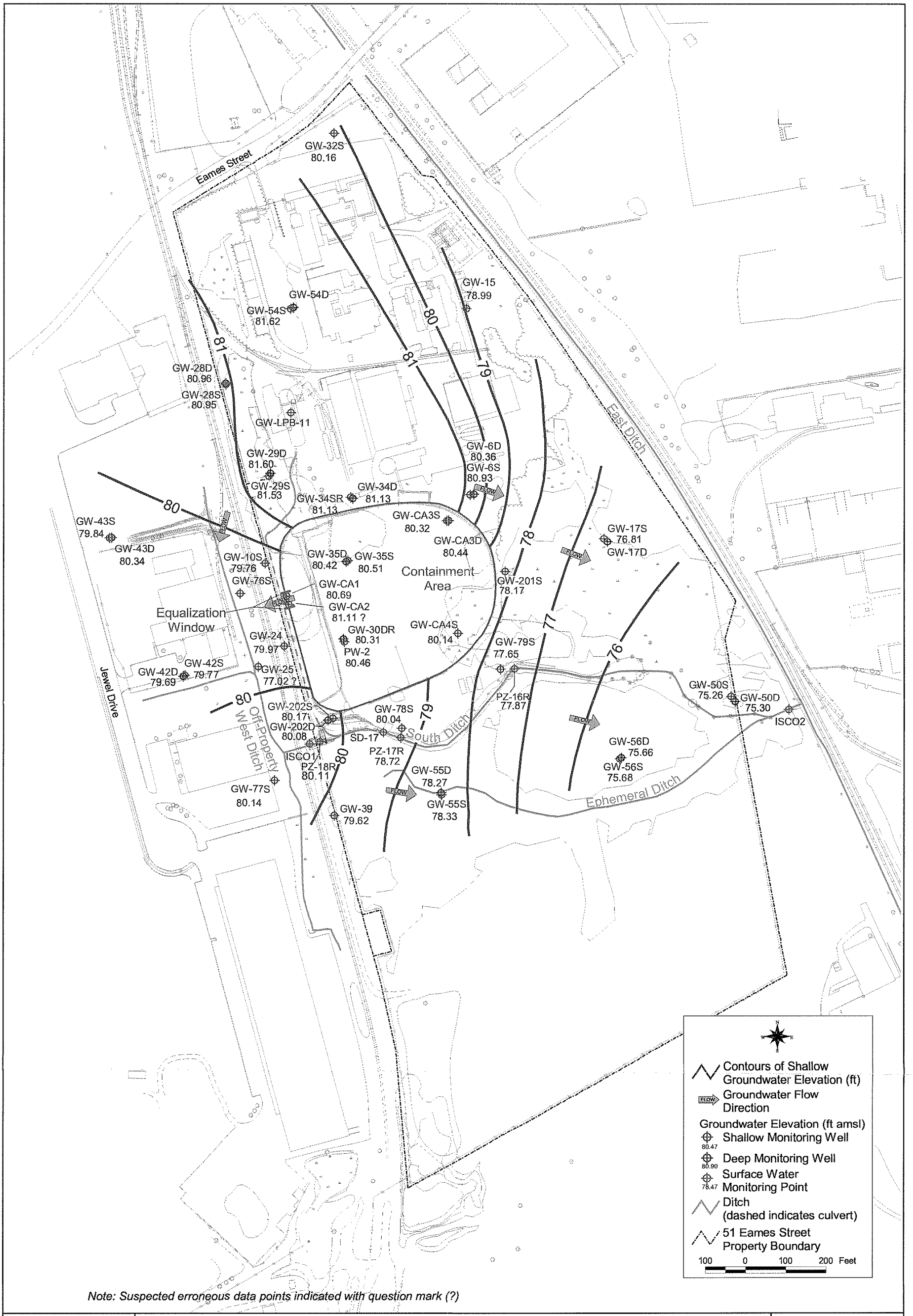
\dm\k\projects2\olin\pcmp_gndwat_2004.epr: location map layout



Note: Suspected erroneous data points indicated with question mark (?)

Generation Date: 8/30/04	Figure 2. Water levels for PCMP wells on August 11, 2003.	Geomega

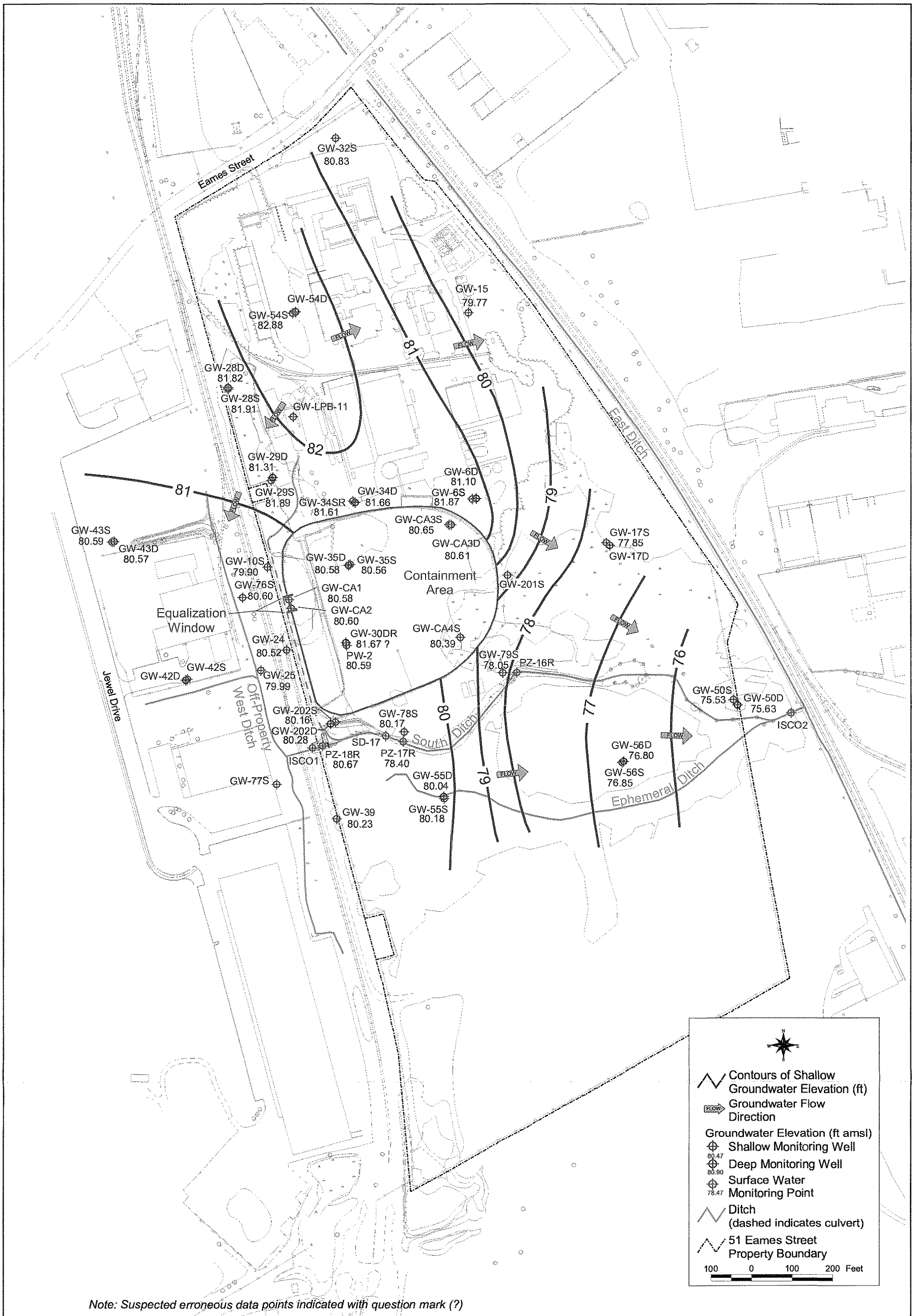
\dm\k\projects2\olin\pcmp_gndwat_2004.apr: aug 11, 2003 layout



Note: Suspected erroneous data points indicated with question mark (?)

Generation Date: 8/30/04	Figure 3. Water levels for PCMP wells on October 9, 2003.	Geomega

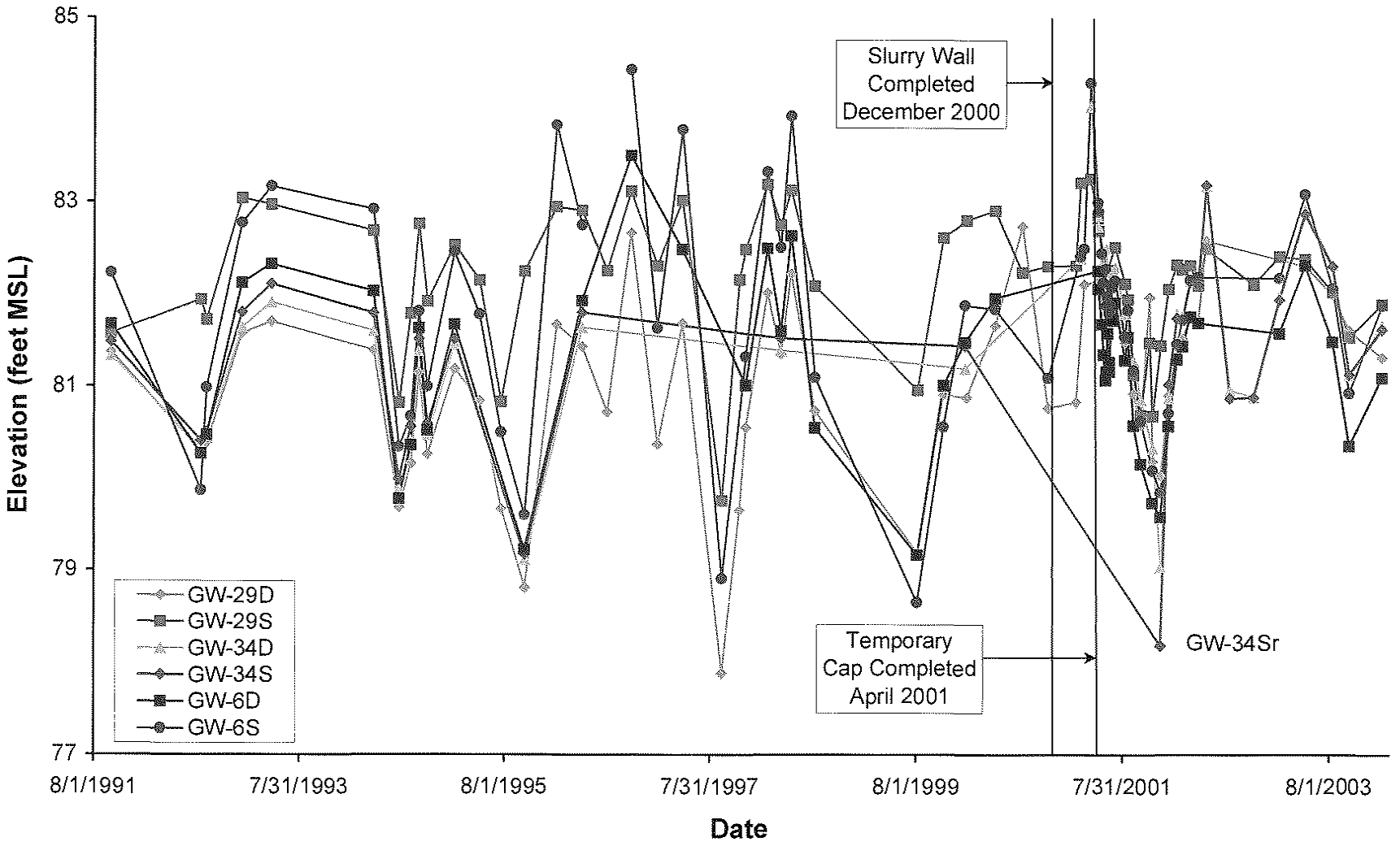
\dm\k\projects2\olin\pcmp_gndwat_2004.apr: oct 9 2003 layout



Note: Suspected erroneous data points indicated with question mark (?)

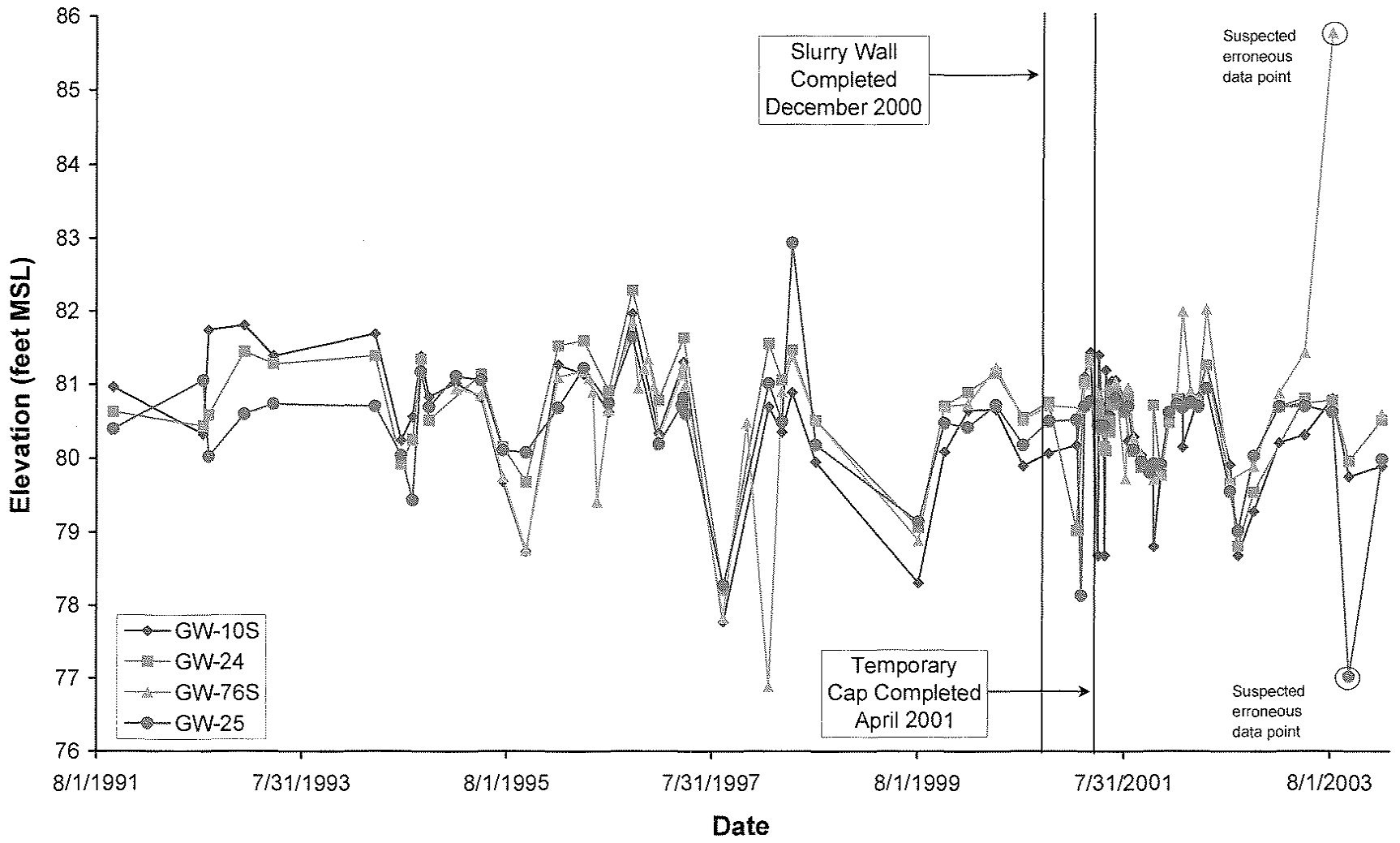
Generation Date: 8/30/04	Figure 4. Water levels for PCMP wells on February 2, 2004.	Geomega

\dm\k\projects2\oiin\pcmp_gndwat_2004.apr: feb 2 2004 layout



Generation Date: 8/30/04	Figure 5. Groundwater elevations vs. time north of containment structure.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (North Fig)



Generation Date: 8/30/04	Figure 6. Groundwater elevations vs. time west of containment structure.	Geomega

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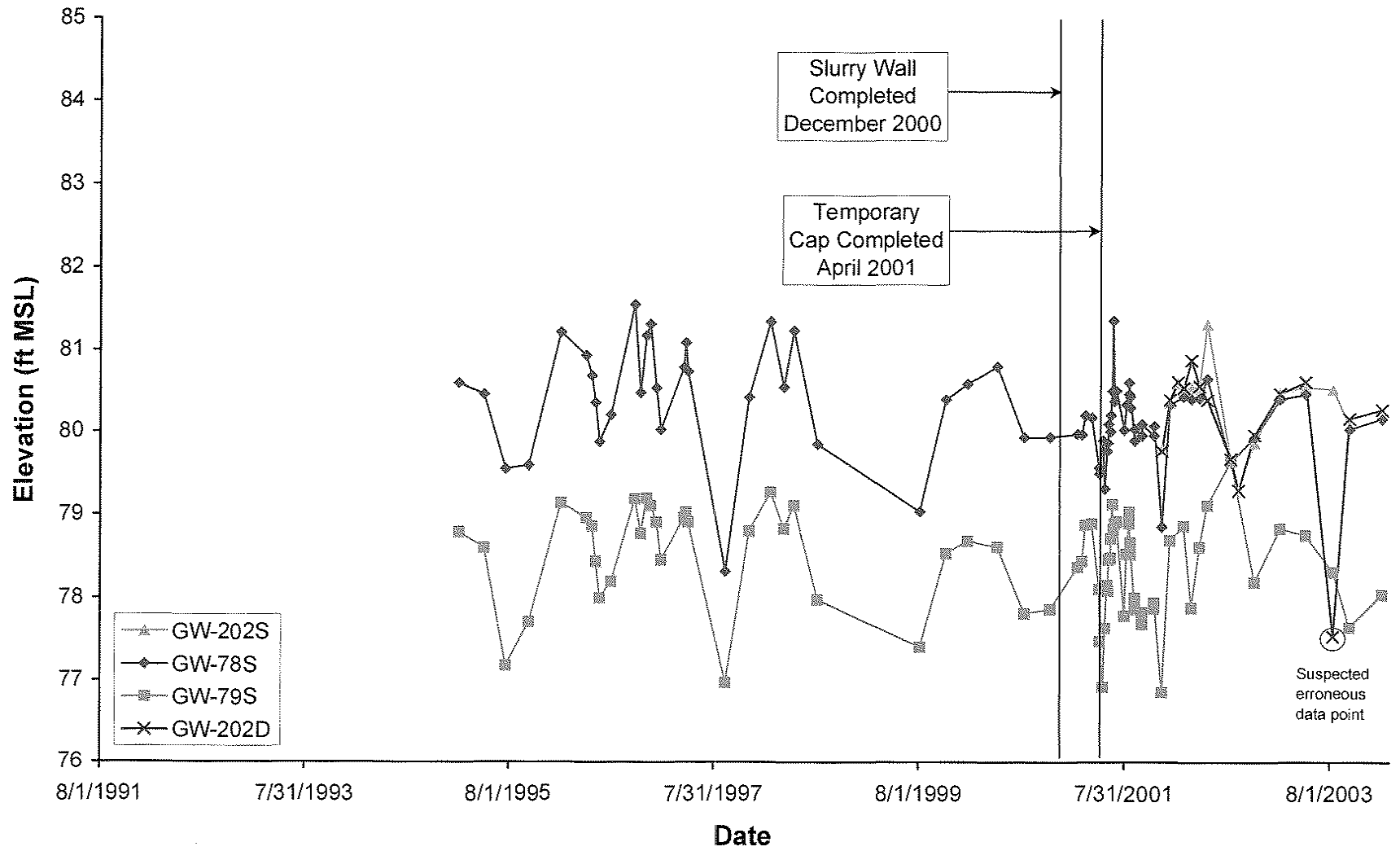

Generation Date: 8/30/04	Figure 7. Groundwater elevations vs. time south of containment structure.	Geomega

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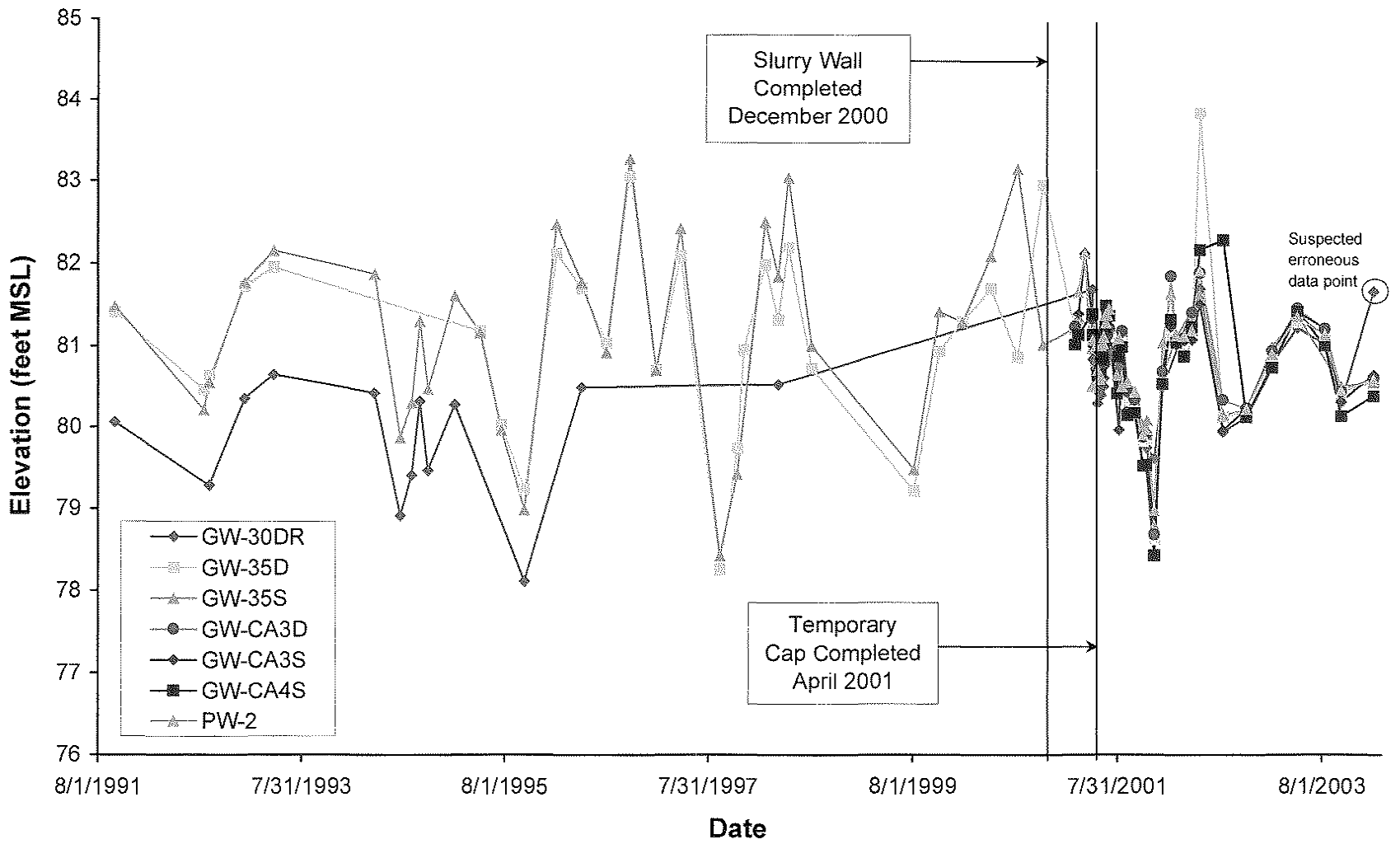

Generation Date: 8/30/04	Figure 8. Groundwater elevations vs. time inside containment structure - historical.	Geomega

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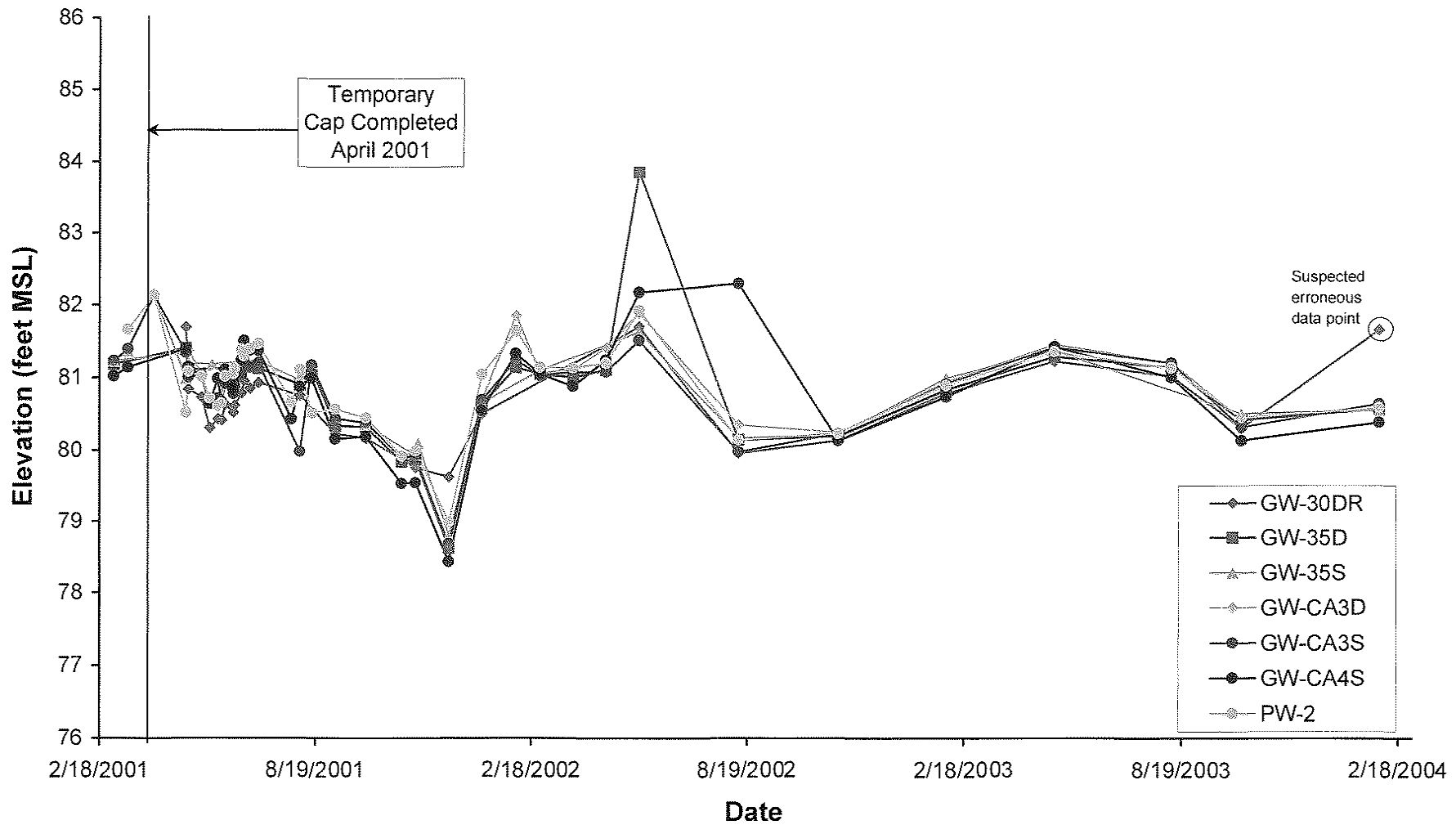

Generation Date: 8/30/04	Figure 9. Groundwater elevations vs. time inside containment structure - recent.	Geomega

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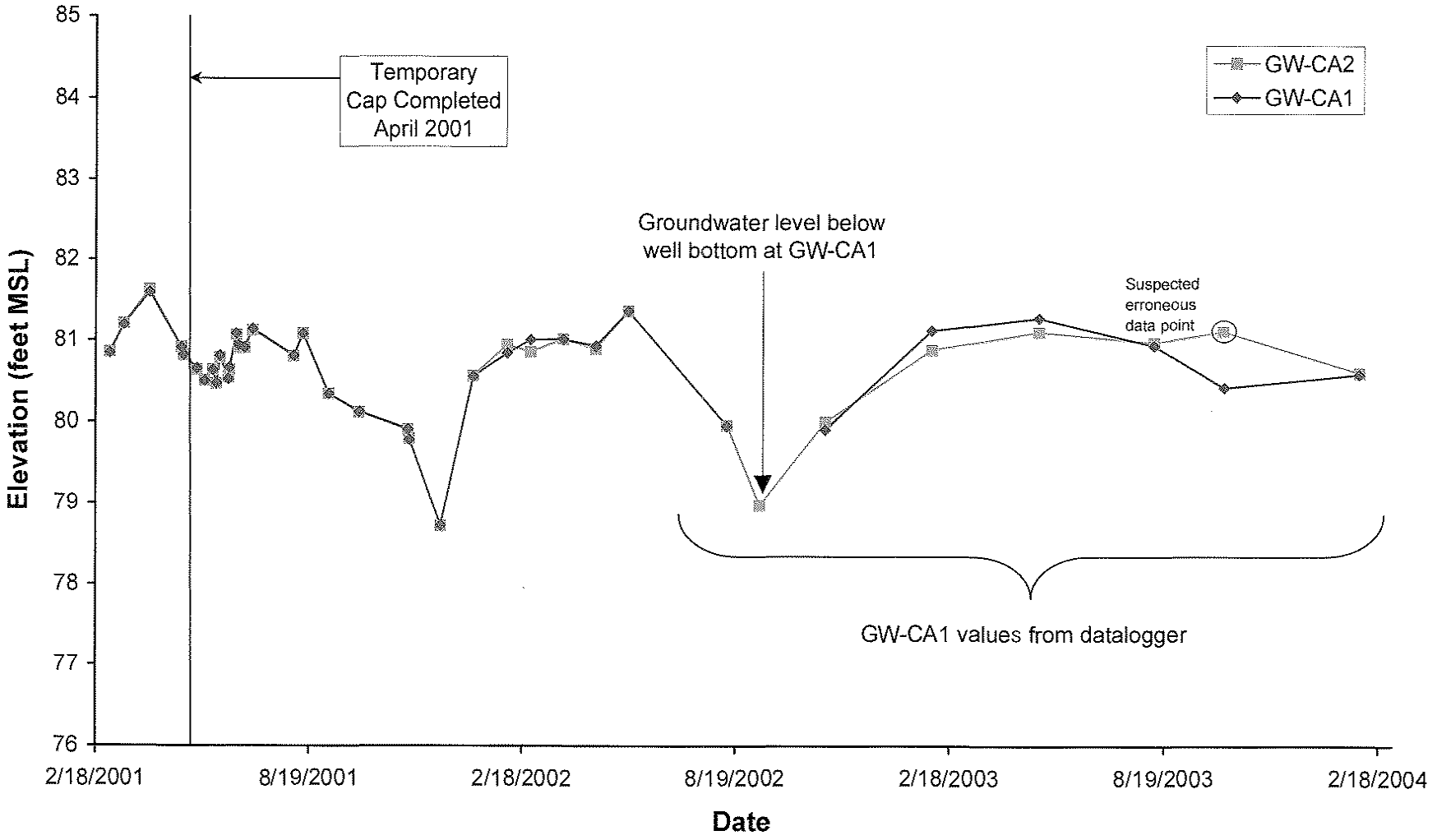

Generation Date: 8/30/04	Figure 10. Groundwater elevations vs. time in equalization window.	Geomega

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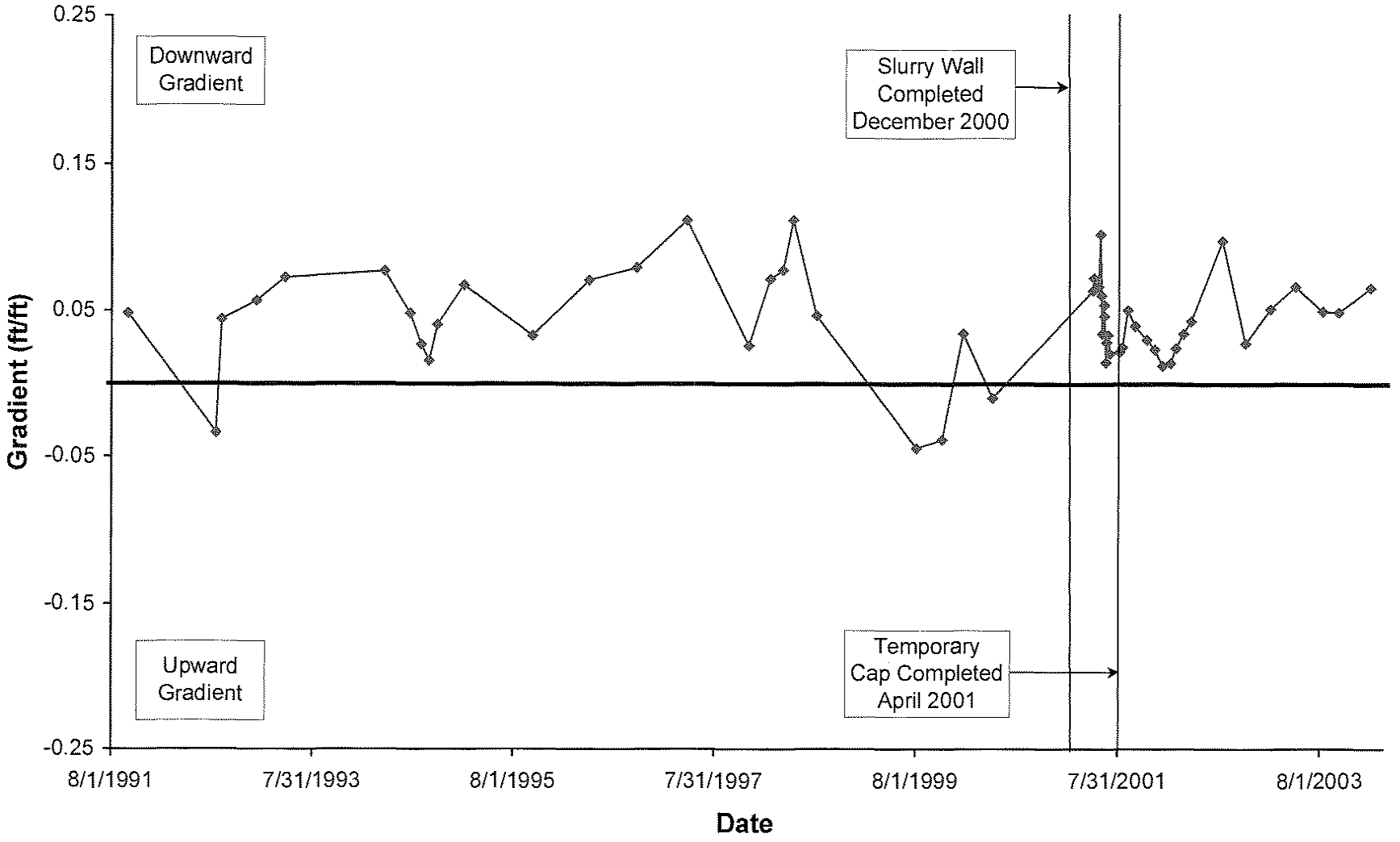
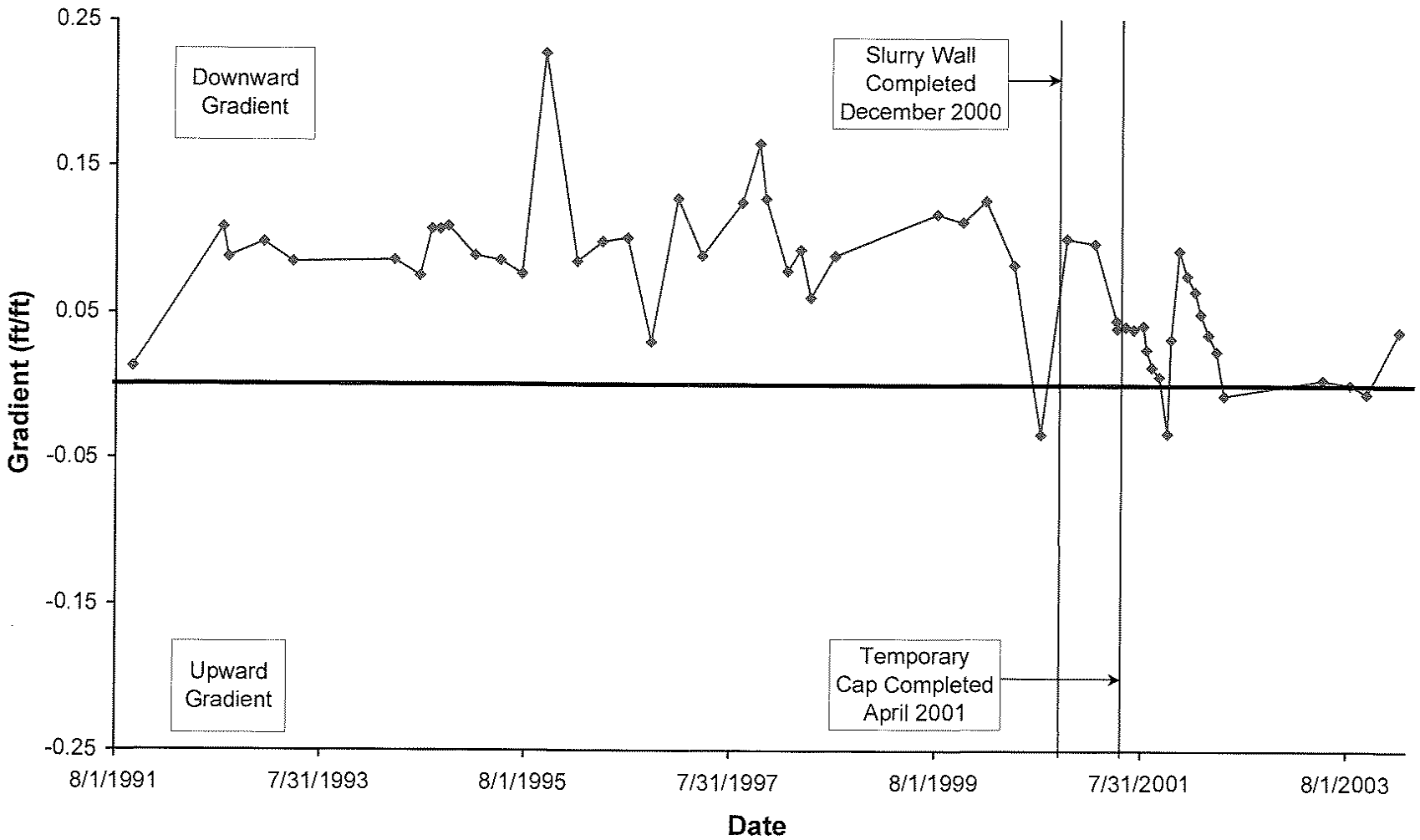


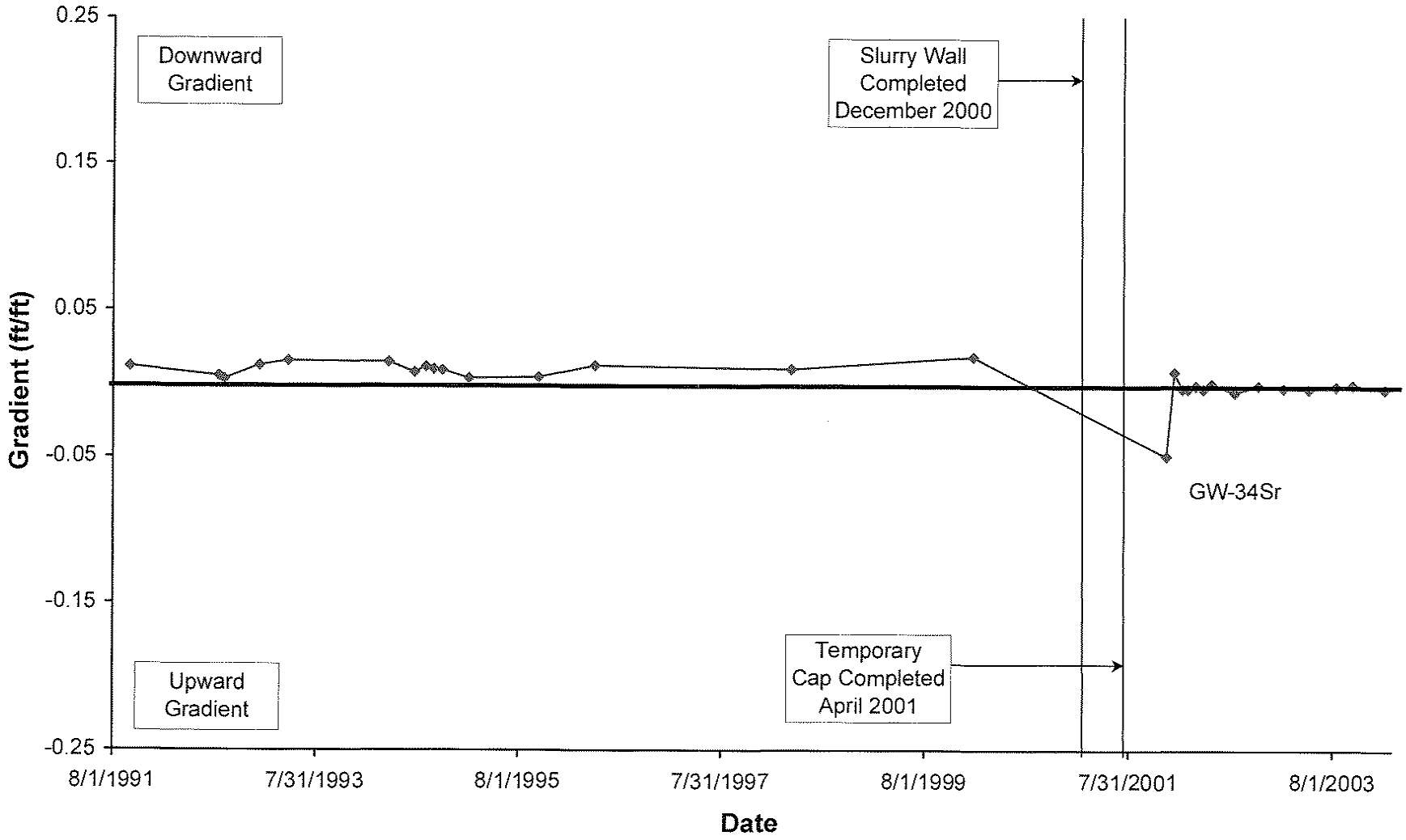
Generation Date: 8/30/04	Figure 11. Vertical gradient in groundwater wells GW-6D & -6S.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-6 Fig)



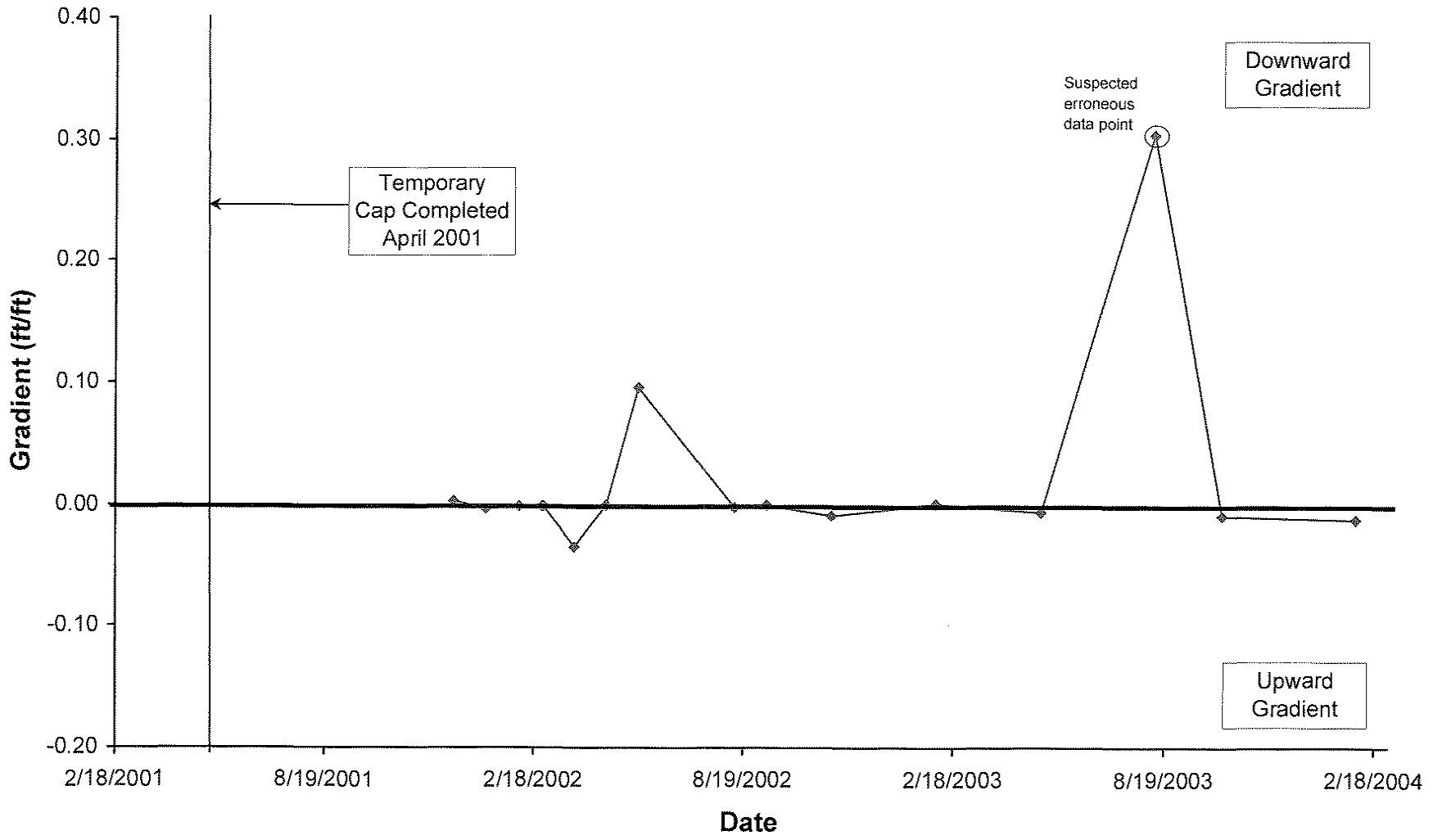
Generation Date: 8/30/04	Figure 12. Vertical gradient in groundwater wells GW-29D & -29S.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-29 Fig)



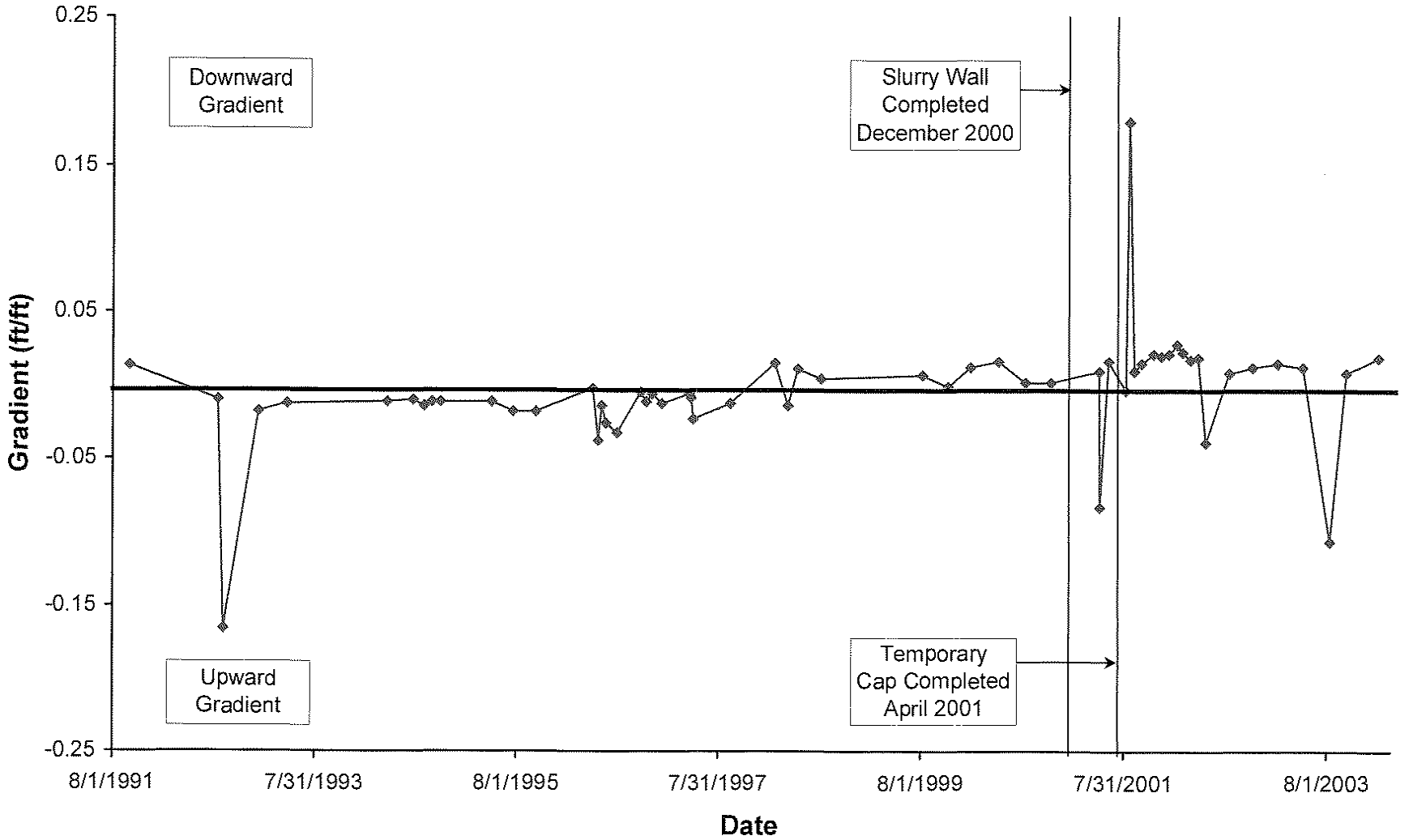
Generation Date: 8/30/04	Figure 13. Vertical gradient in groundwater wells GW-34D & -34S/34Sr.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-34 Fig)



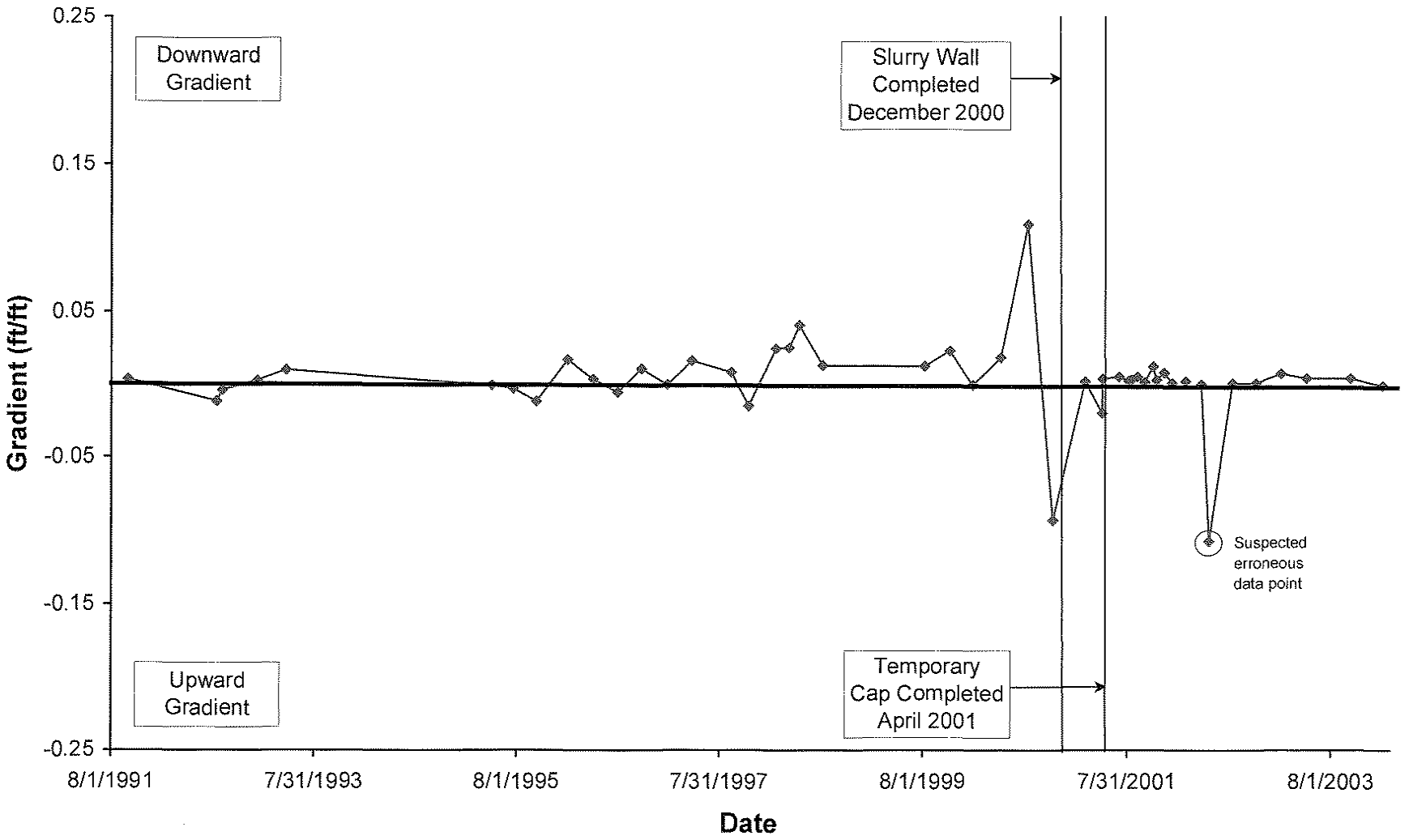
Generation Date: 8/30/04	Figure 14. Vertical gradient in groundwater wells GW-202D & -202S.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-202 Fig)



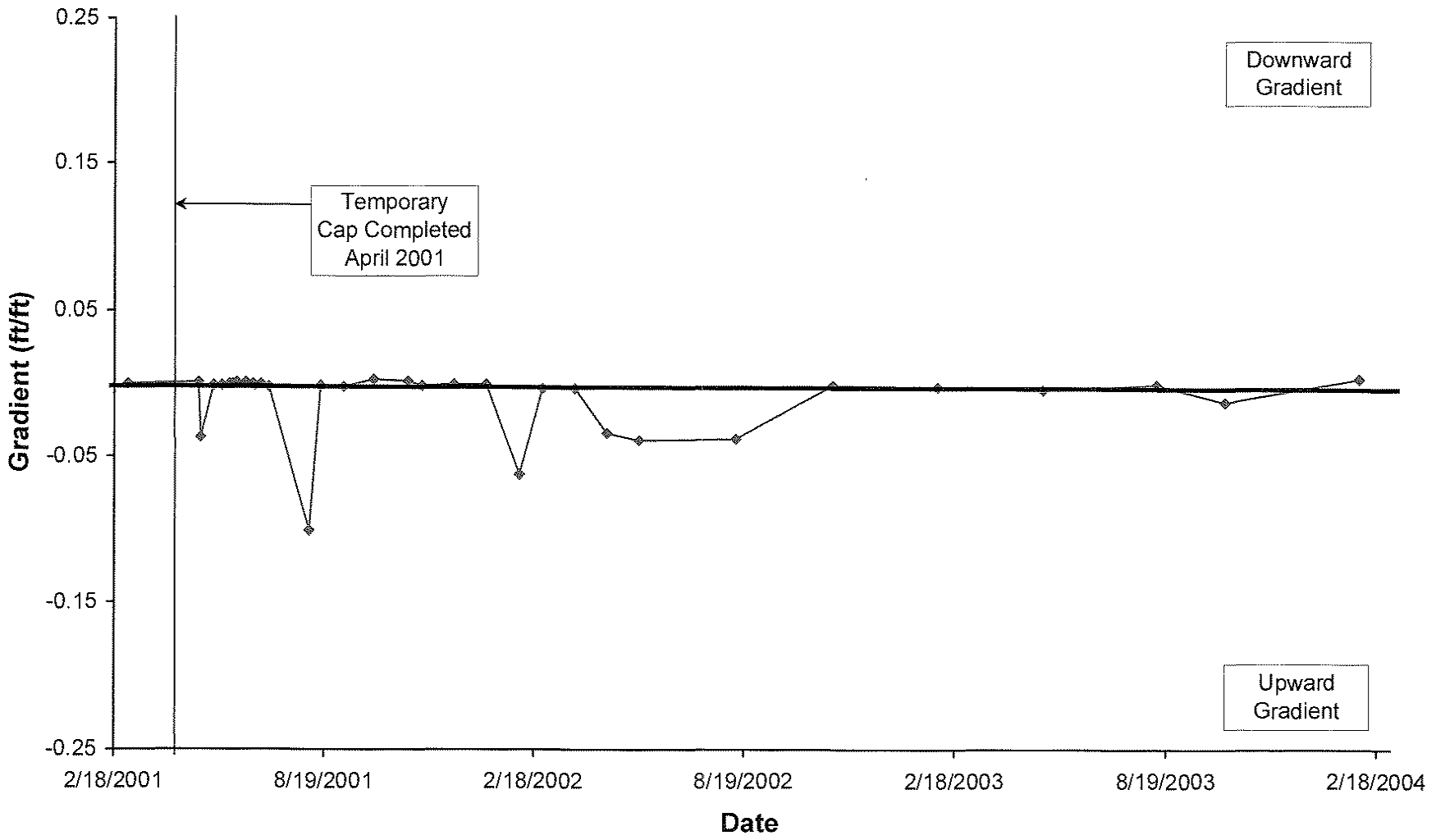
Generation Date: 8/30/04	Figure 15. Vertical gradient in groundwater wells GW-55D & -55S.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-55 Fig)



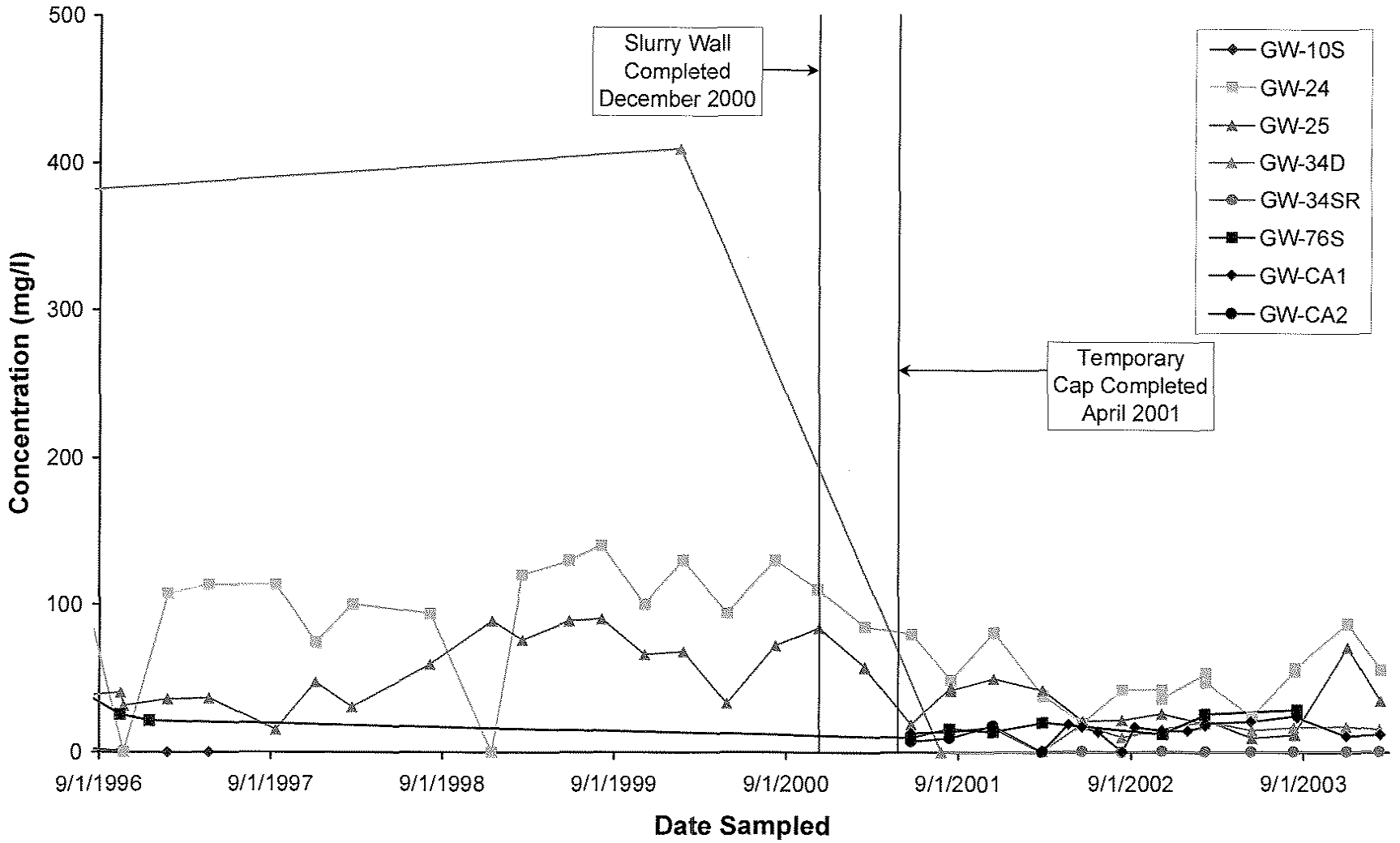
Generation Date: 8/30/04	Figure 16. Vertical gradient in groundwater wells GW-35D & -35S.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-35 Fig)



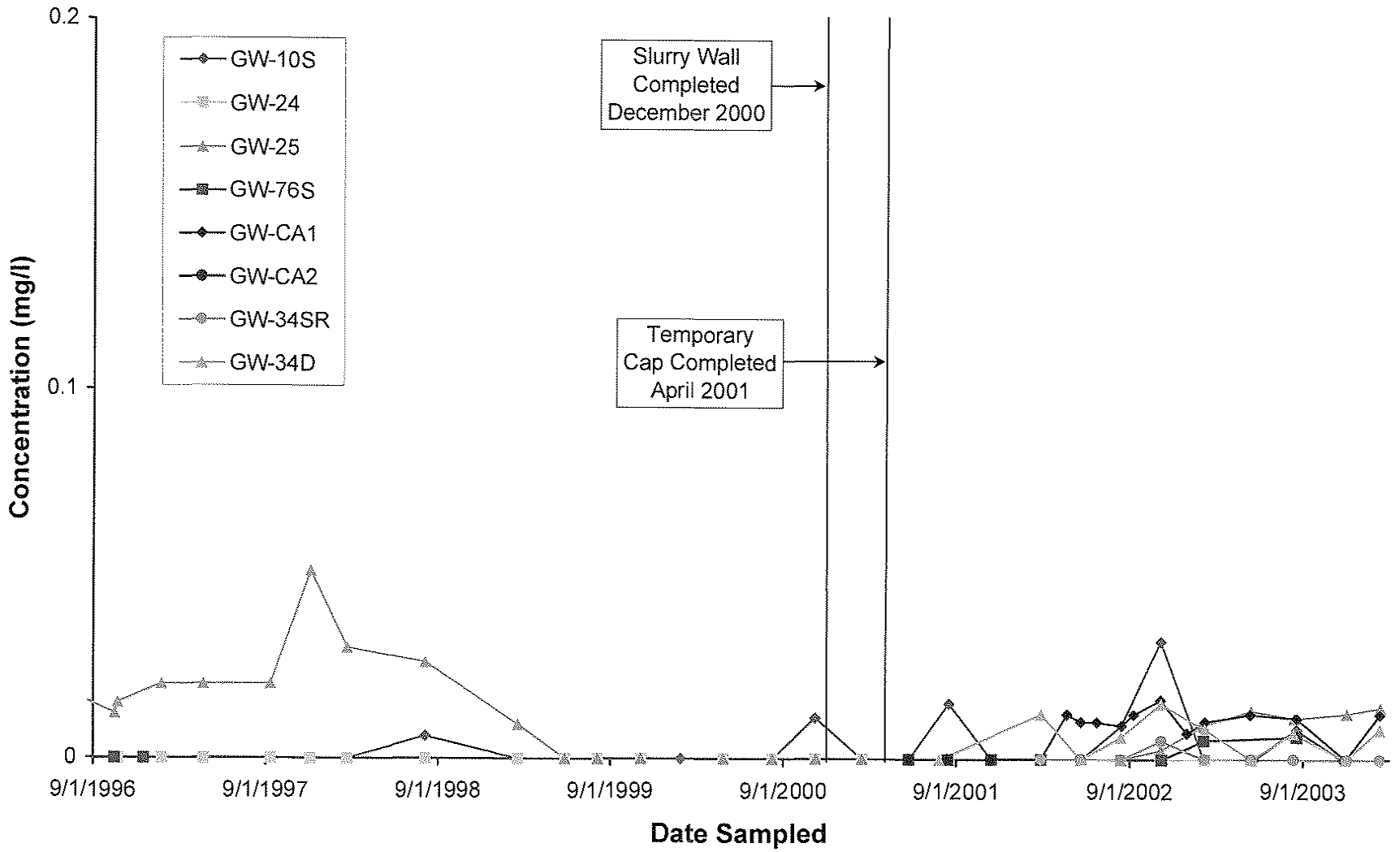
Generation Date: 8/30/04	Figure 17. Vertical gradient in groundwater wells GW-CA3D & -CA3S.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells water levels SR #8.xls (GW-CA3 Fig)



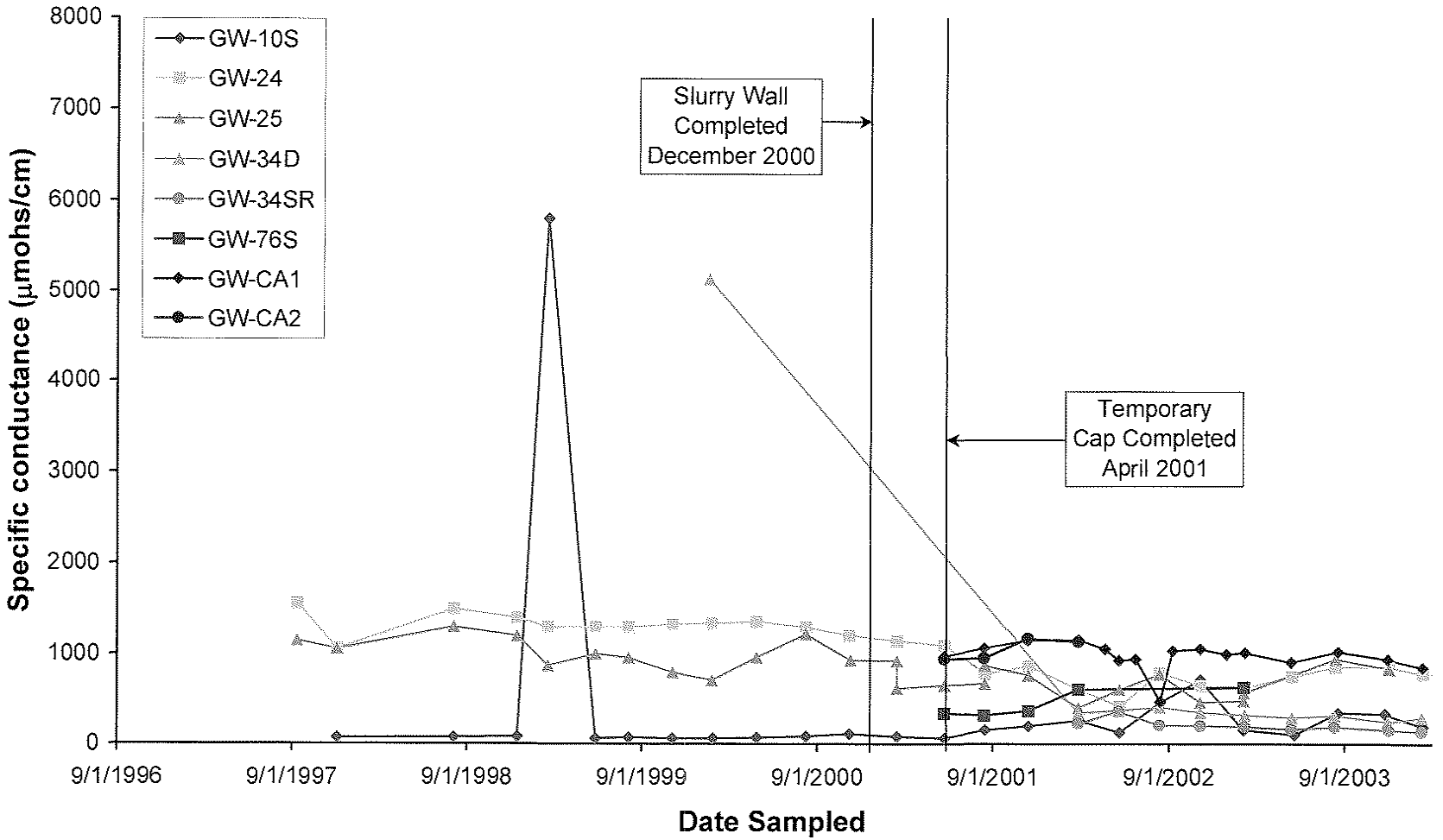
Generation Date: 8/30/04	Figure 18. Ammonia in groundwater north and west of containment structure.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Ammonia W.Fig)



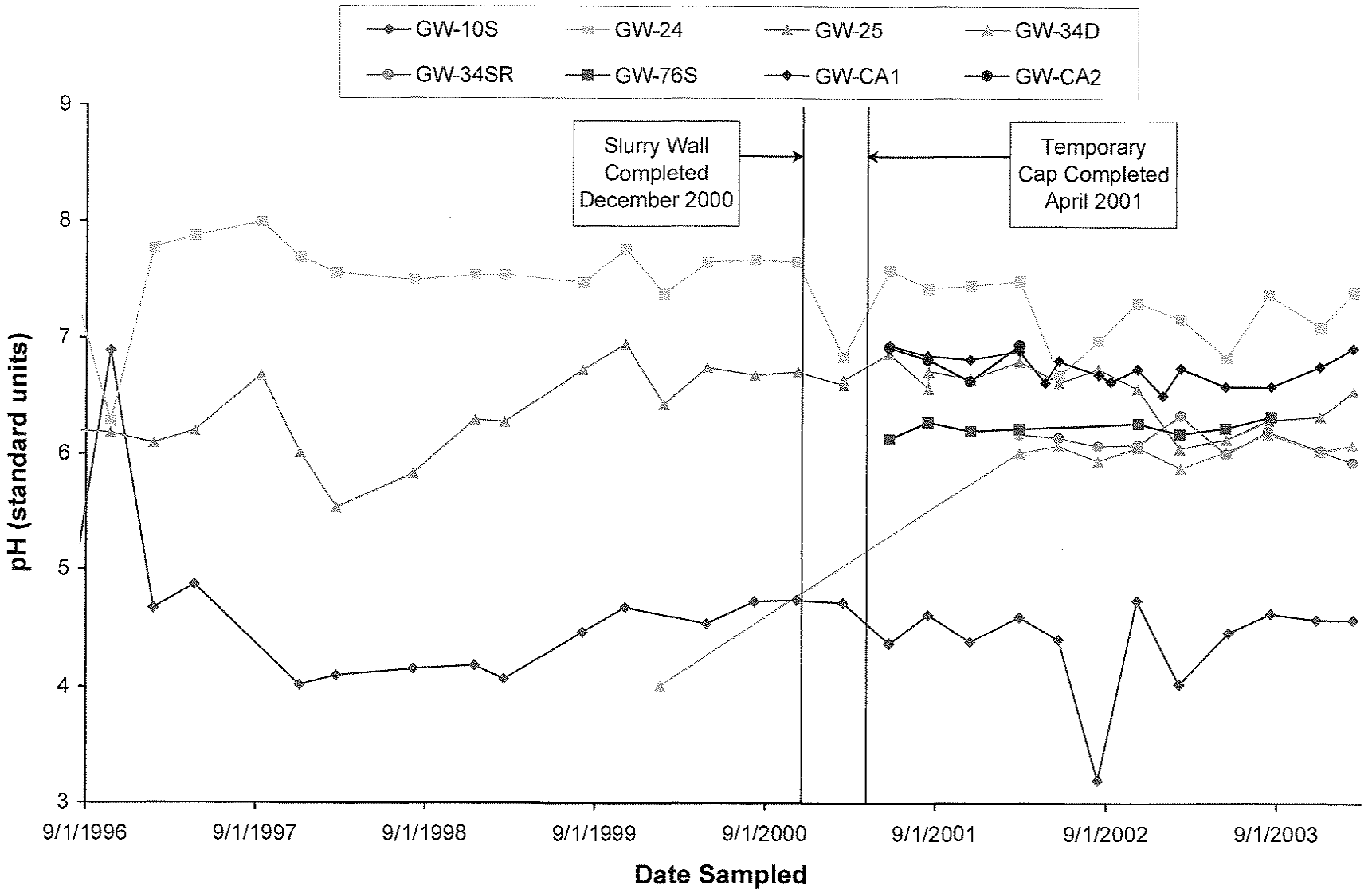
Generation Date: 8/30/04	Figure 21. Dissolved chromium in groundwater north and west of containment structure.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Dissolved Chromium W.fig)



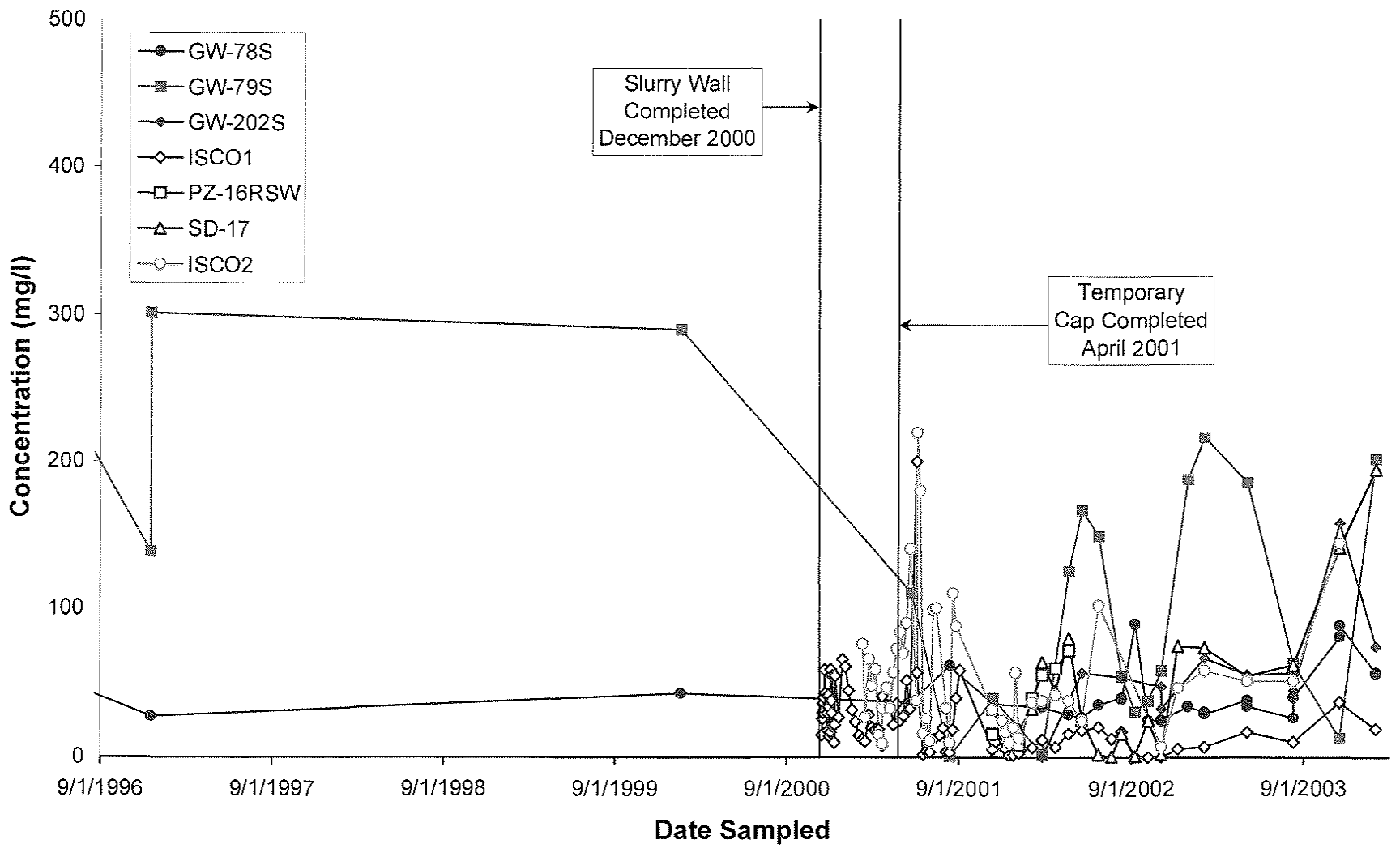
Generation Date: 8/30/04	Figure 22. Specific conductance in groundwater north and west of containment structure.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Specific Conductance W. Fig)



Generation Date: 8/30/04	Figure 23. pH in groundwater north and west of containment structure.	Geomega

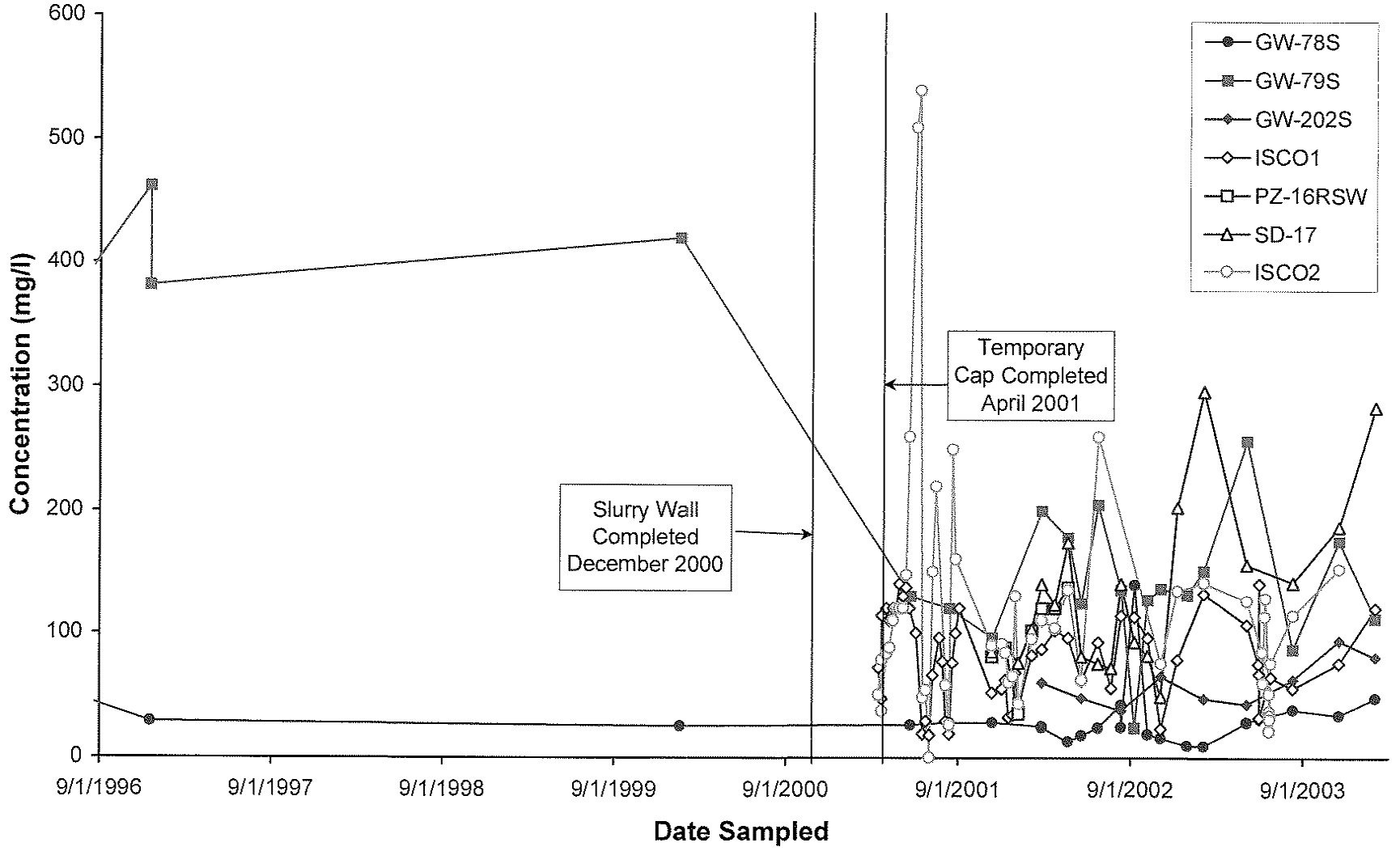
o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (pH W.Fig)



Note: open symbol indicates surface water sample.

Generation Date: 8/30/04	Figure 24. Ammonia in groundwater and surface water south of containment structure.	Geomega

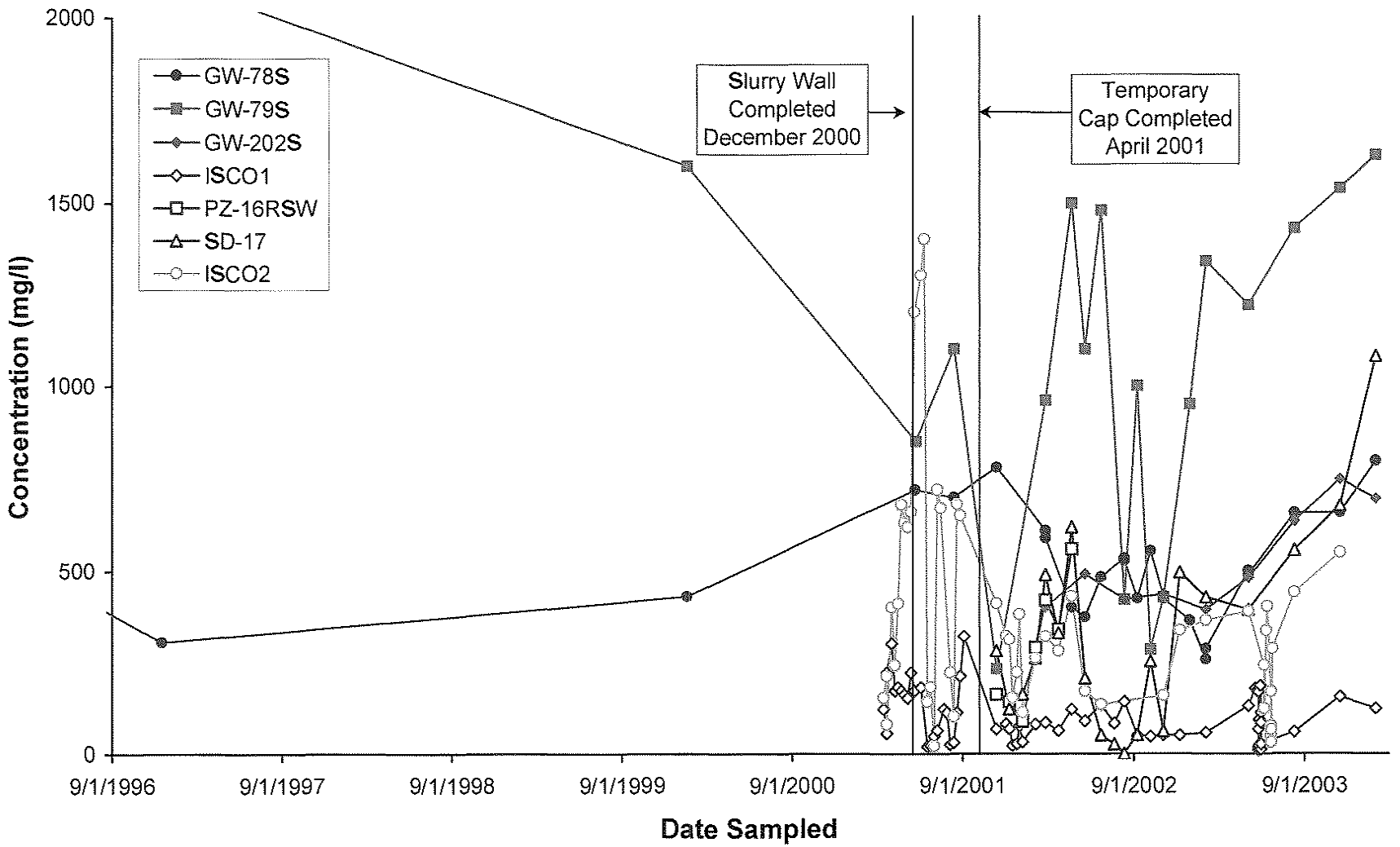
o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Ammonia S.Fig)



Note: open symbol indicates surface water sample.

Generation Date: 8/30/04	Figure 25. Chloride in groundwater and surface water south of containment structure.	Geomega

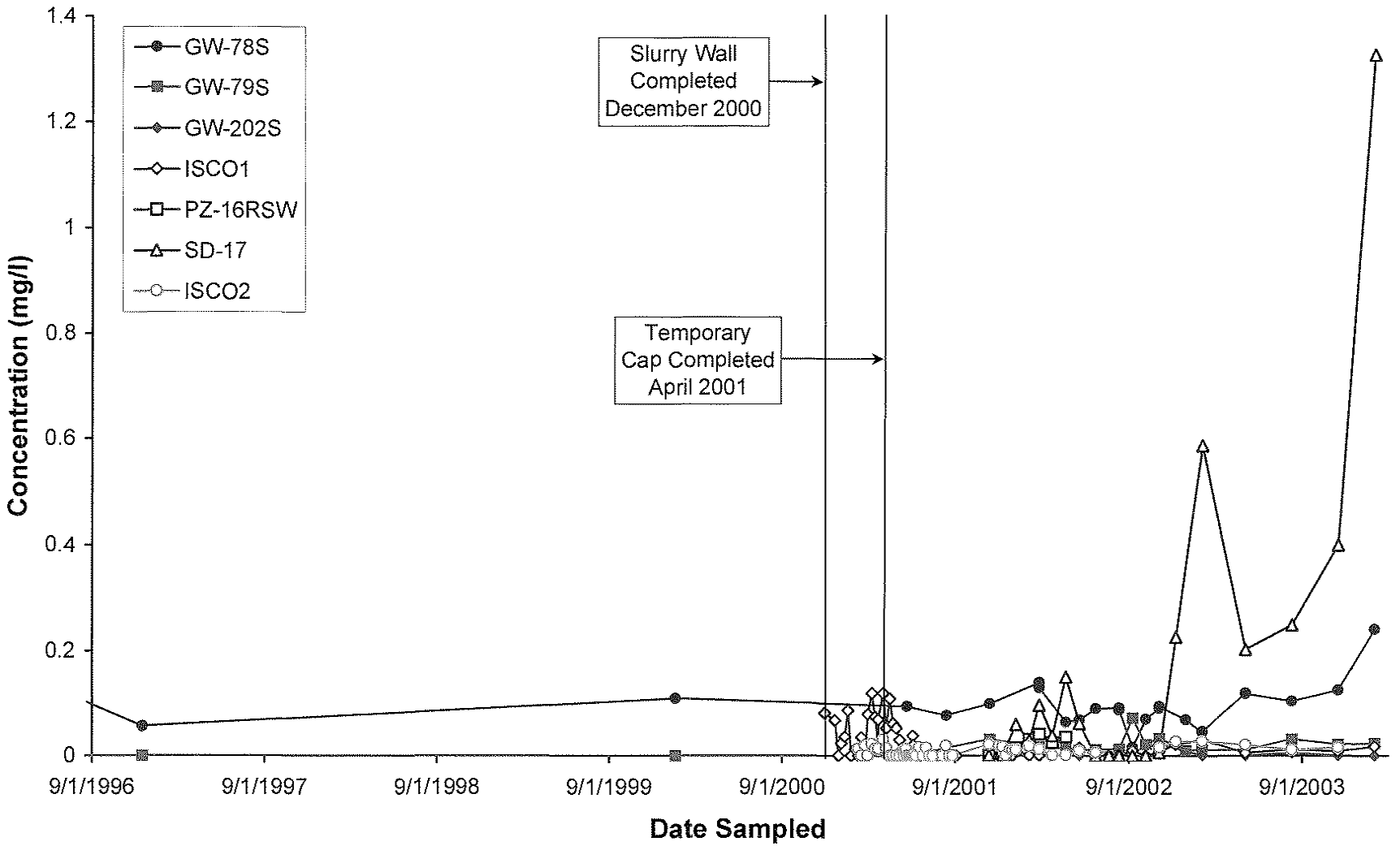
o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Chloride S.Fig)



Note: open symbol indicates surface water sample.

Generation Date: 8/30/04	Figure 26. Sulfate in groundwater and surface water south of containment structure.	Geomega

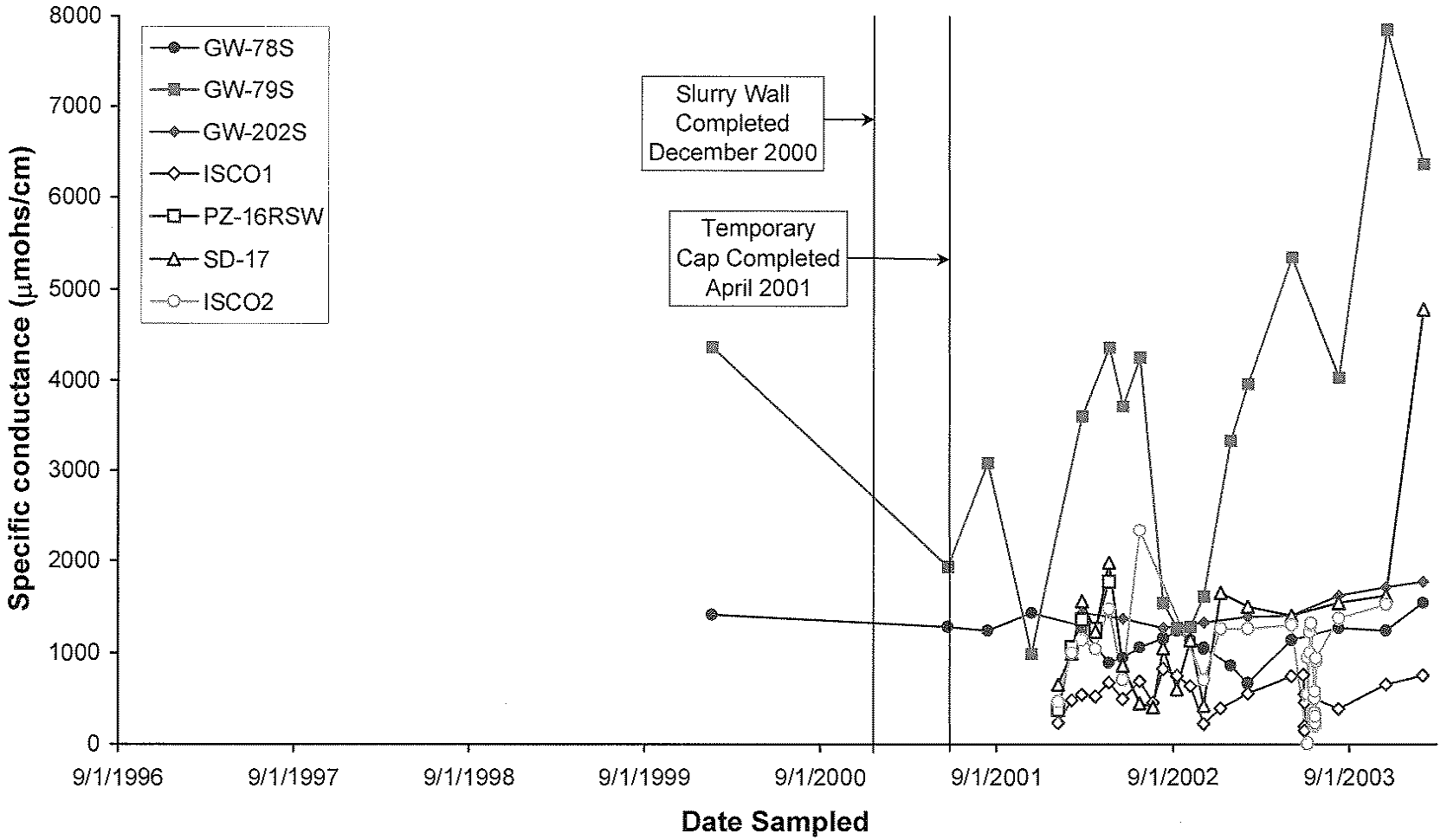
o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8 xls (Sulfate S. Fig)



Note: open symbol indicates surface water sample.

Generation Date: 8/30/04	Figure 27. Dissolved chromium in groundwater and surface water south of containment structure.	Geomega

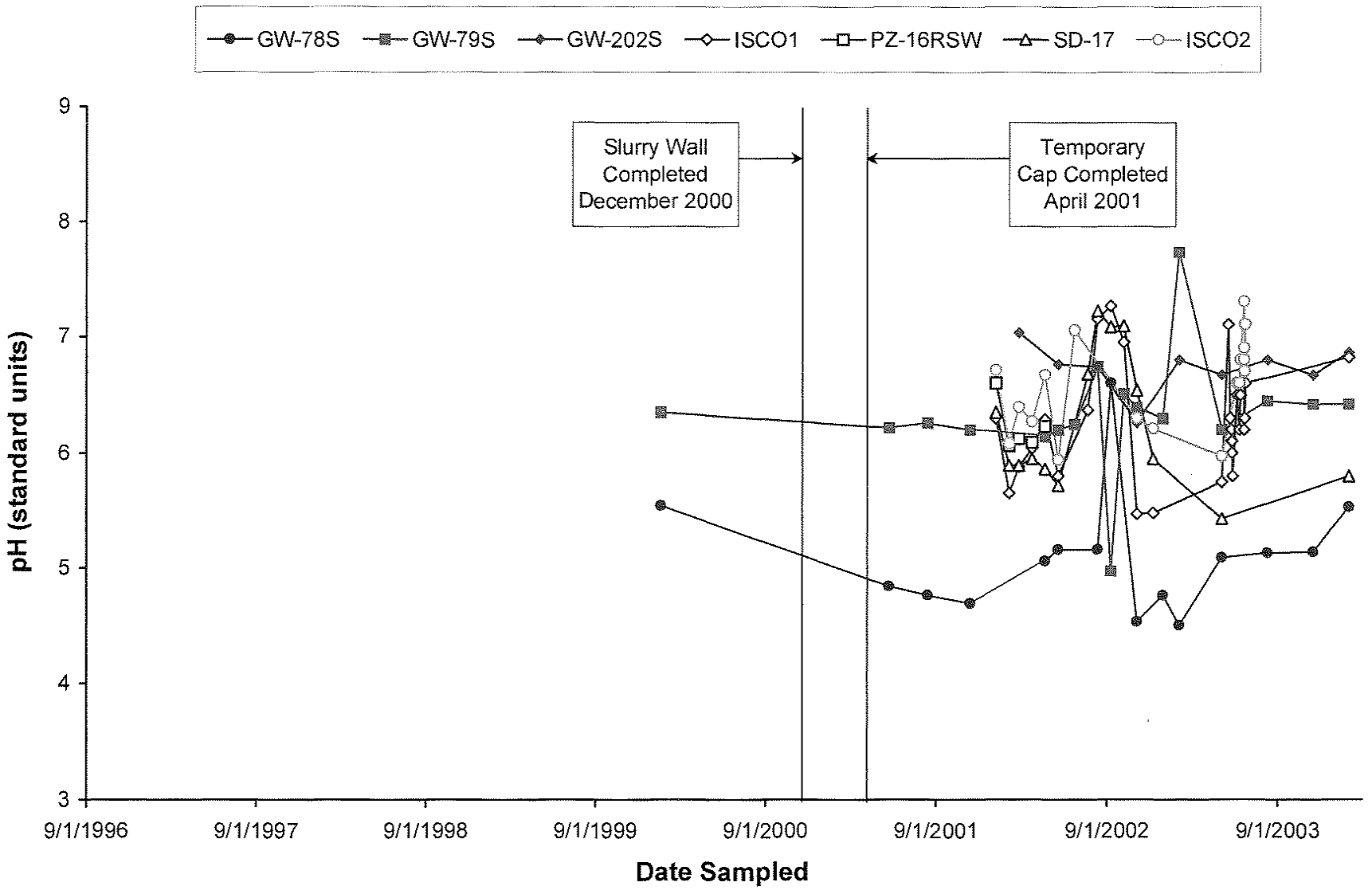
o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Dissolved Chromium S.fig)



Note: open symbol indicates surface water sample.

Generation Date: 8/30/04	Figure 28. Specific conductance in groundwater and surface water south of containment structure.	Geomega

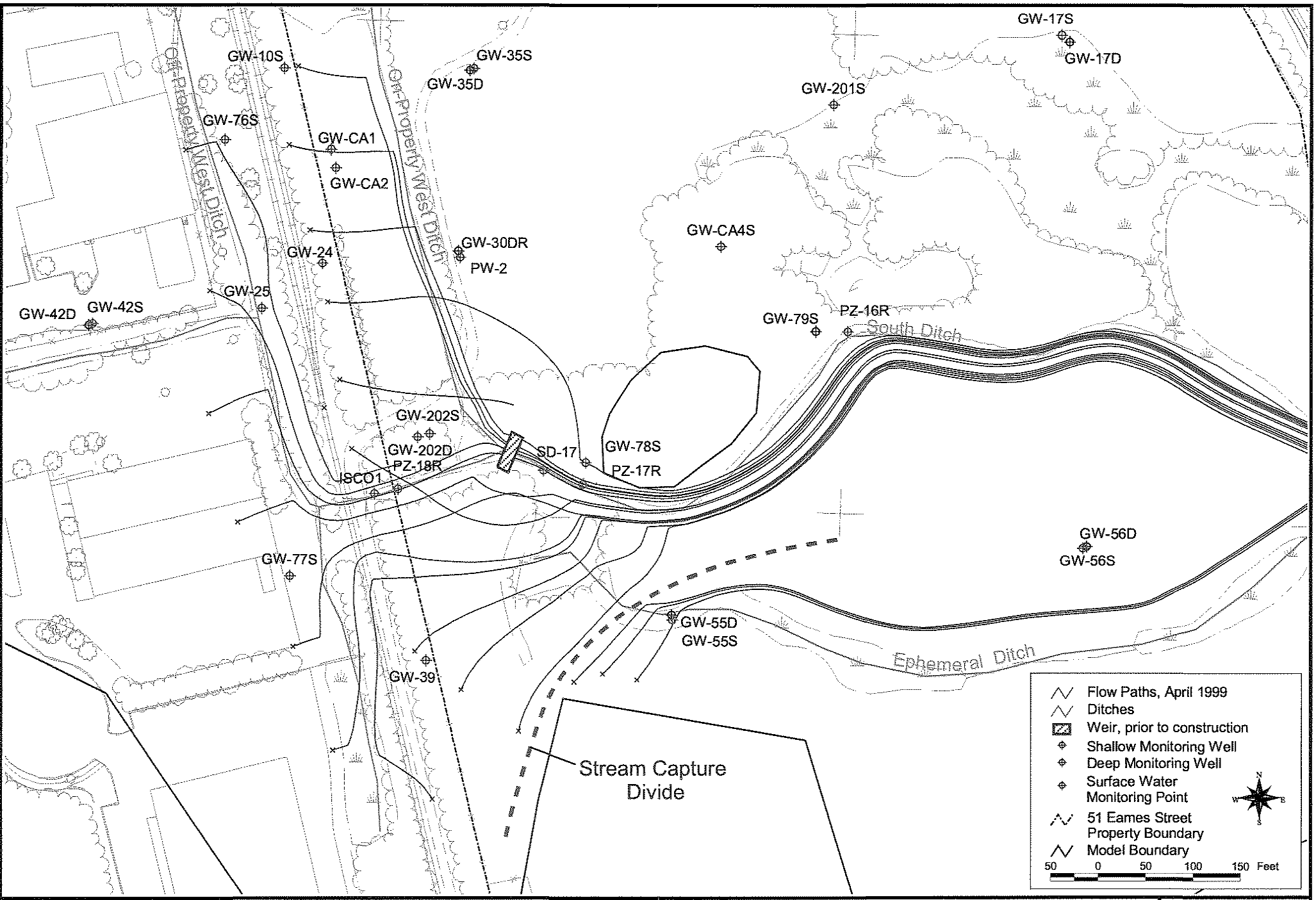
o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (Specific Conductance S.Fig)



Note: open symbol indicates surface water sample.

Generation Date: 8/30/04	Figure 29. pH in groundwater and surface water south of containment structure.	Geomega

o:\Olin\PCMP_SR#8\DATA\PCMP wells DAPL constituents SR#8.xls (pH S.Fig)

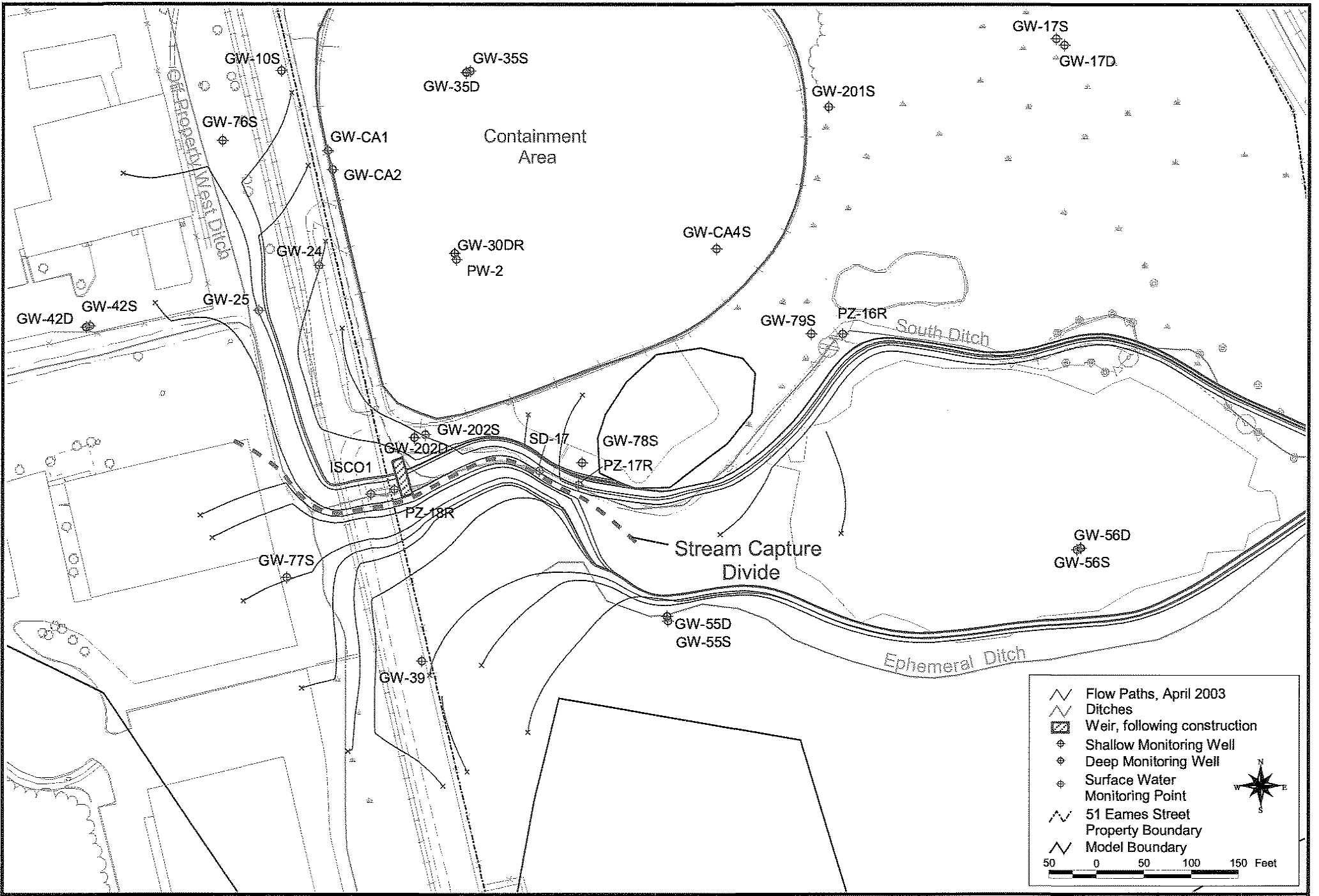


Generation Date: 8/30/04

Figure 30. Simulated flow paths near South Ditch prior to construction (April 1999).

Geomega

\\dm\k:\projects2\olin\pcmp_gndwat_2004.apr: feflow flowpaths april 1999 layout

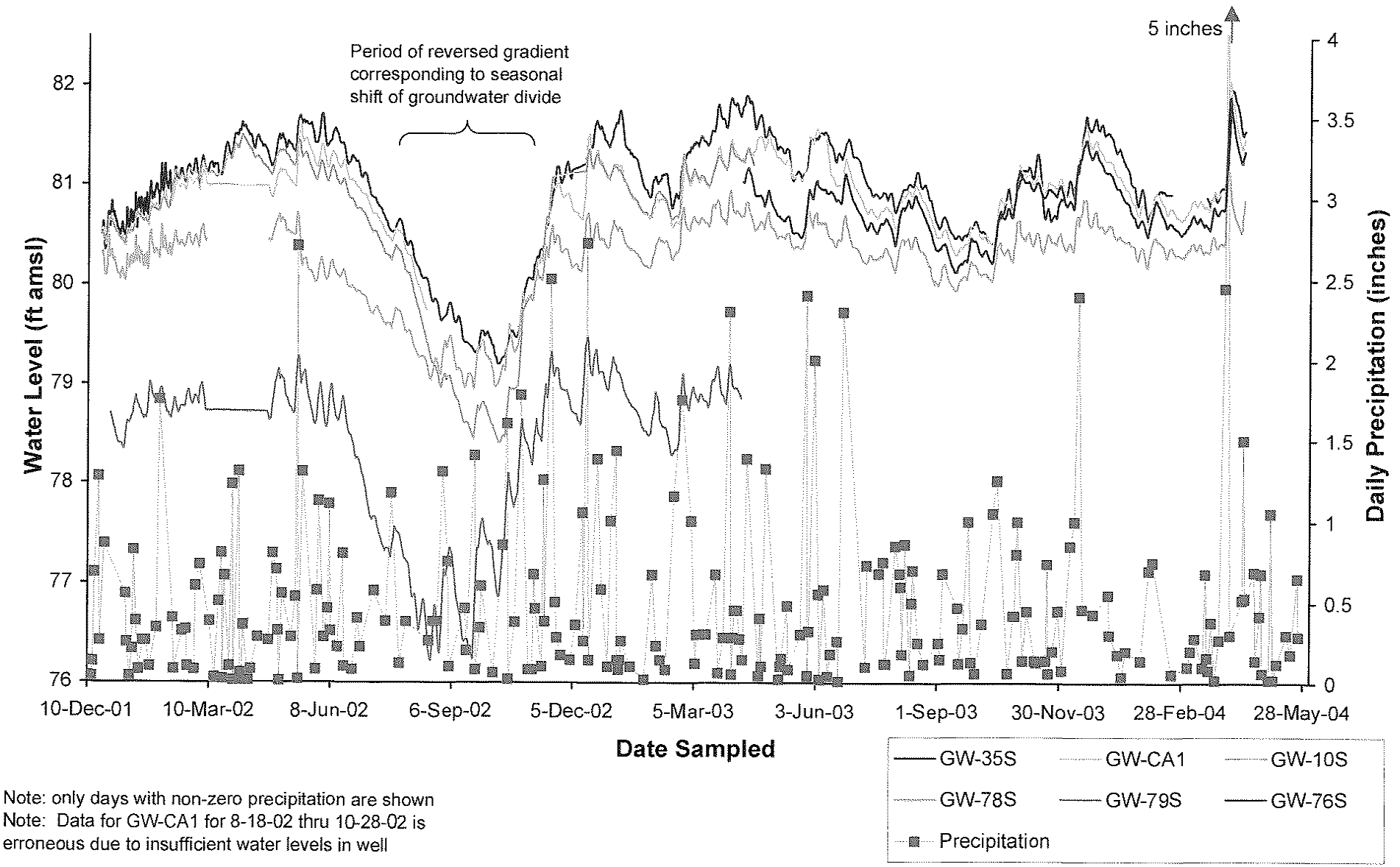


Generation Date: 8/30/04

Figure 31. Simulated flow paths near South Ditch post-construction (April 2003).

Geomega

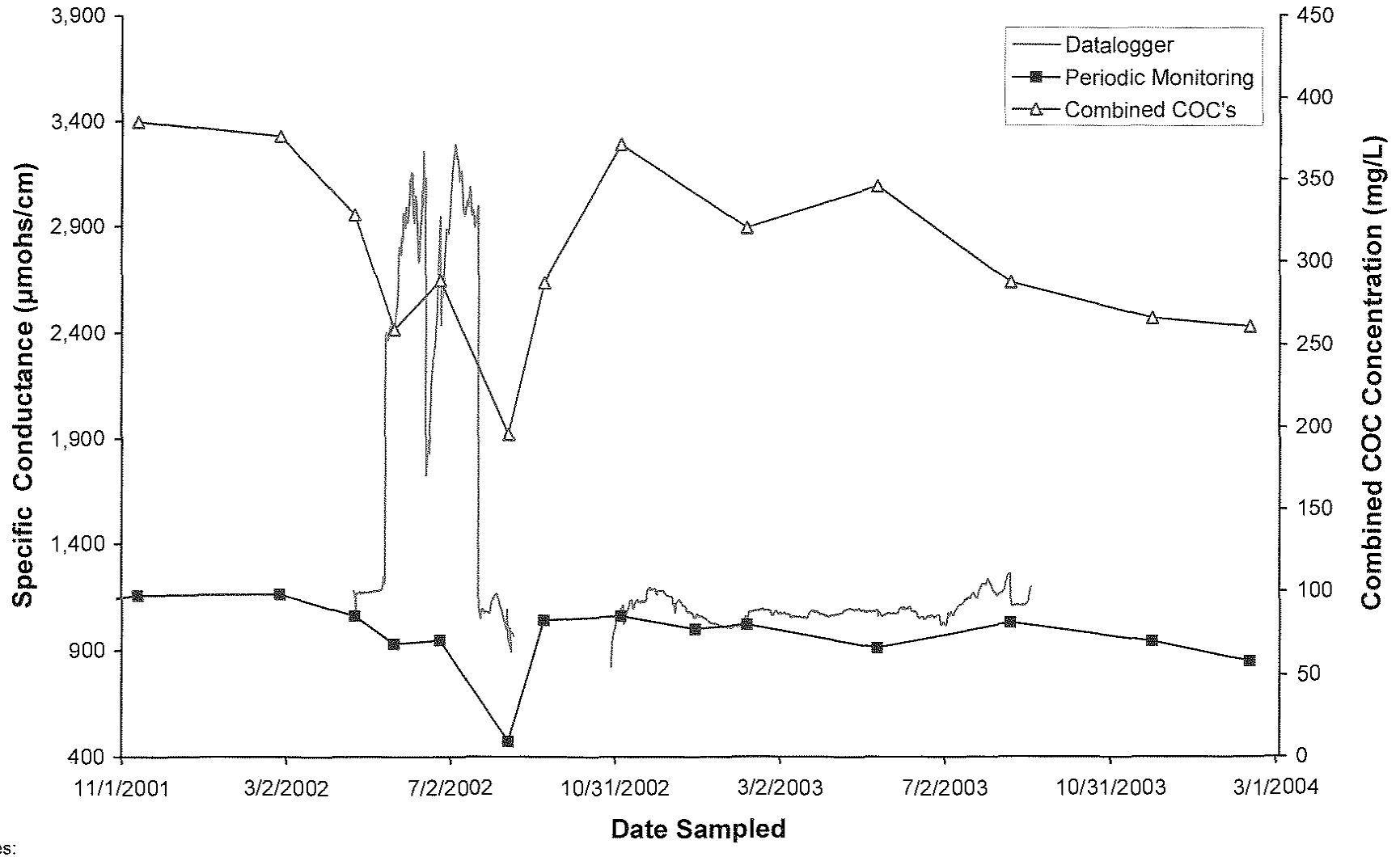
\\dmk:\projects2\olin\pcmp_gndwat_2004.apr: feflow flowpaths april 2003 layout



Note: only days with non-zero precipitation are shown
Note: Data for GW-CA1 for 8-18-02 thru 10-28-02 is erroneous due to insufficient water levels in well

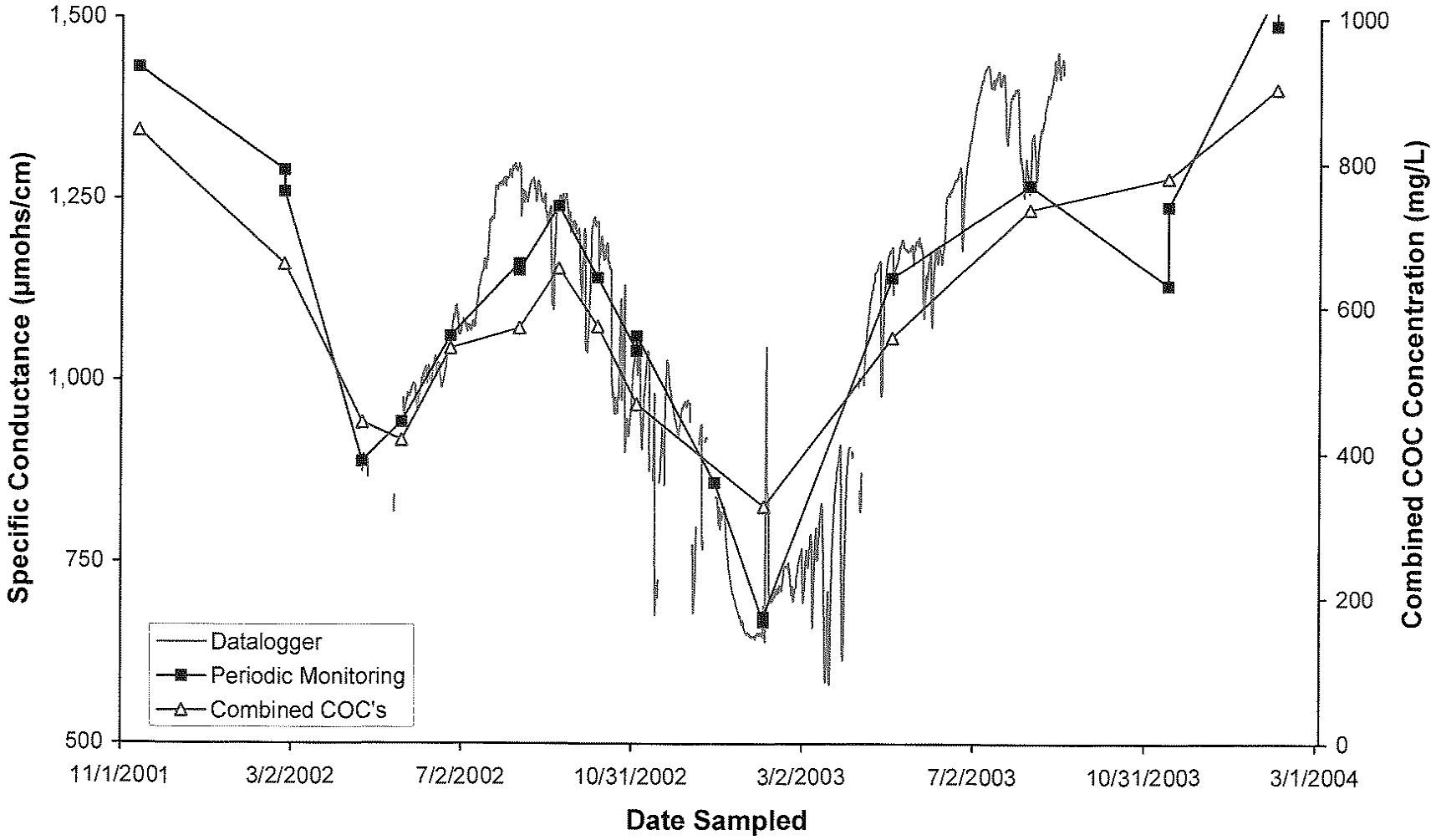
Generation Date: 8/30/04	Figure 32. Precipitation and water levels at instrumented wells.	Geomega

o:\Olin\PCMP_SR#8\DATA\correlation of logger data to precip SR#8.xls (Precip Fig-smooth)



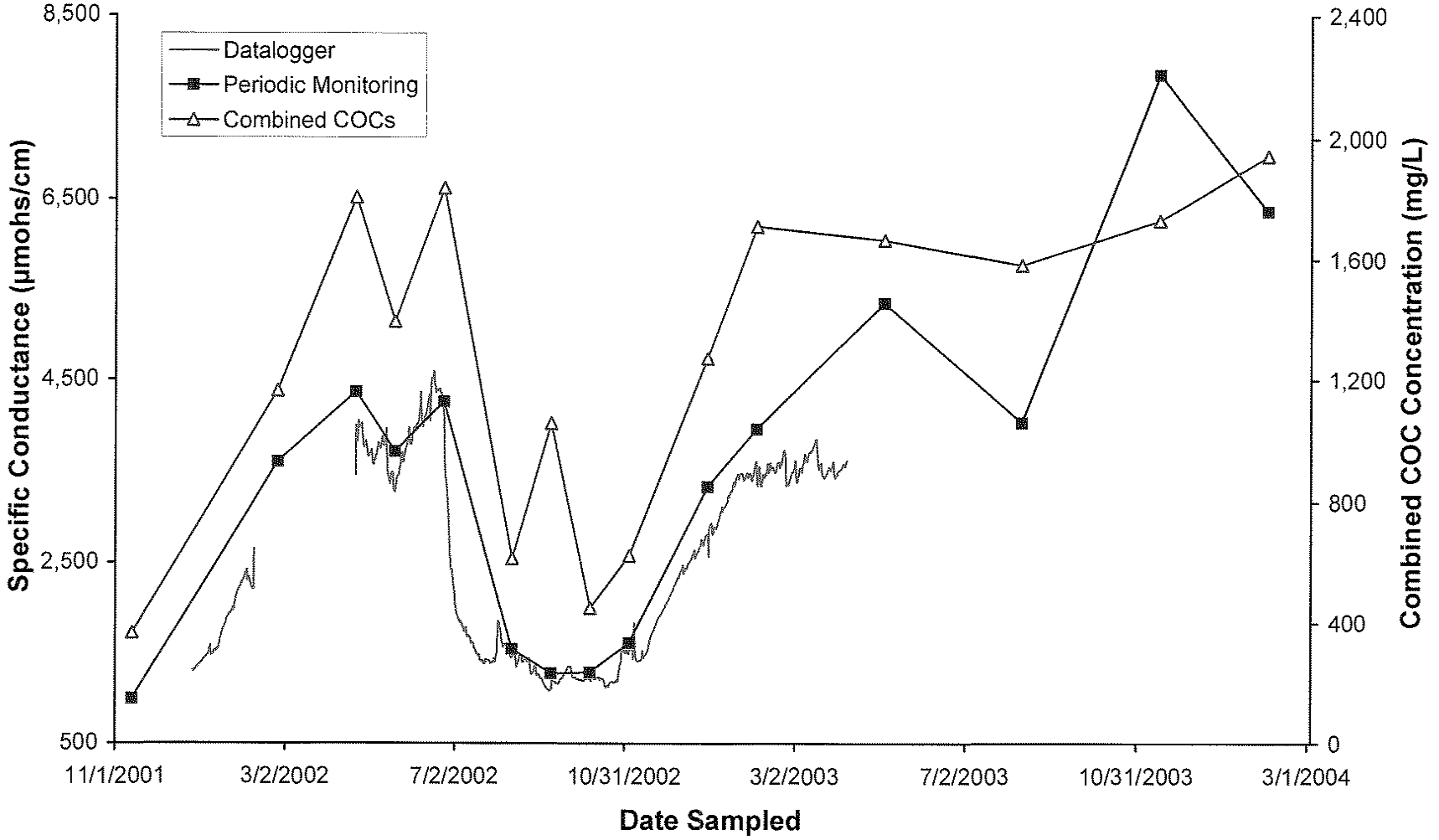
Notes:
1) Combined COCs = sum of ammonia, chloride, sulfate and chromium concentrations
2) Datalogger measurements are corrected to reference temperature (25°C)
3) 8-18-02 thru 10-28-02 data is erroneous due to insufficient water level in well

Generation Date: 8/30/04	Figure 33. Specific conductance and combined COCs at GW-CA1.	Geomega



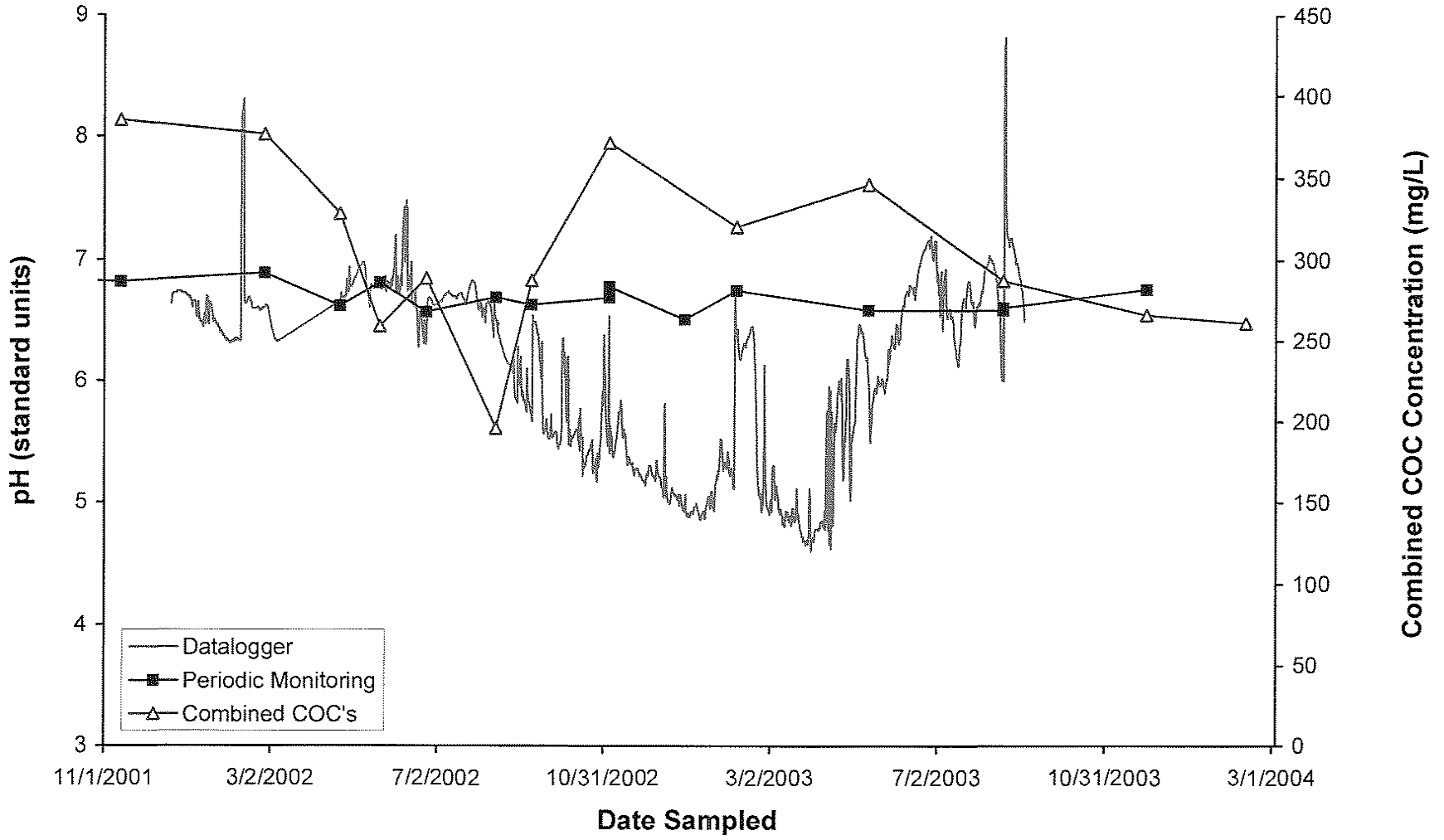
Notes:
1) Combined COCs = sum of ammonia, chloride, sulfate and chromium concentrations
2) Datalogger measurements are corrected to reference temperature (25°C)

Generation Date: 8/30/04	Figure 34. Specific conductance and combined COCs at GW-78S	Geomega



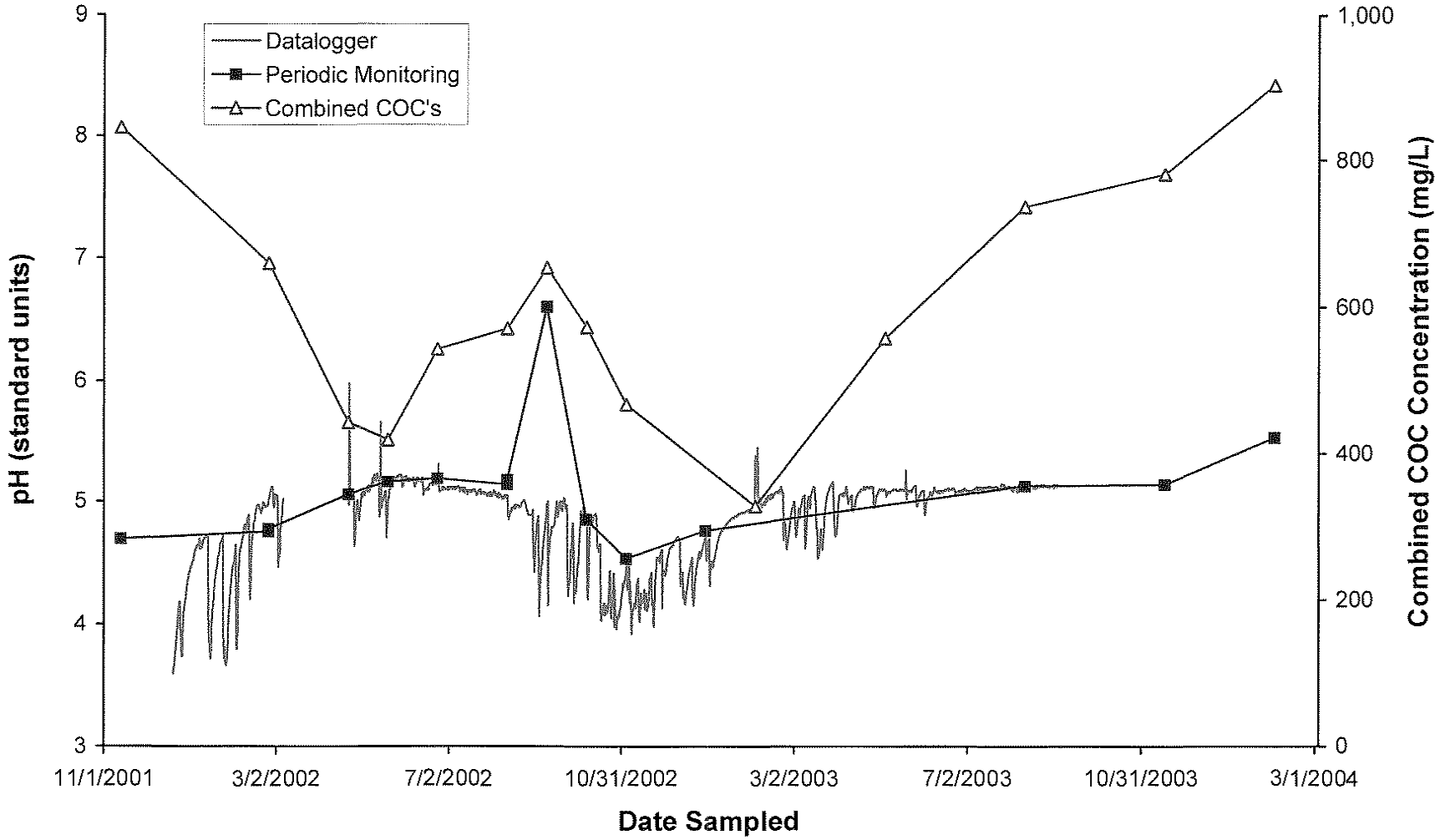
Notes:
1) Combined COCs = sum of ammonia, chloride, sulfate and chromium concentrations
2) Datalogger measurements are corrected to reference temperature (25°C)

Generation Date: 8/30/04	Figure 35. Specific conductance and combined COCs at GW-79S	Geomega



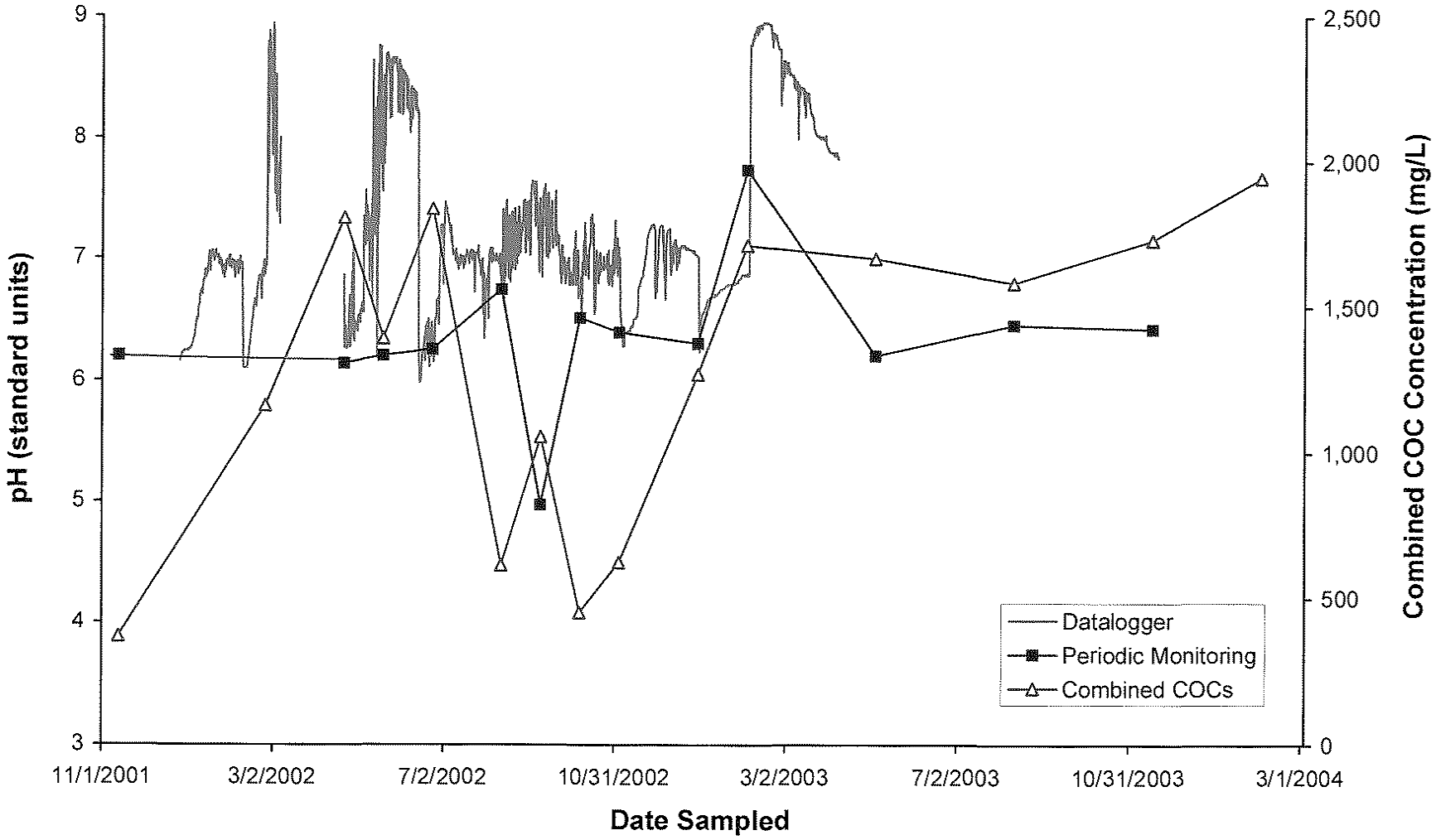
Note: Combined COCs = sum of ammonia, chloride, sulfate and chromium concentrations

Generation Date: 8/30/04	Figure 36. pH and combined COCs at GW-CA1.	Geomega



Note: Combined COCs = sum of ammonia, chloride, sulfate and chromium concentrations

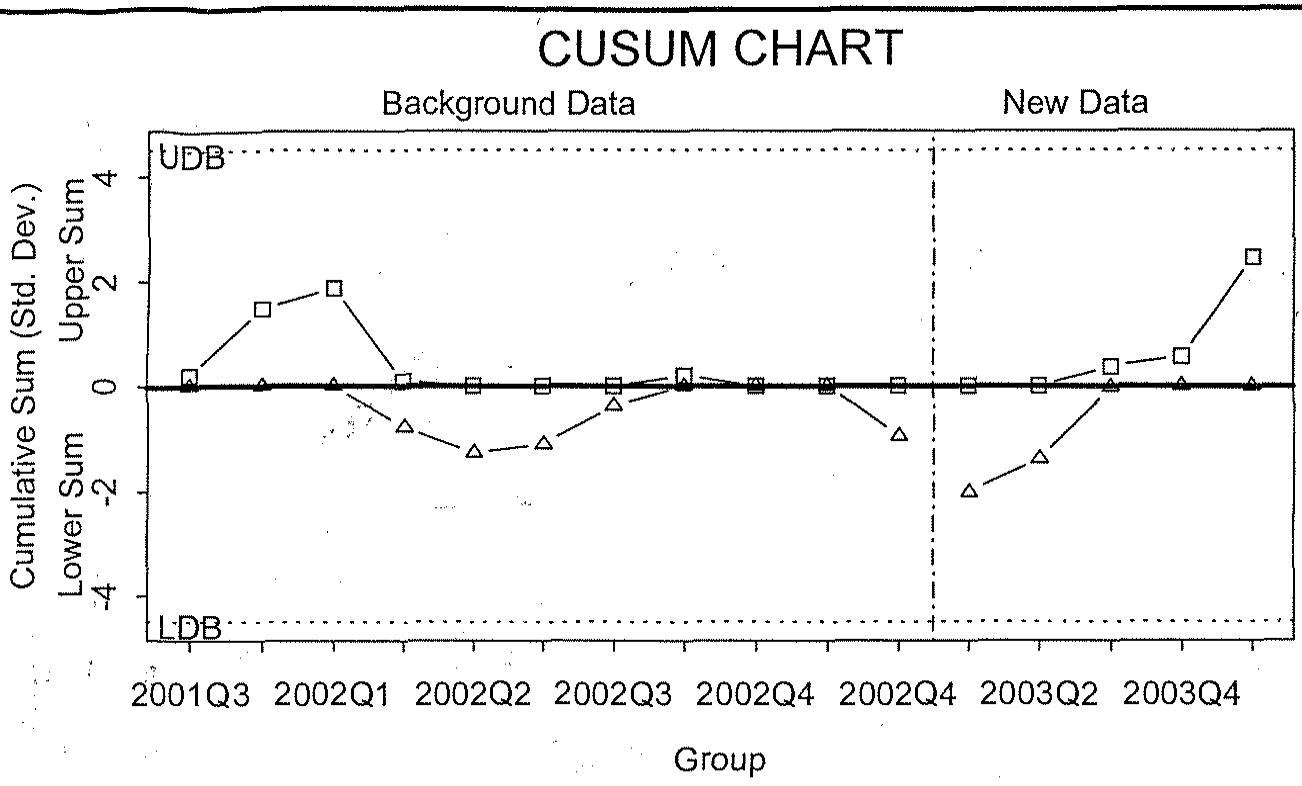
Generation Date: 8/30/04	Figure 37. pH and combined COCs at GW-78S.	Geomega

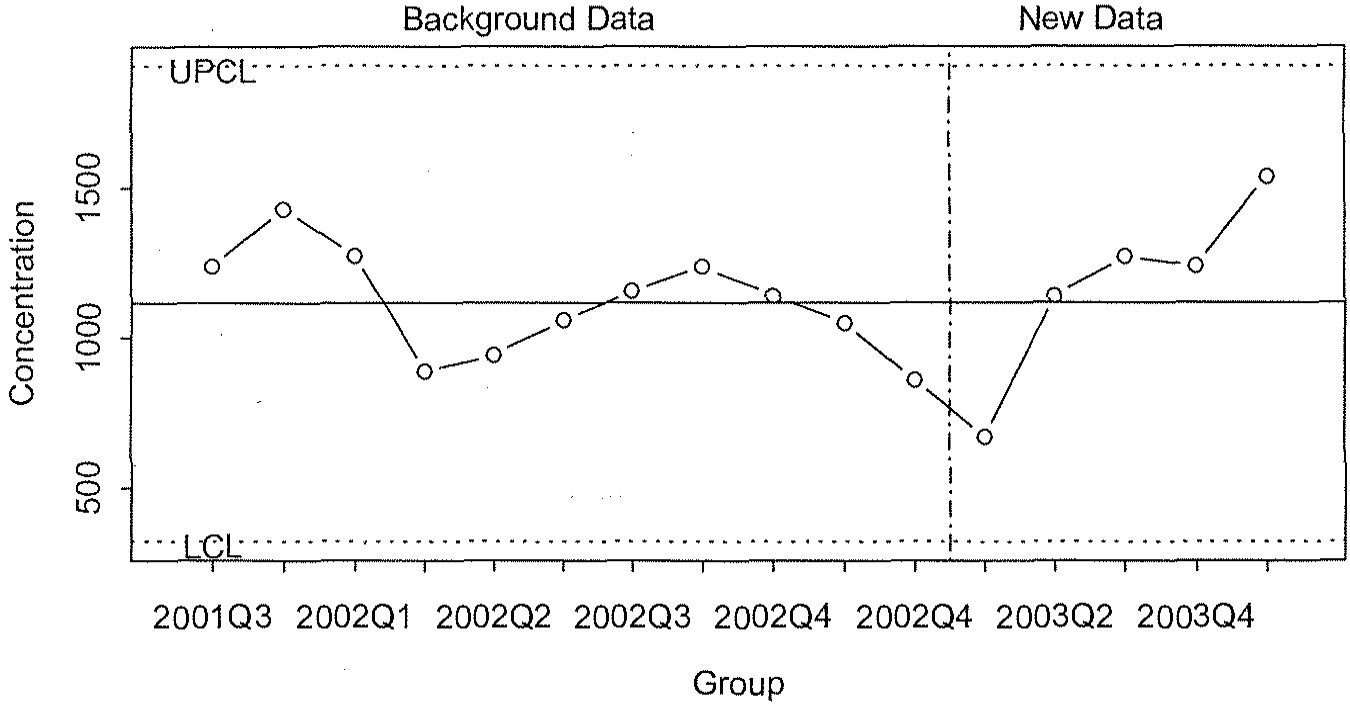


Note: Combined COCs = sum of ammonia, chloride, sulfate and chromium concentrations

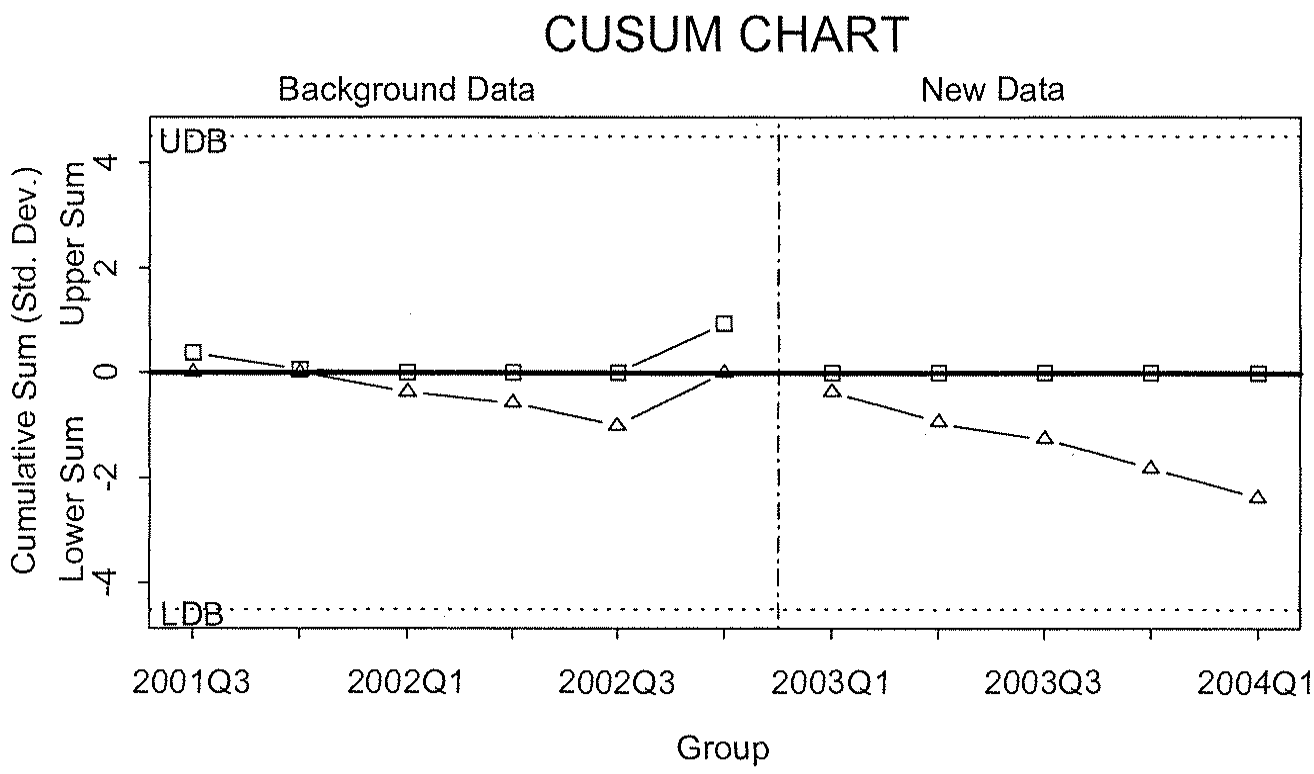
Generation Date: 8/30/04	Figure 38. pH and combined COCs at GW-79S.	Geomega

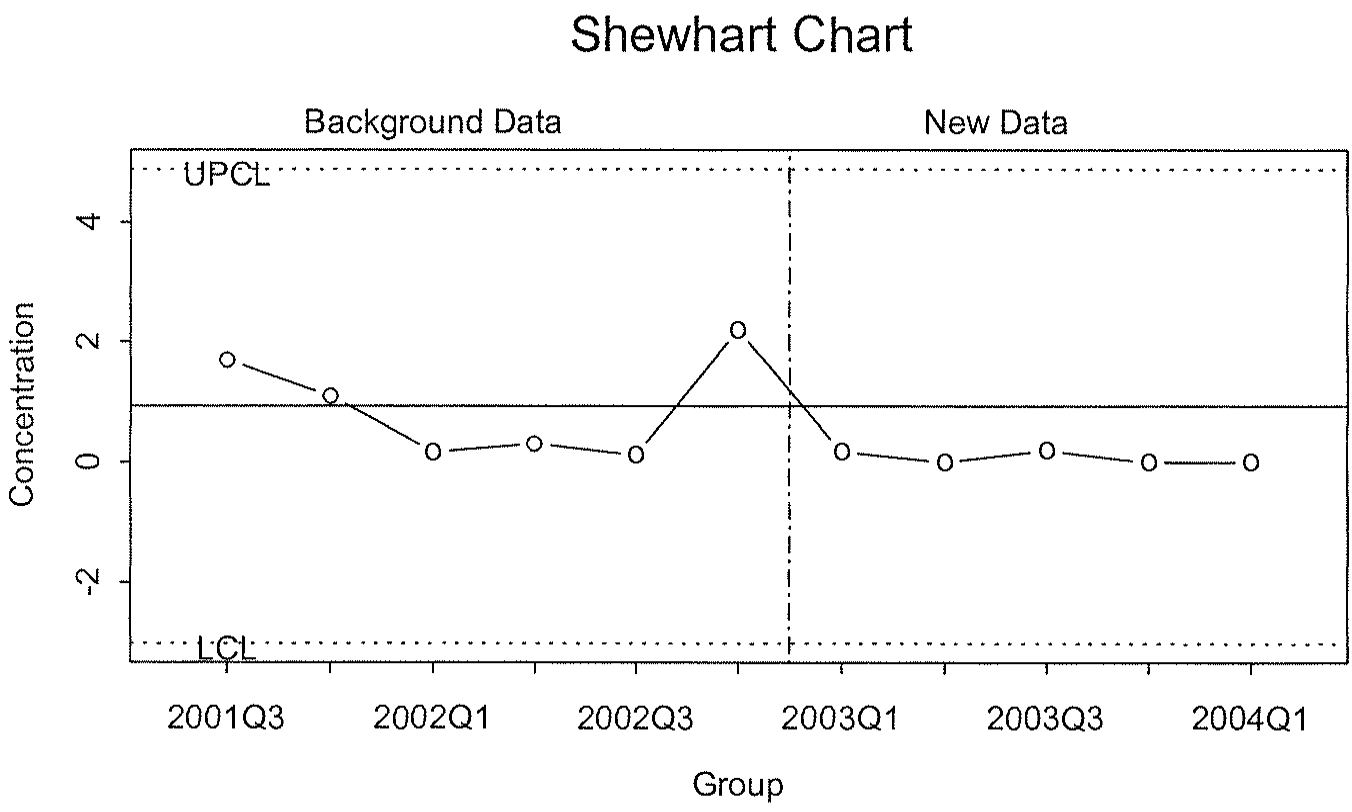
Appendix A





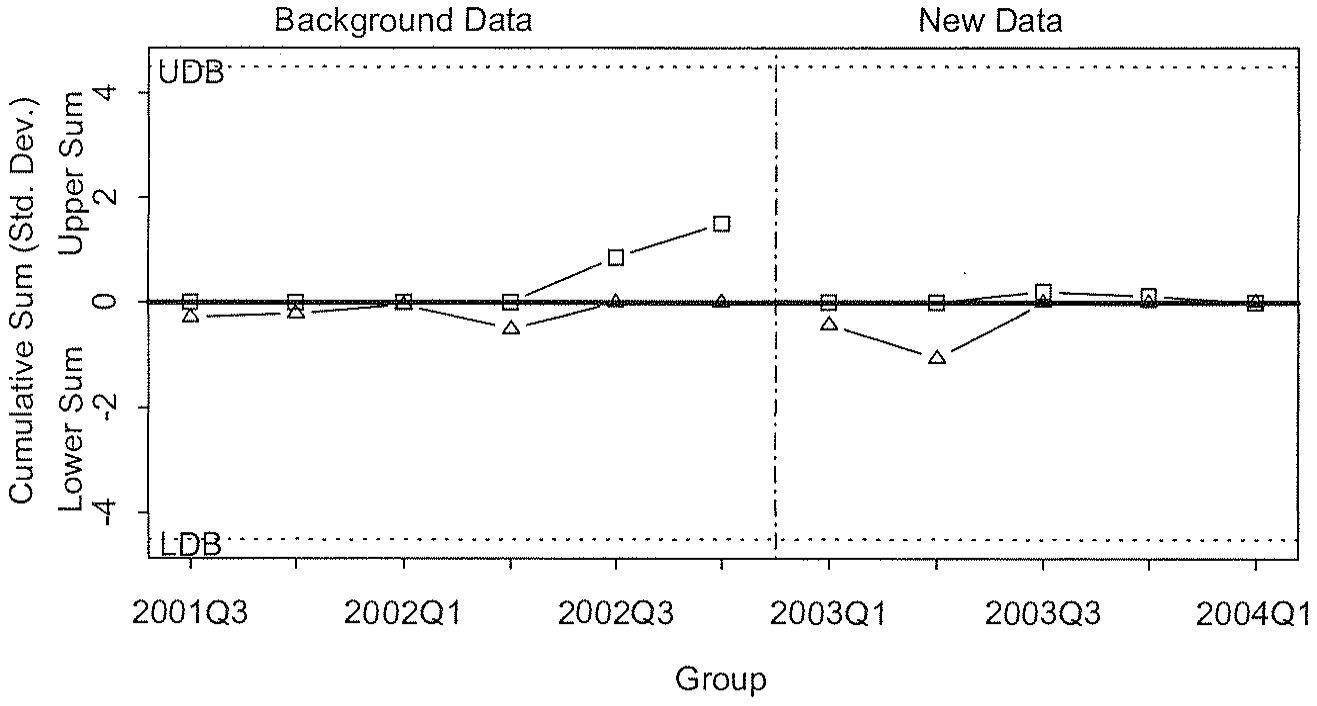
GENERATION DATE: 06/15/04	GW-78S Specific Conductance umhos/cm	Geomega



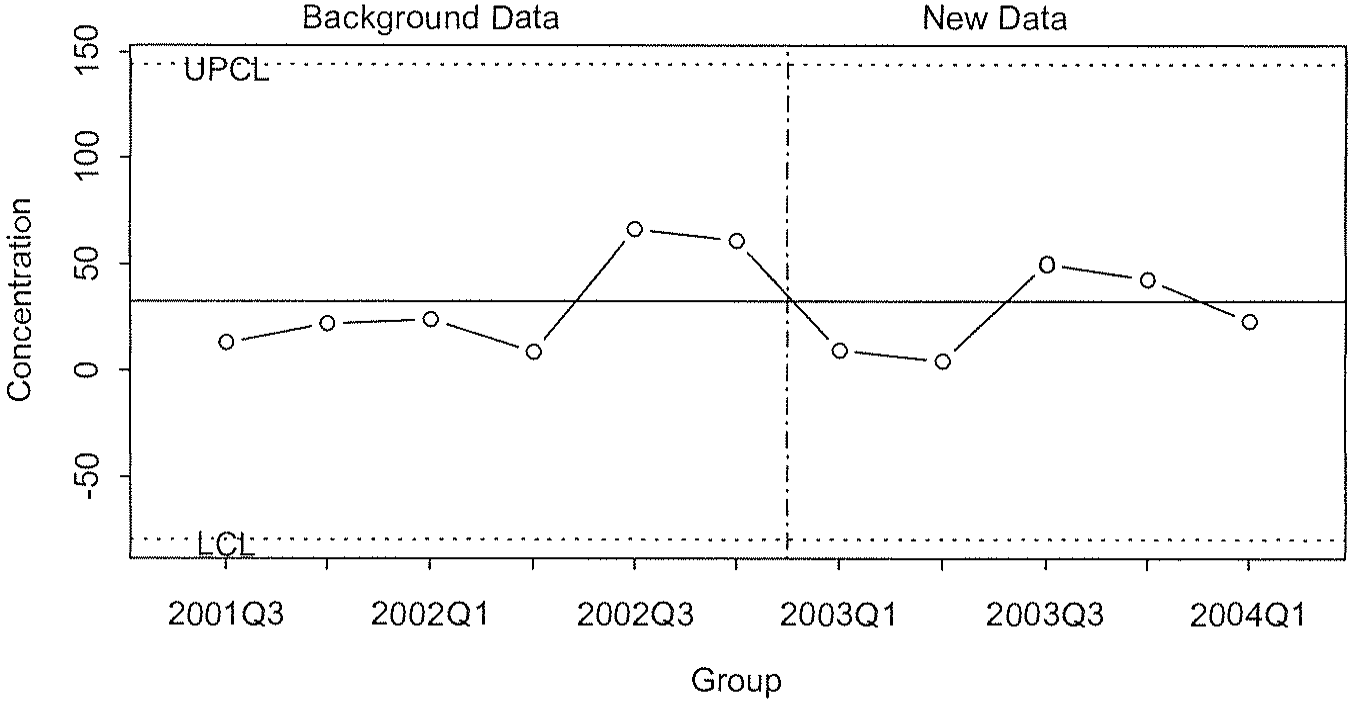


GENERATION DATE: 06/15/04	GW-10S Ammonia mg/l	Geomega

CUSUM CHART

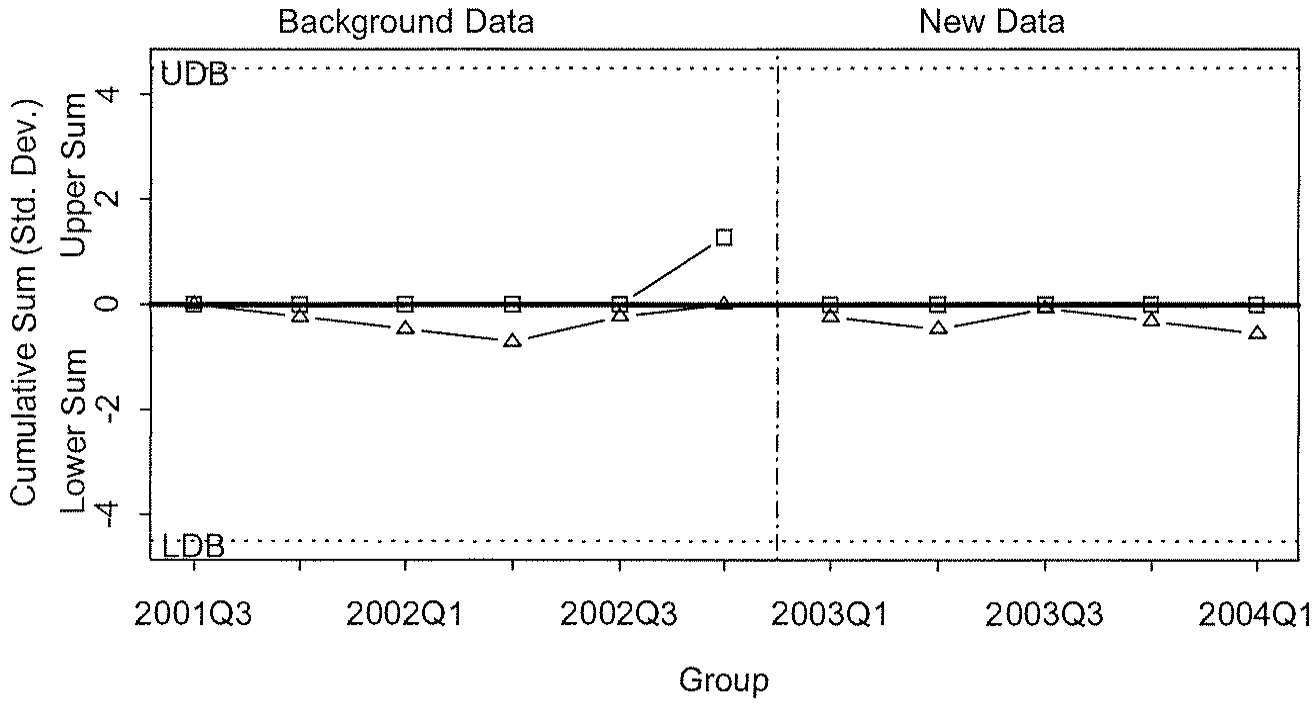


Shewhart Chart



GENERATION DATE: 06/15/04	GW-10S Chloride mg/l	Geomega

CUSUM CHART



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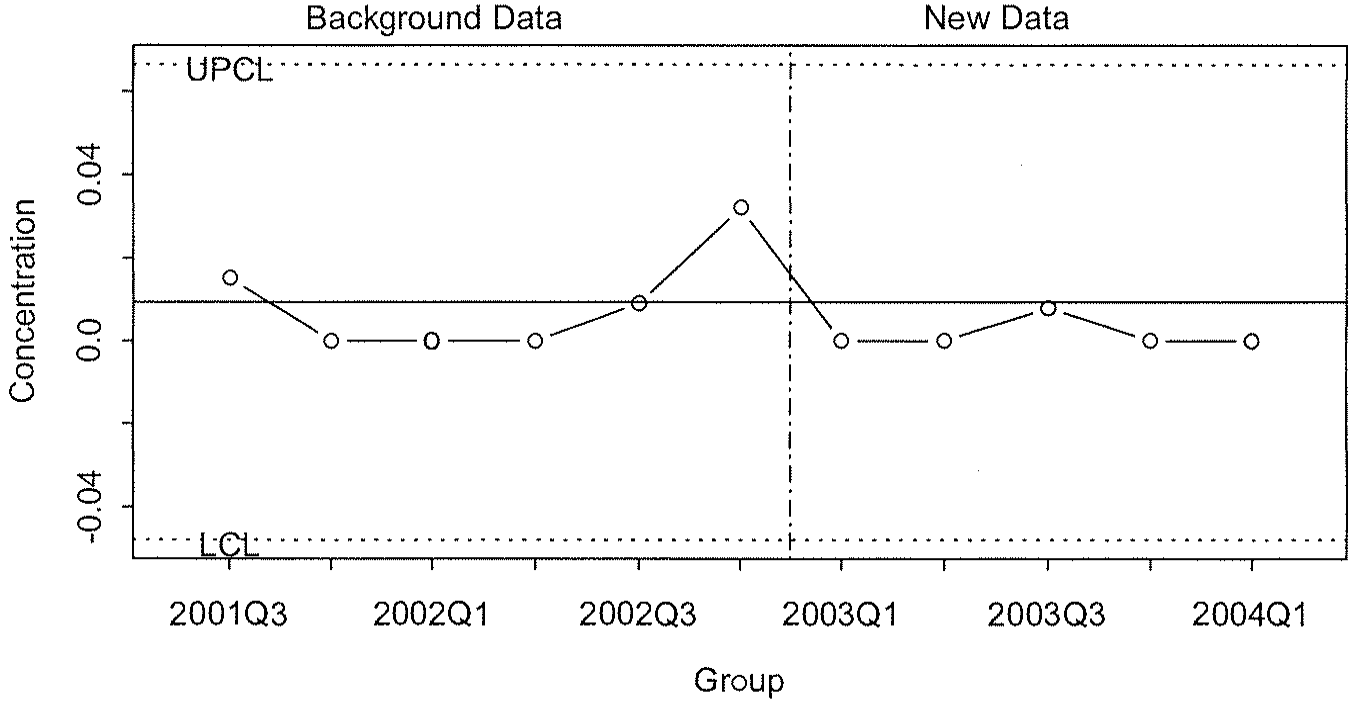
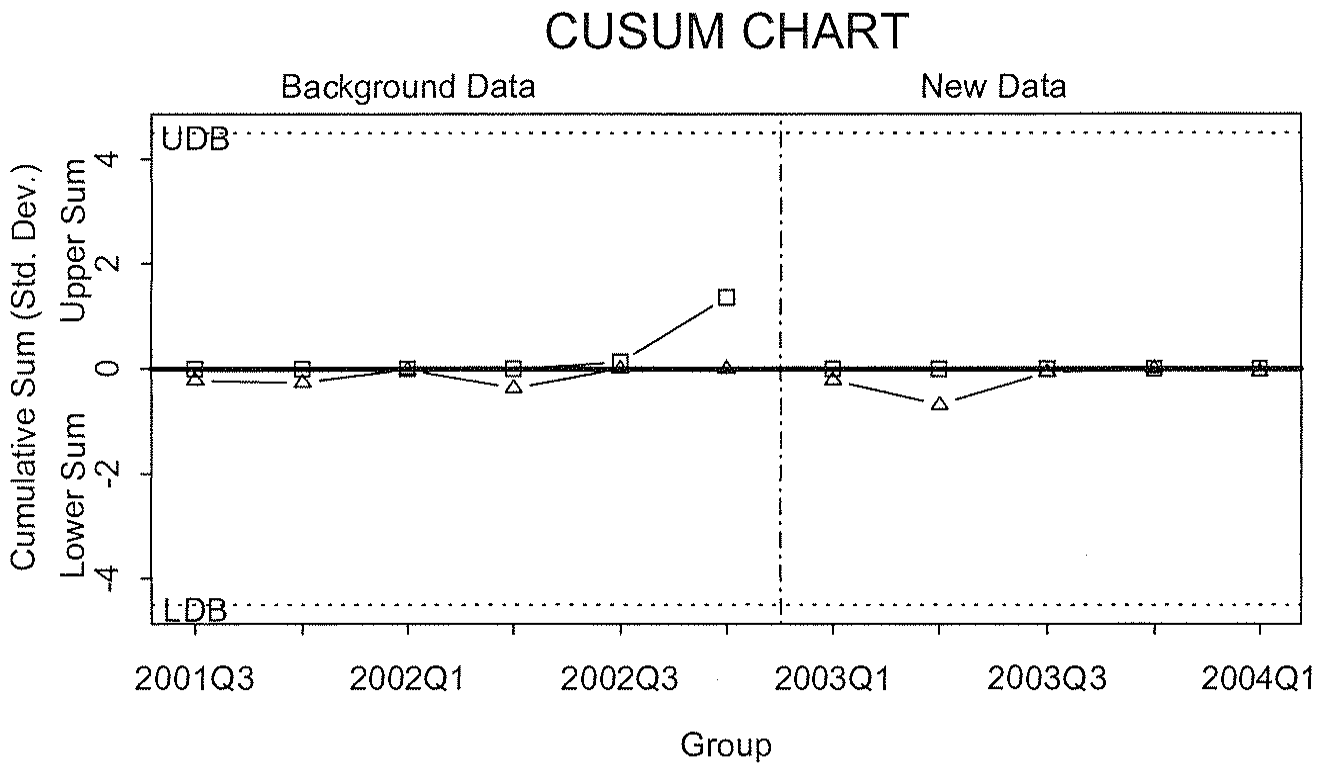
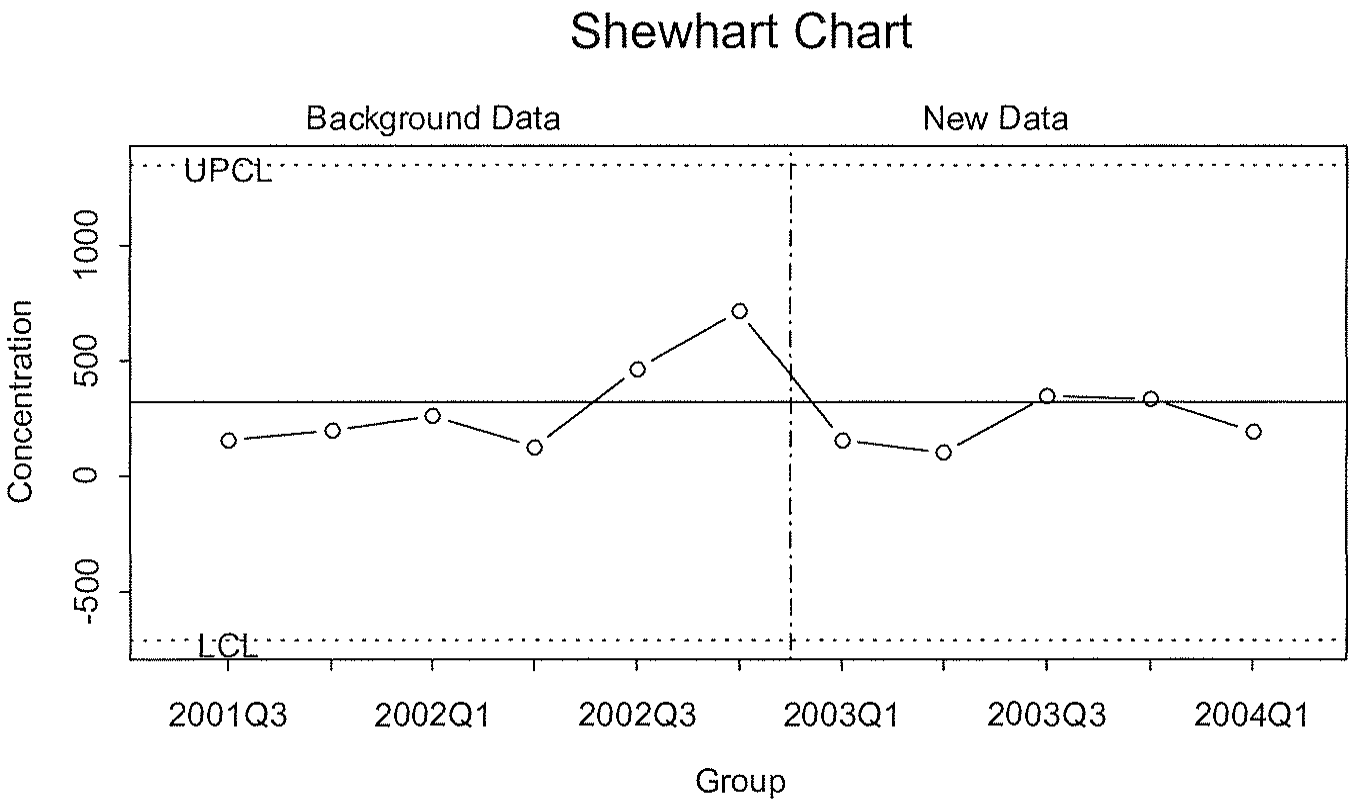
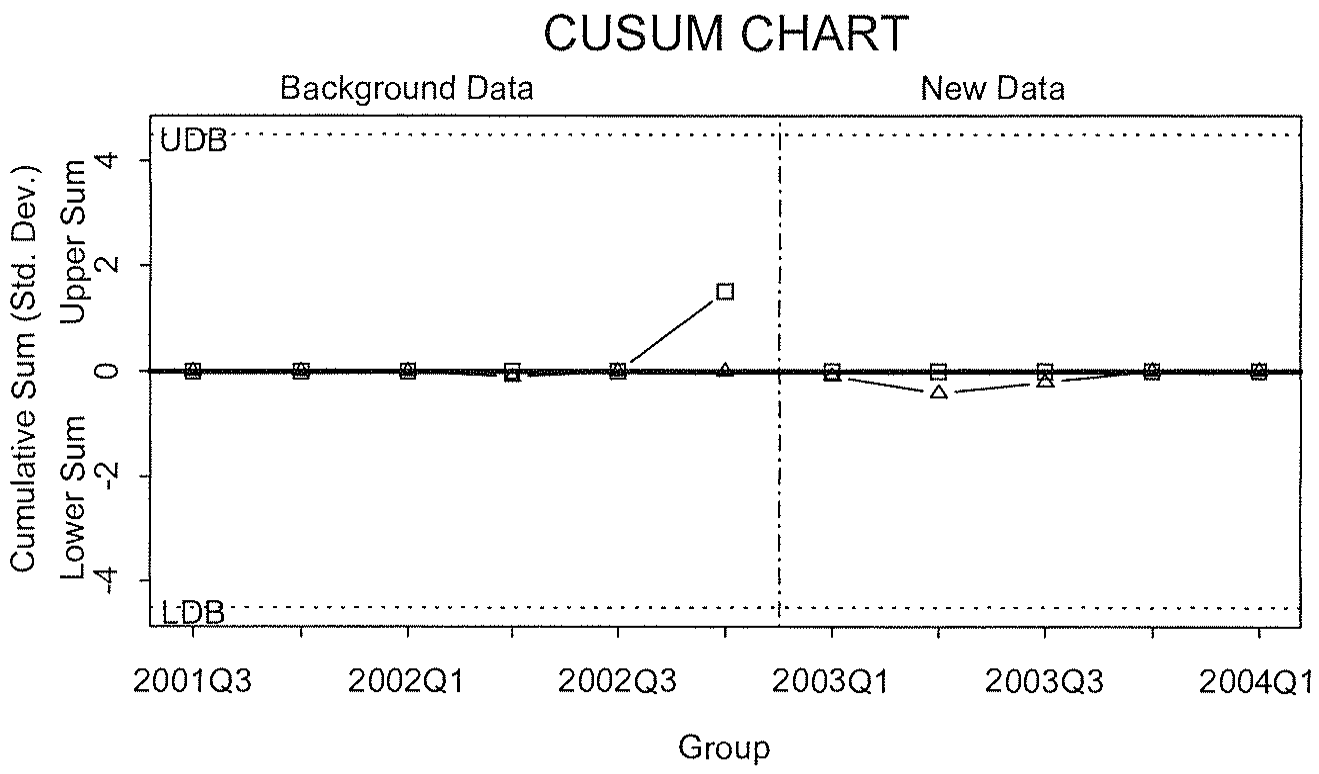


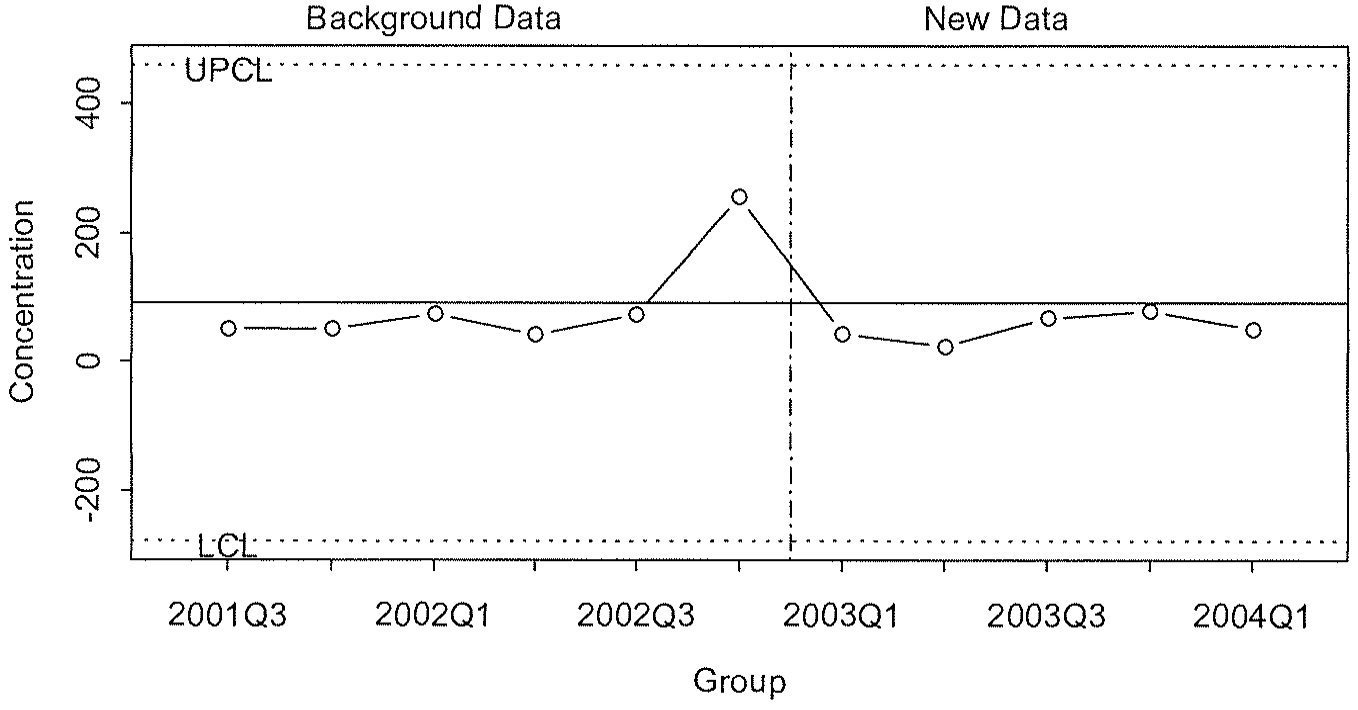
GENERATION DATE: 06/15/04	GW-10S Chromium, Dissolved mg/l	Geomega



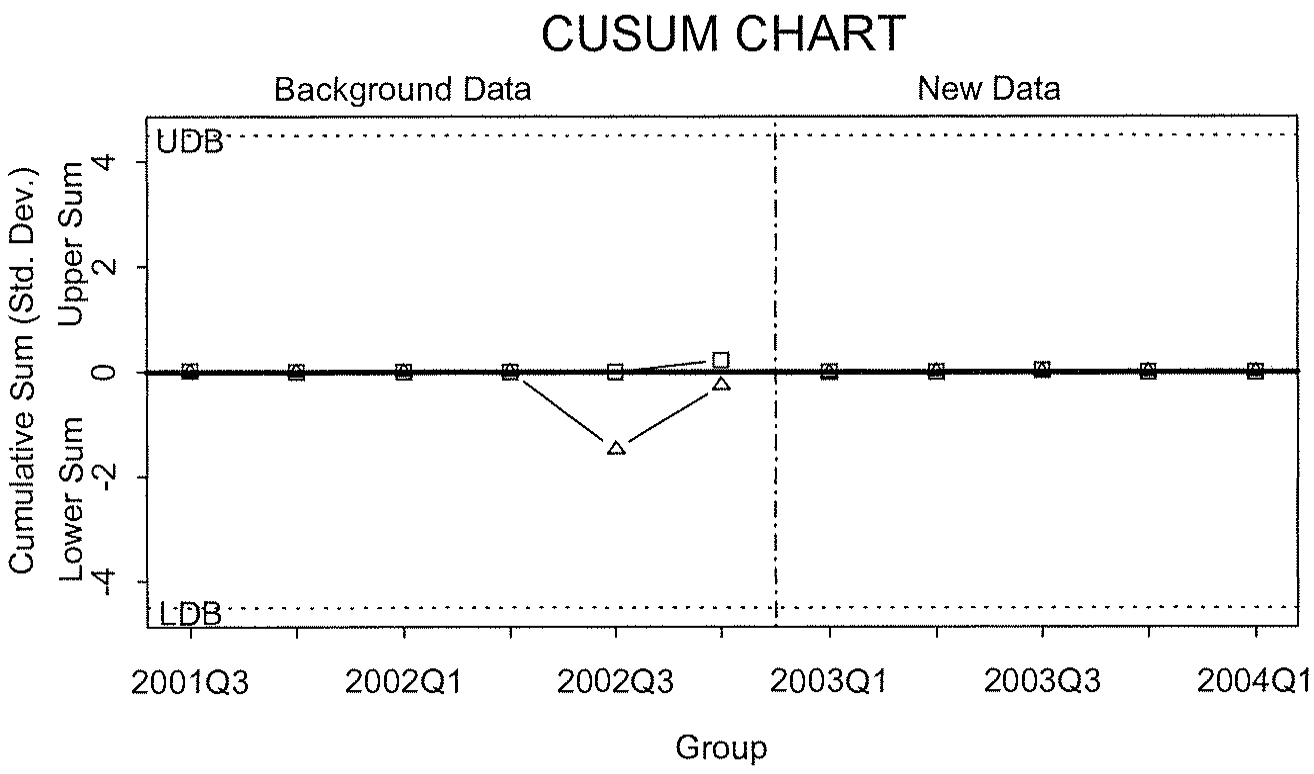


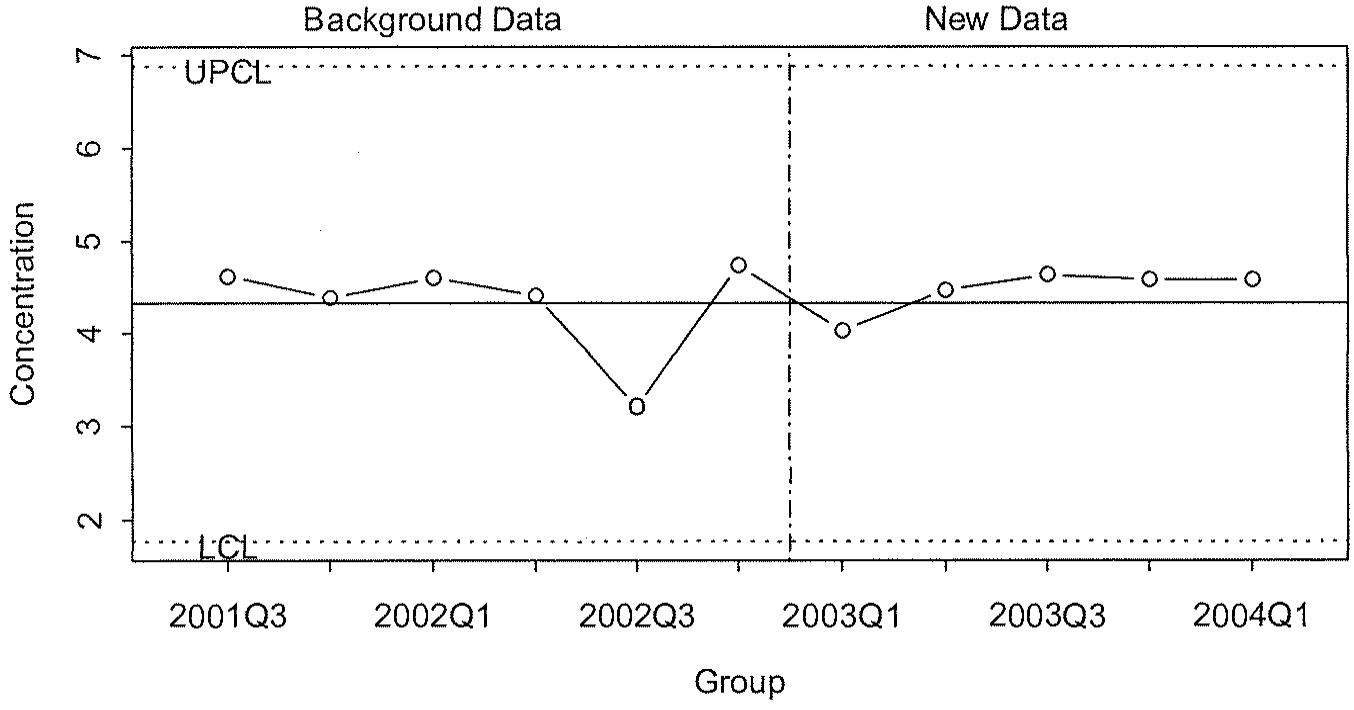
GENERATION DATE: 06/15/04	GW-10S Specific Conductance umhos/cm	Geomega



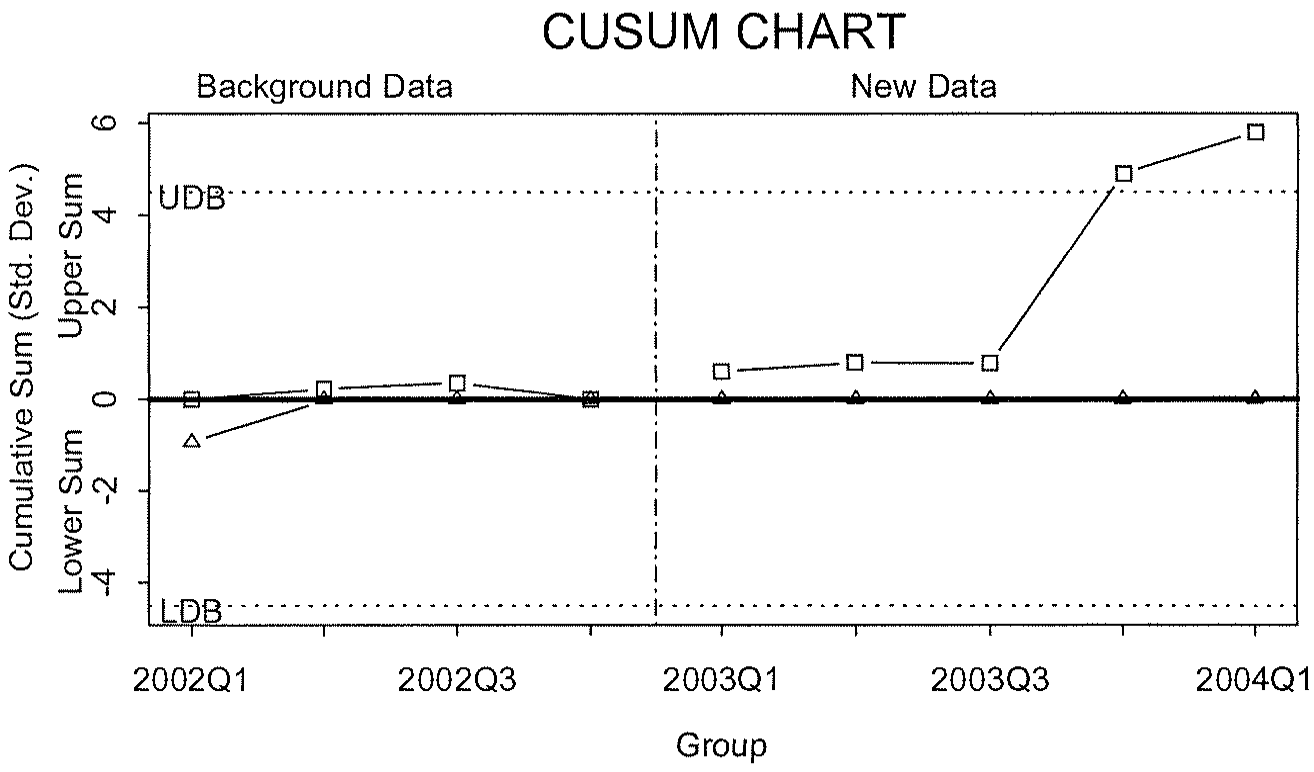


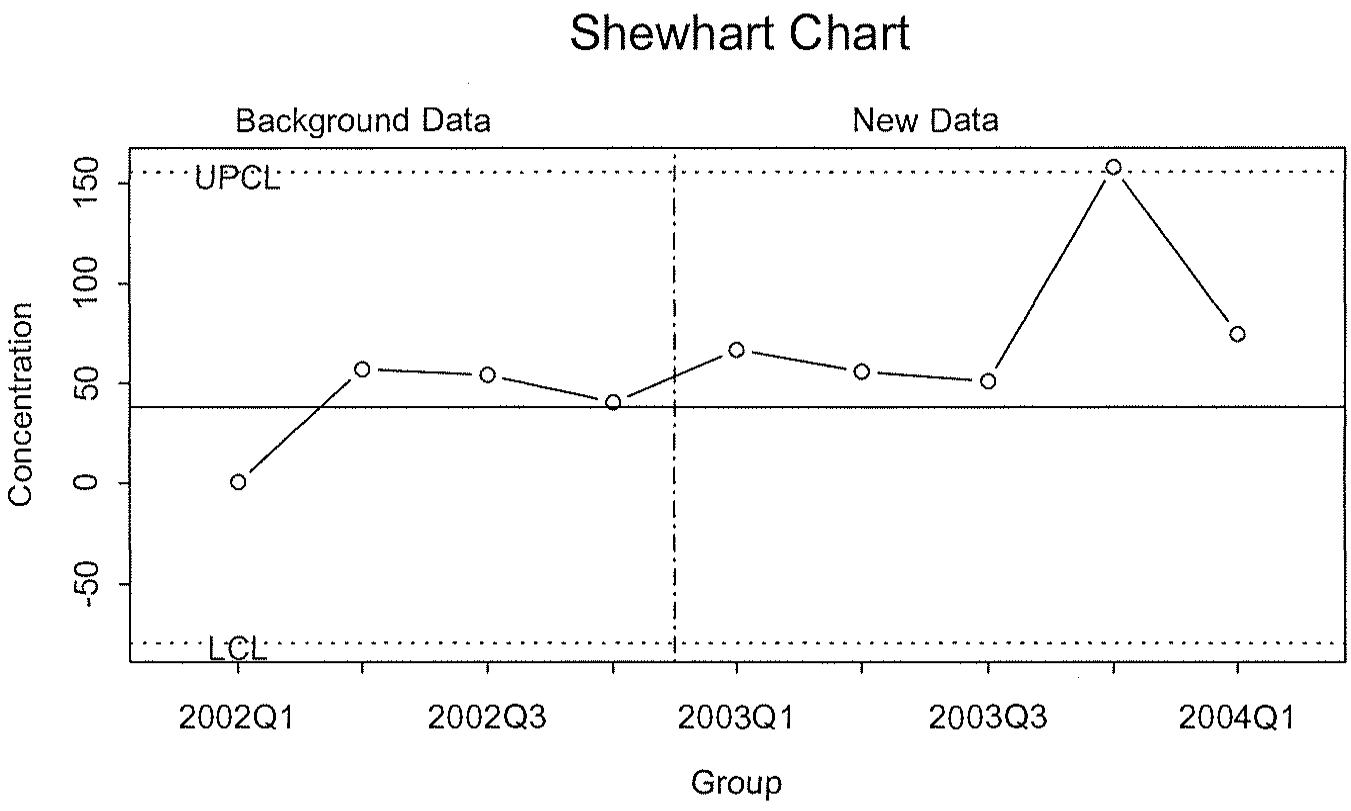
GENERATION DATE: **06/15/04**	GW-10S Sulfate mg/l	Geomega



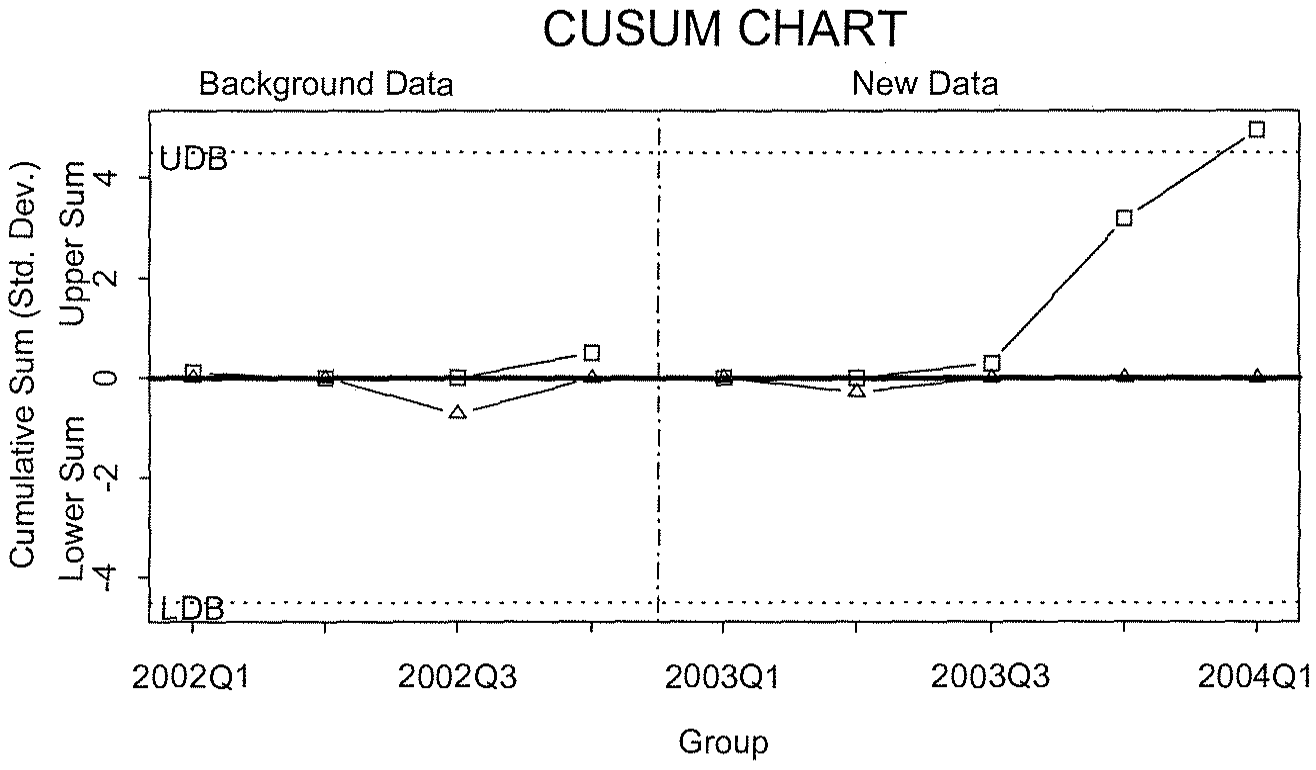


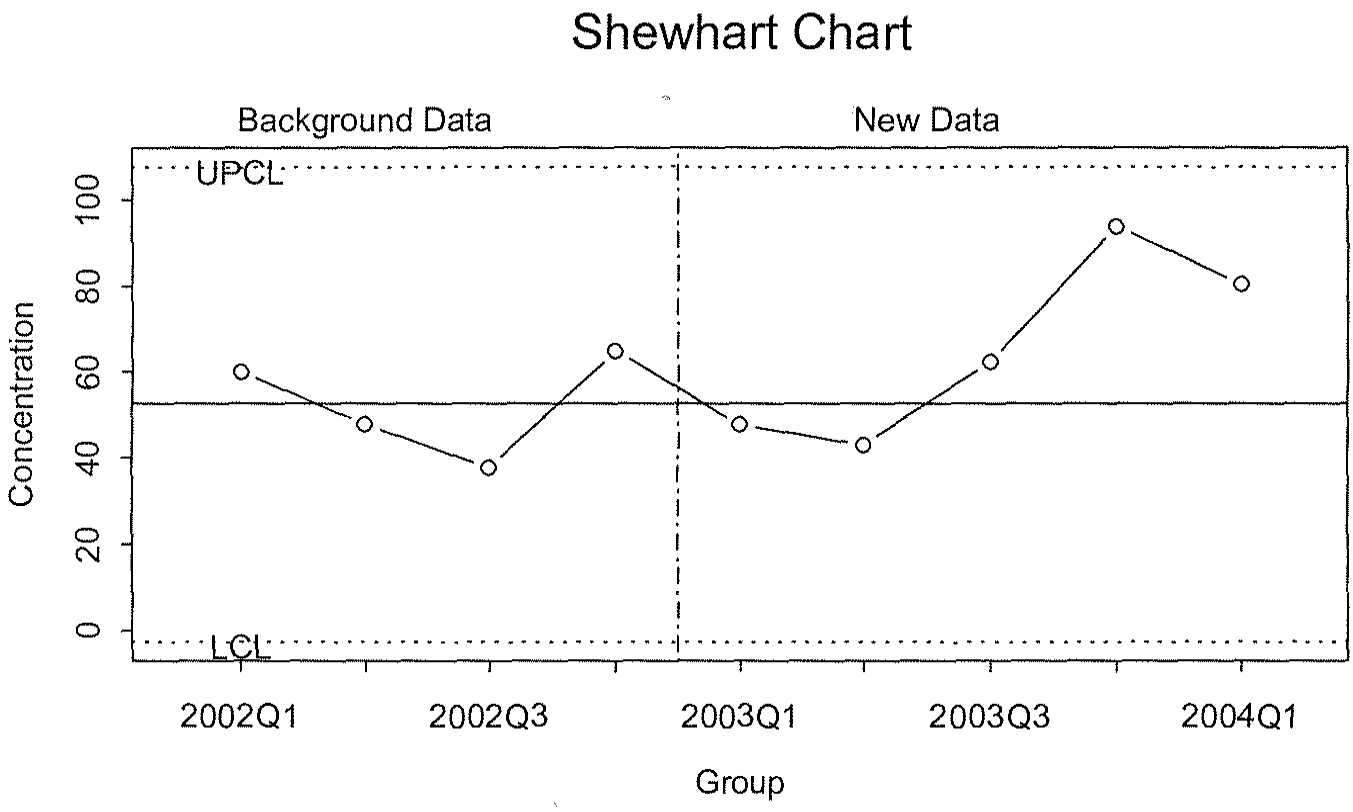
GENERATION DATE: 06/15/04	GW-10S pH mg/l	Geomega





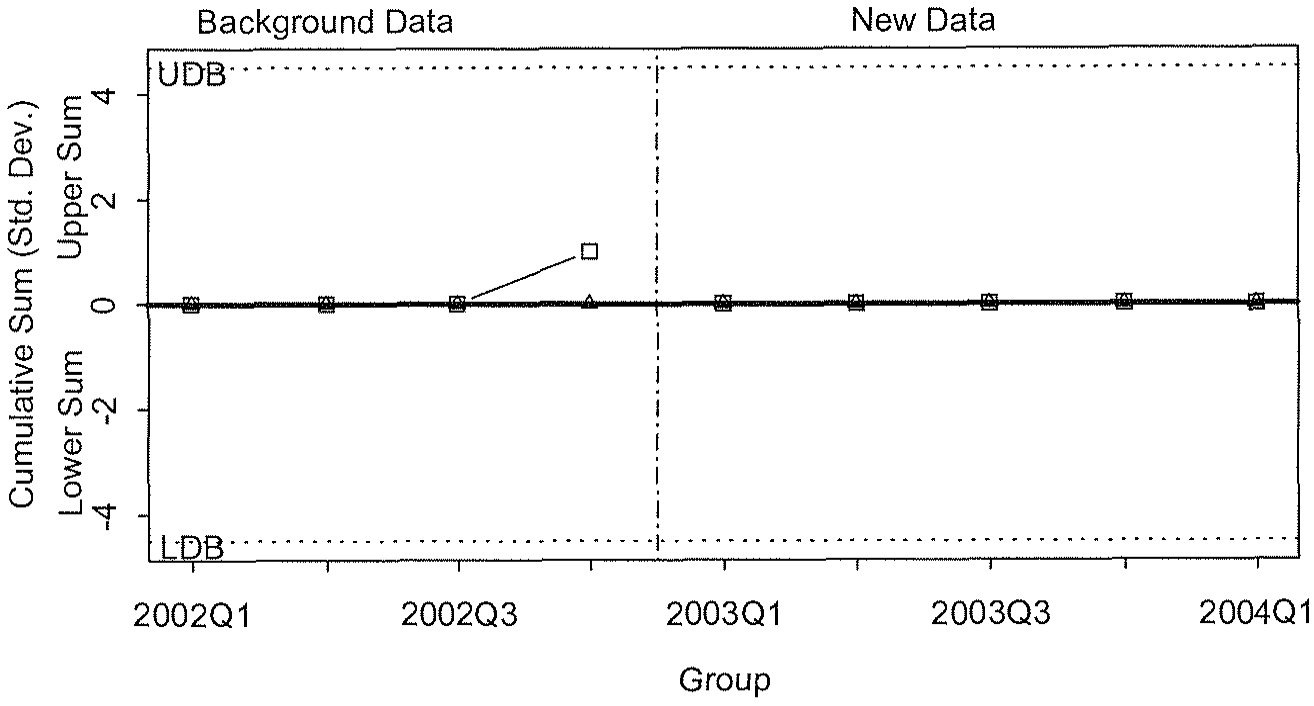
GENERATION DATE: 06/15/04	GW-202S Ammonia mg/l	Geomega



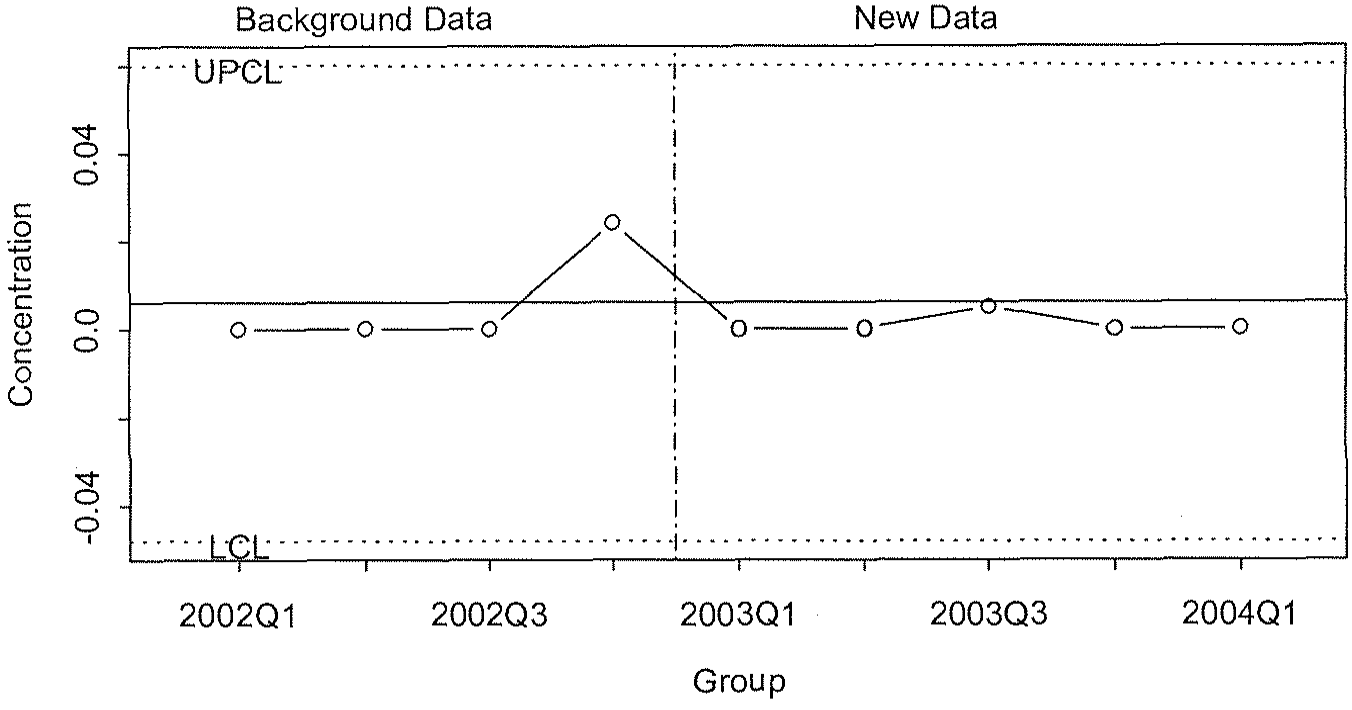


GENERATION DATE: 06/15/04	GW-202S Chloride mg/l	Geomega

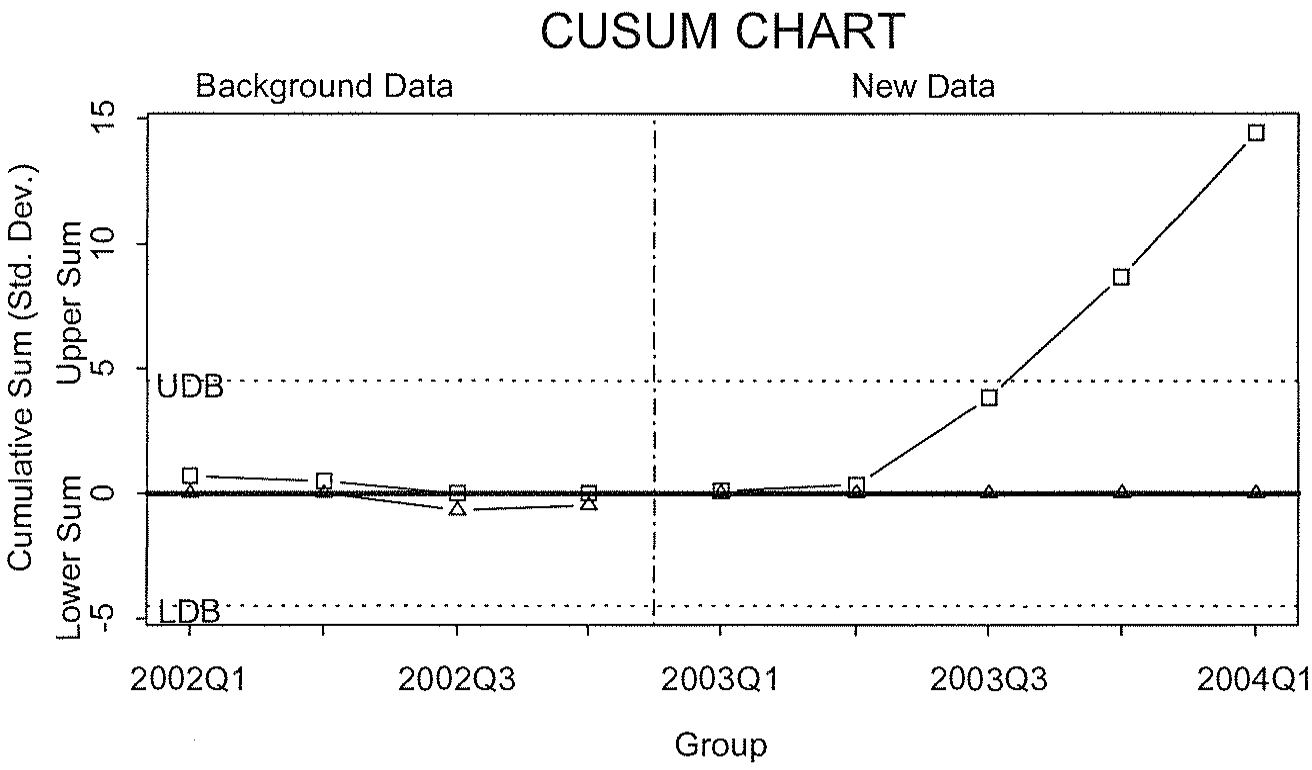
CUSUM CHART

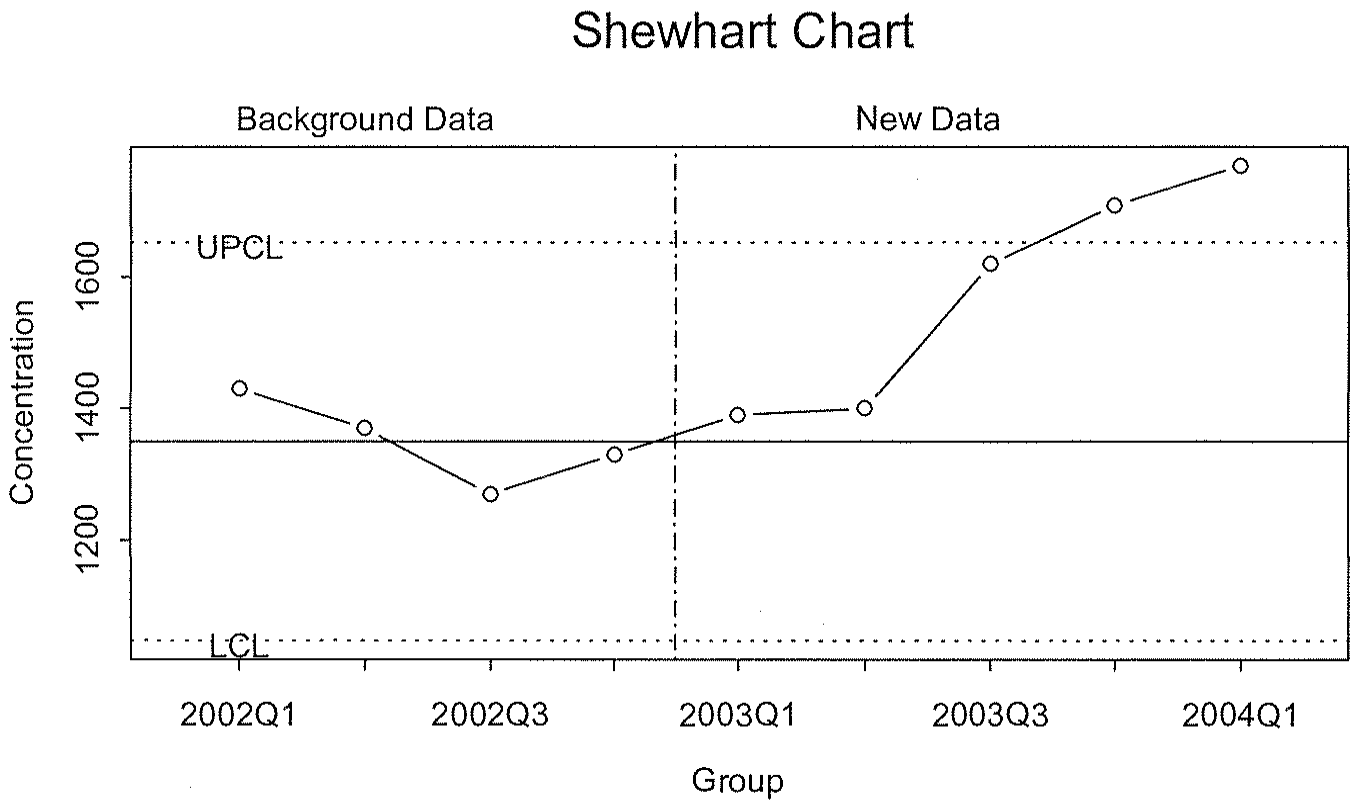


Shewhart Chart

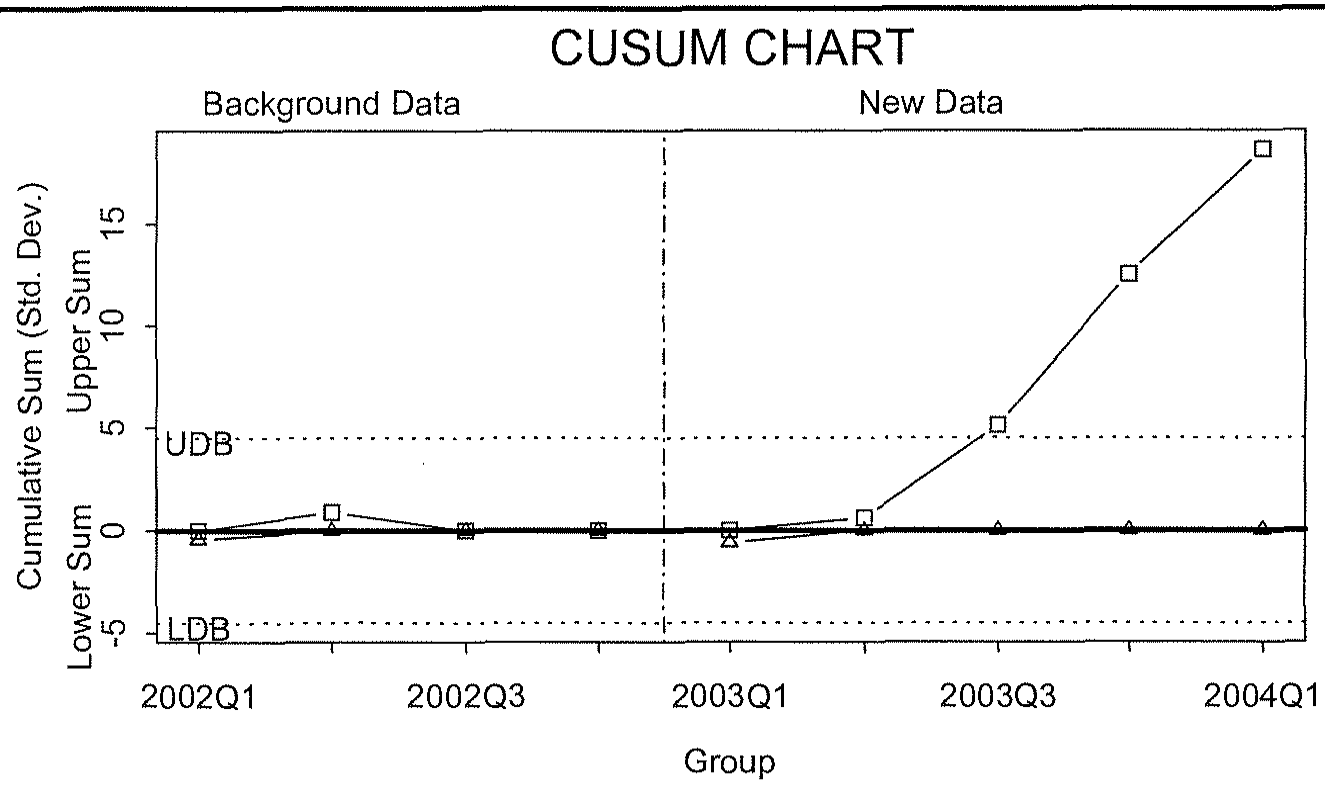


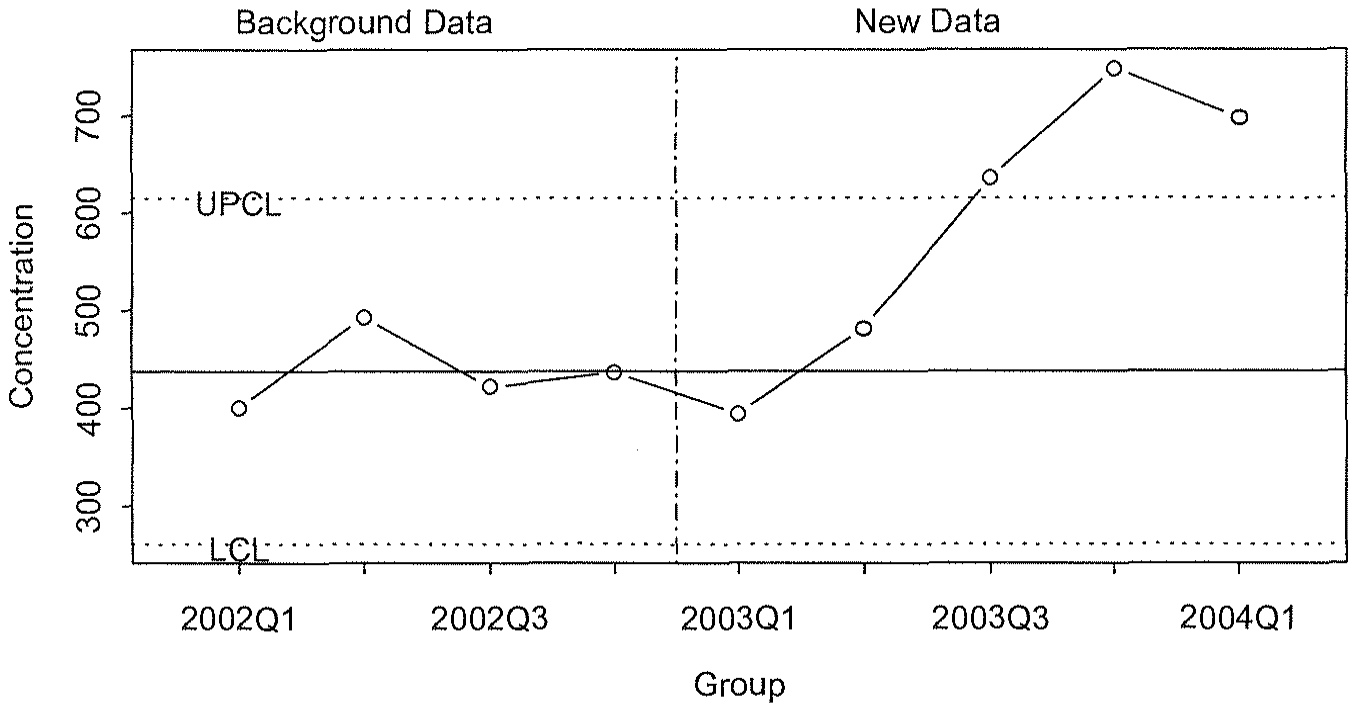
GENERATION DATE: 06/15/04	GW-202S Chromium, Dissolved mg/l	Geomega



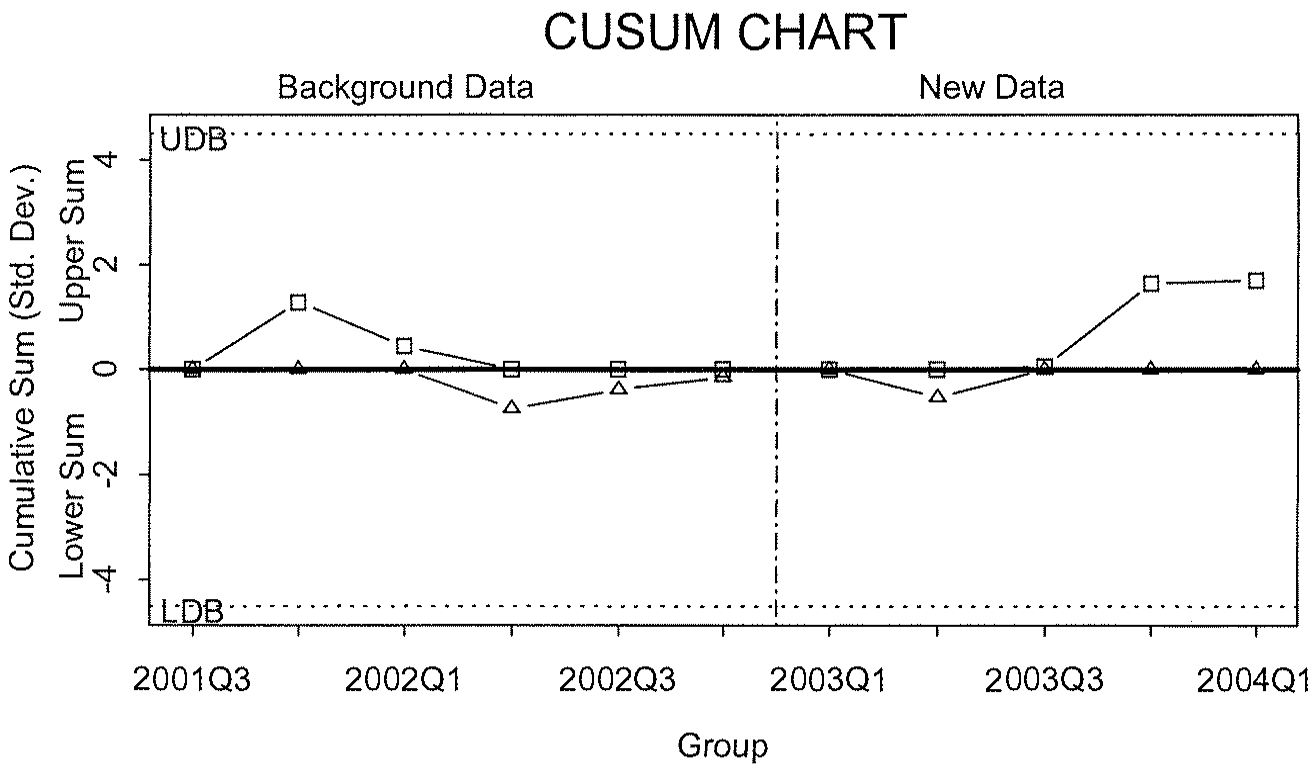


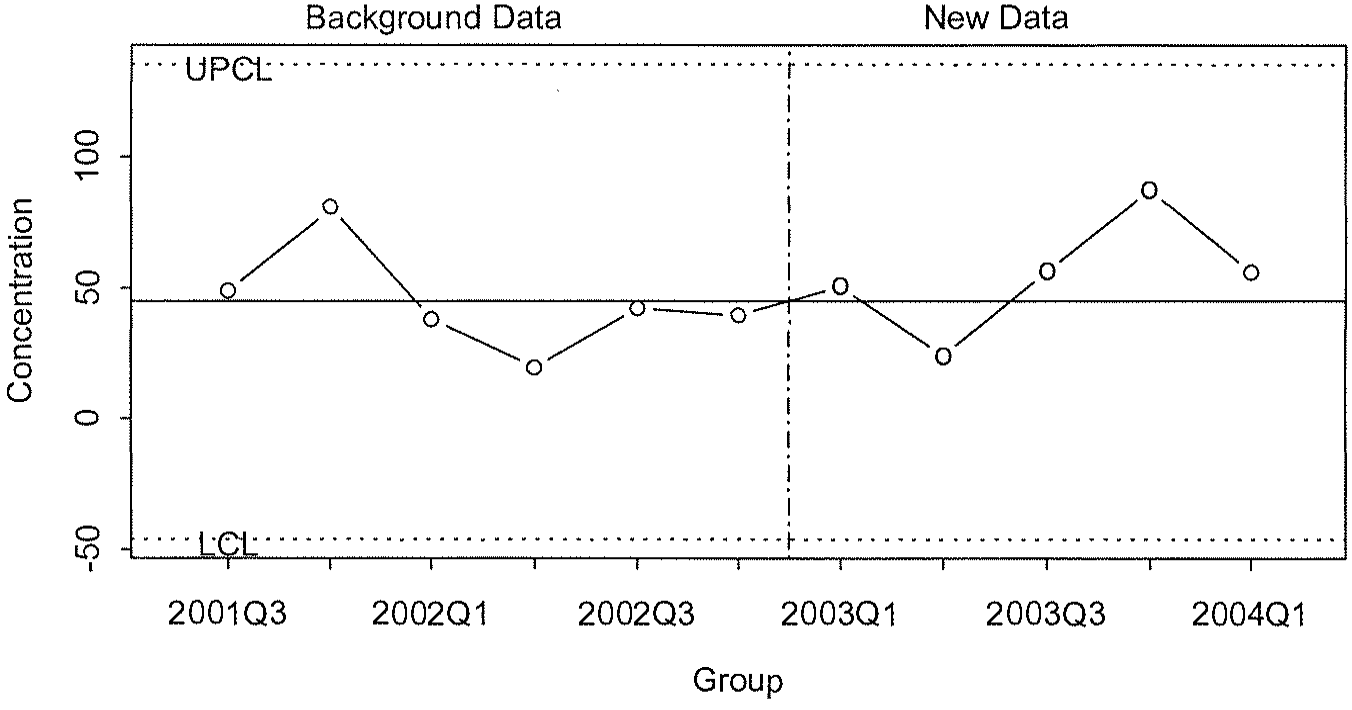
GENERATION DATE: 06/15/04	GW-202S Specific Conductance umhos/cm	Geomega



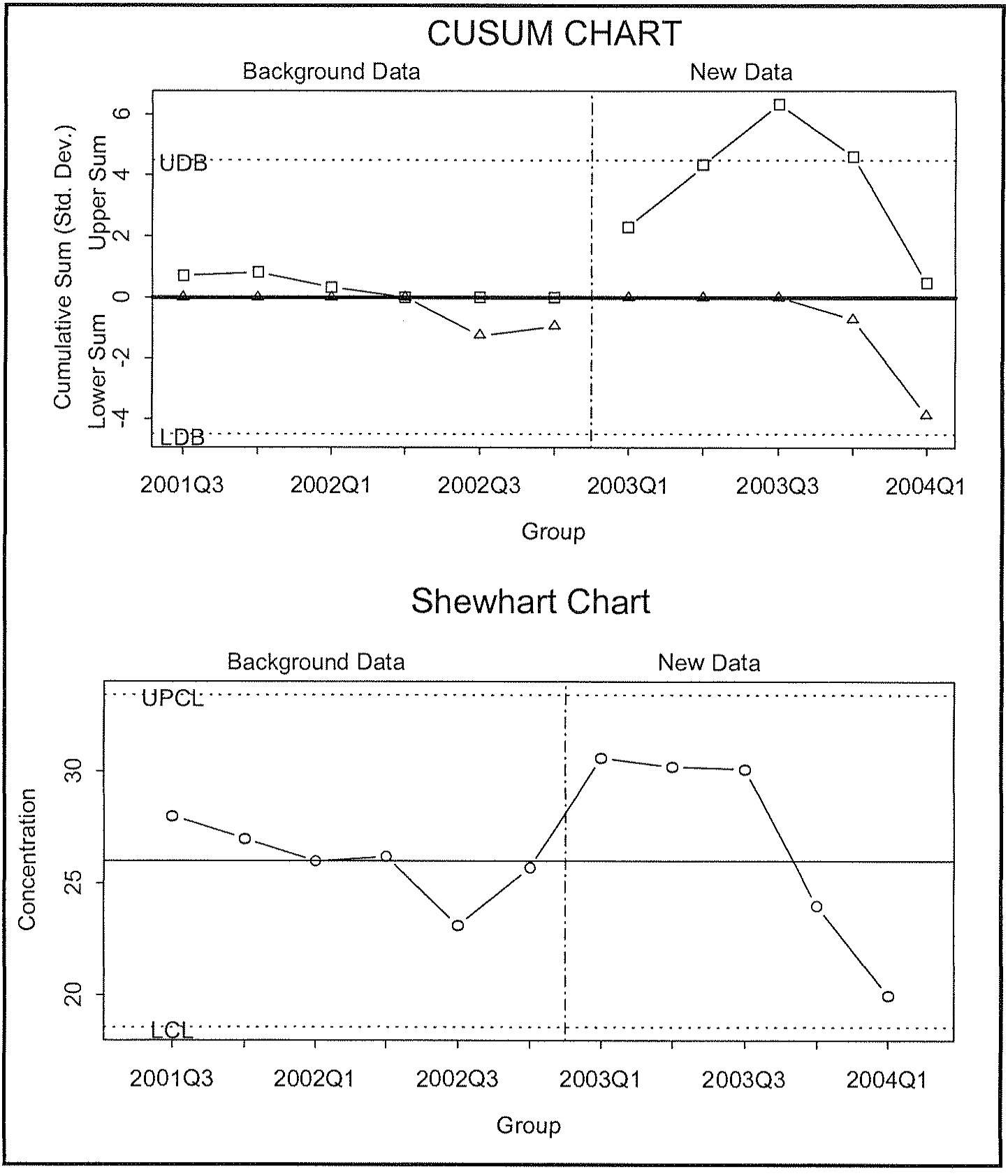


GENERATION DATE: 06/15/04	GW-202S Sulfate mg/l	Geomega

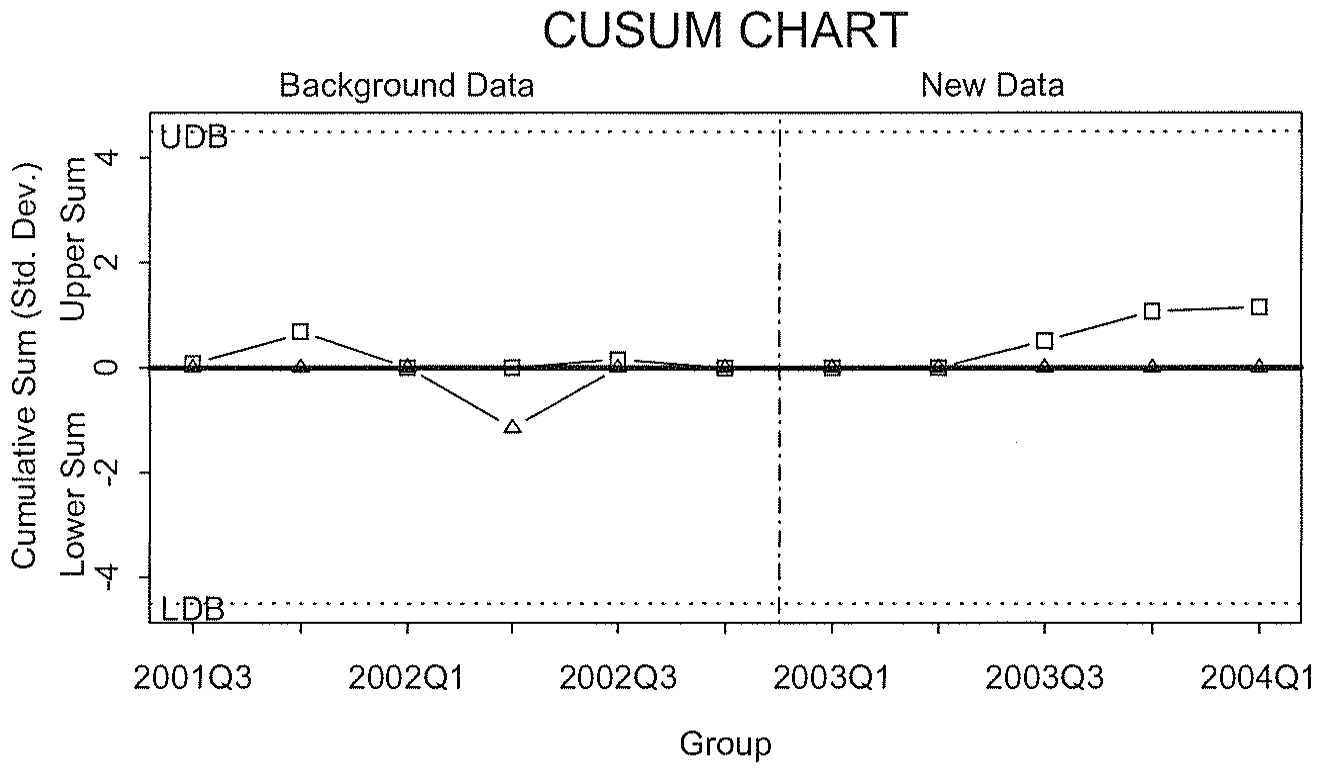


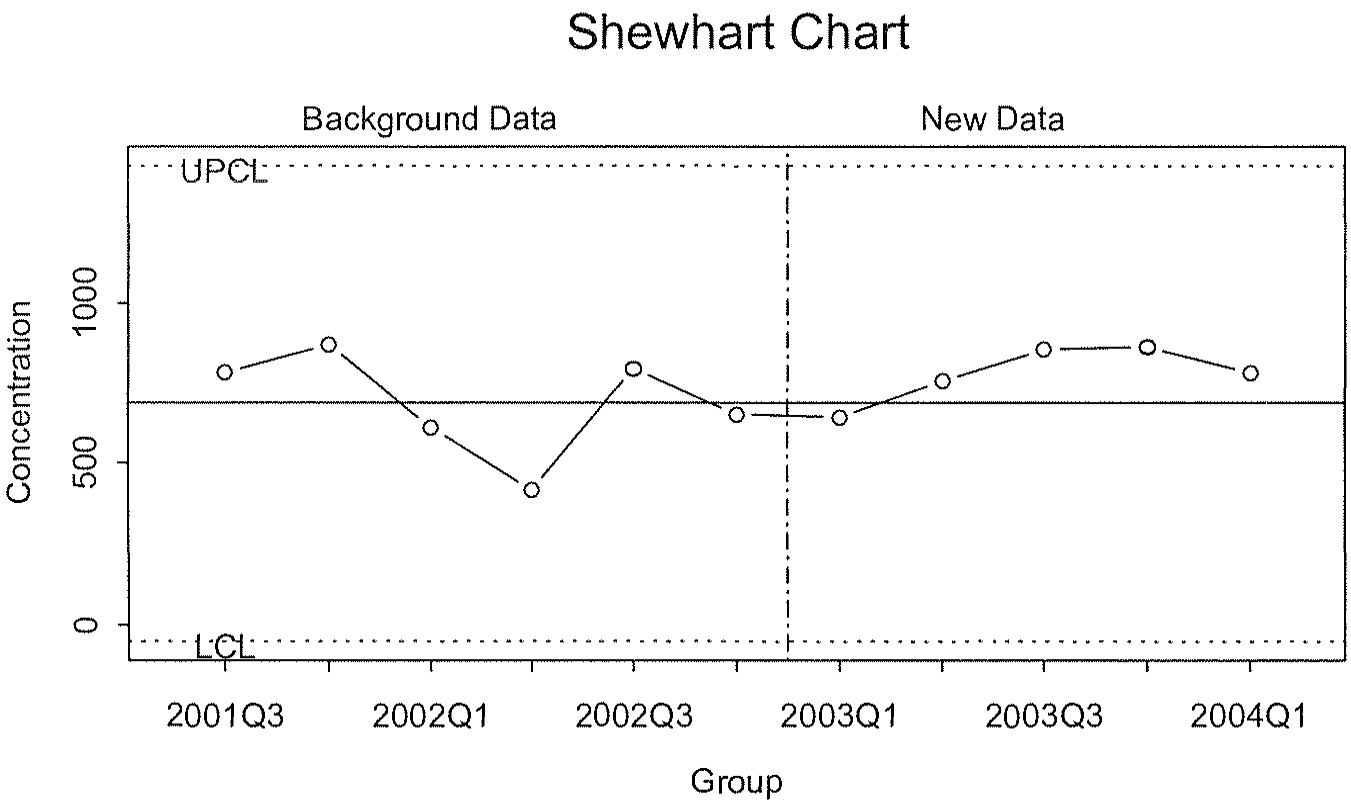


GENERATION DATE: 06/15/04	GW-24 Ammonia mg/l	Geomega

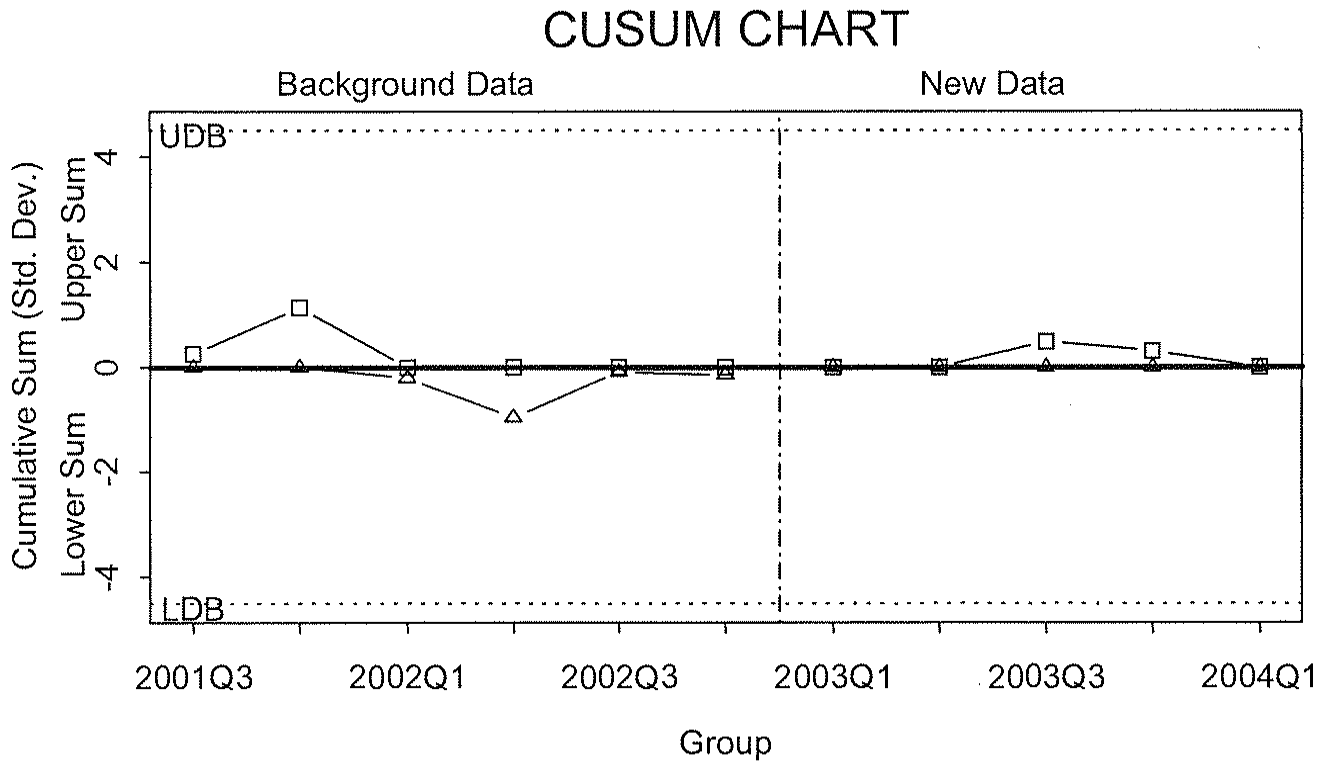


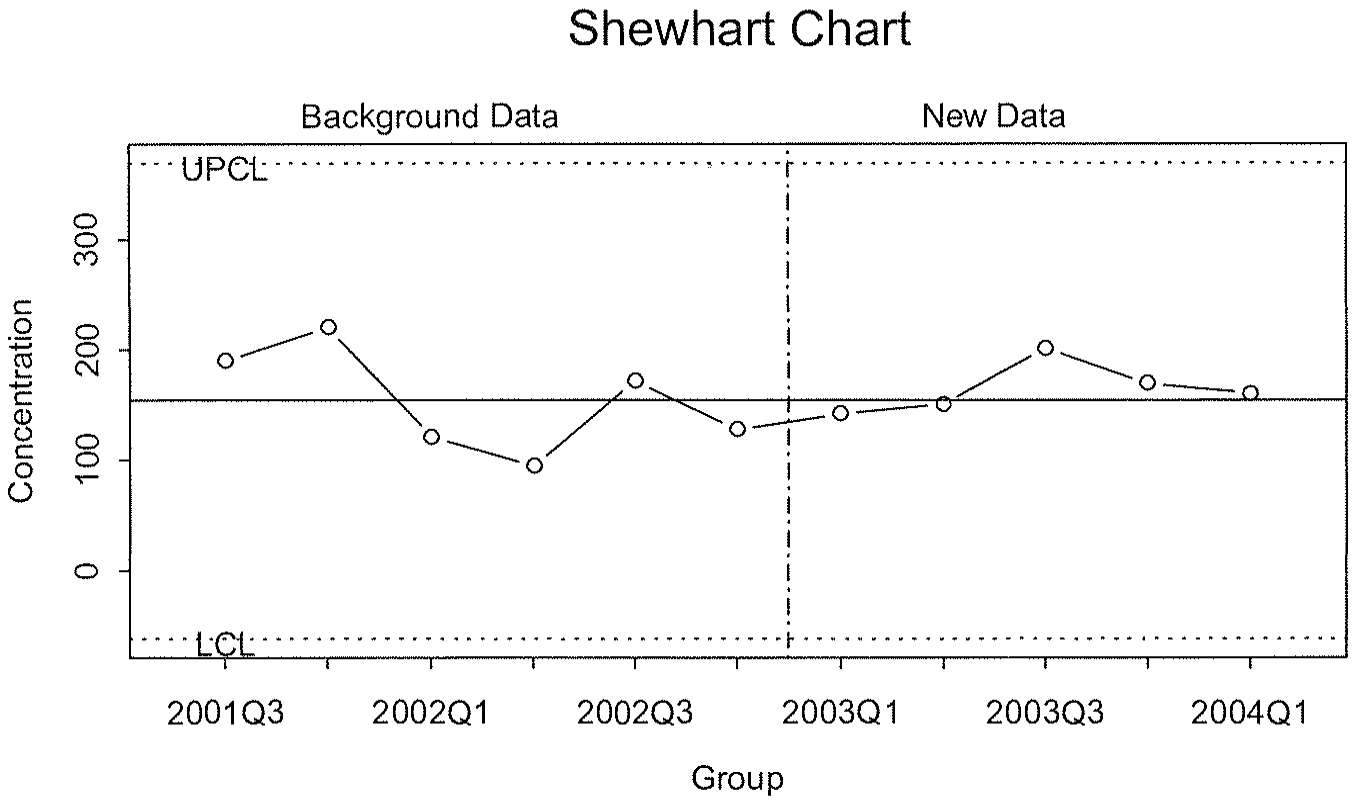
GENERATION DATE: 06/15/04	GW-24 Chloride mg/l	Geomega



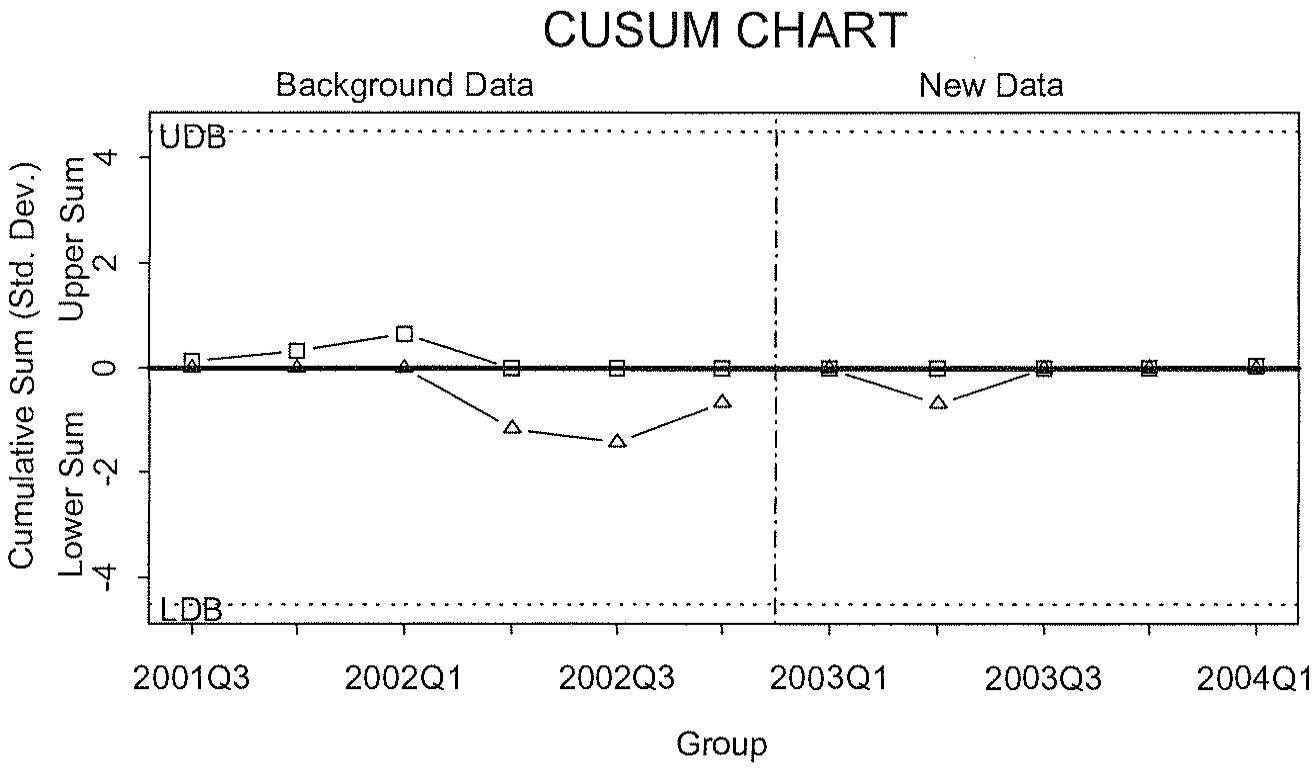


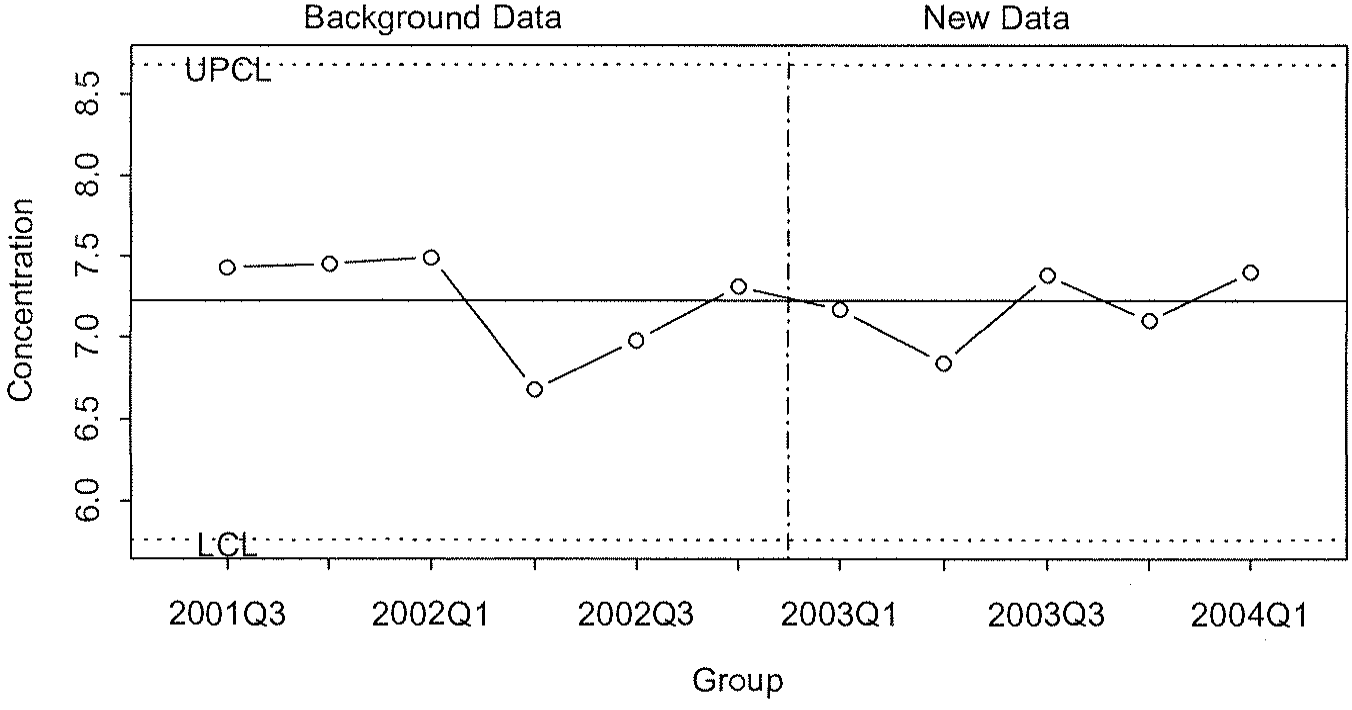
GENERATION DATE: 06/15/04	GW-24 Specific Conductance umhos/cm	Geomega



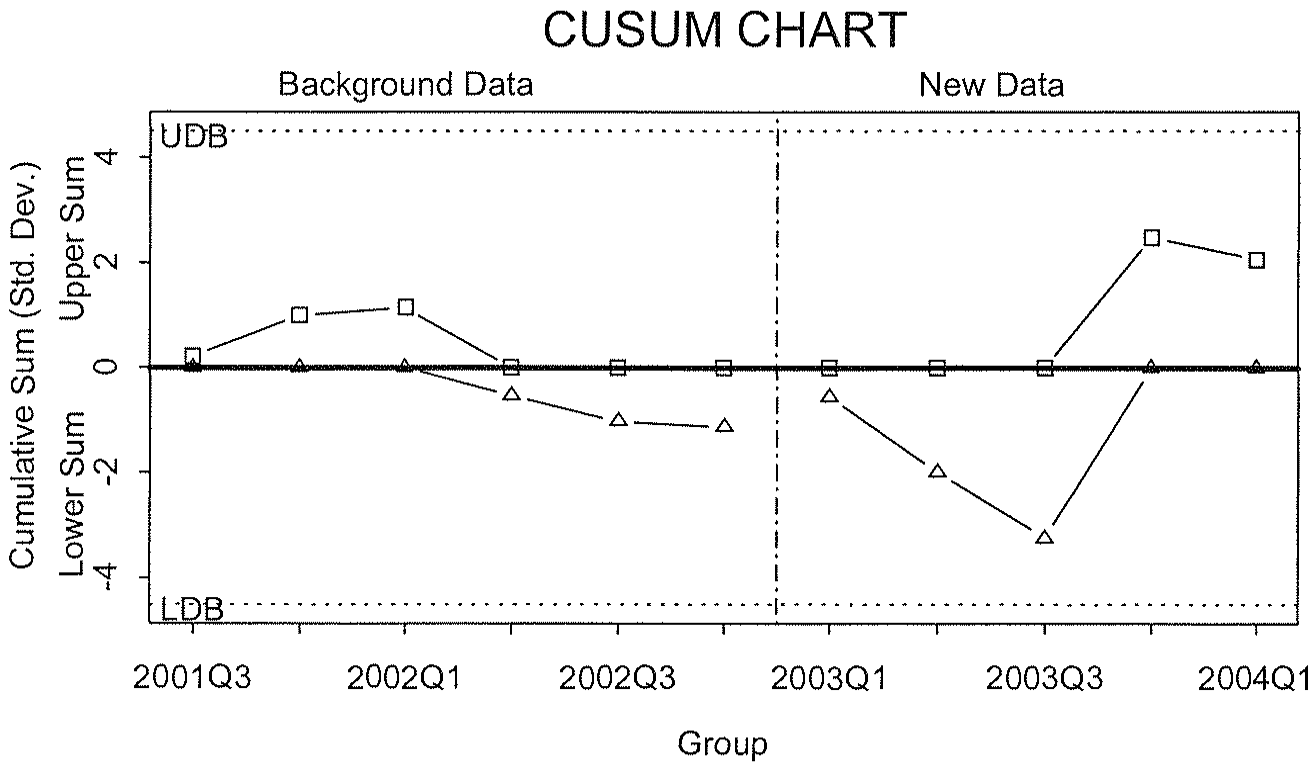


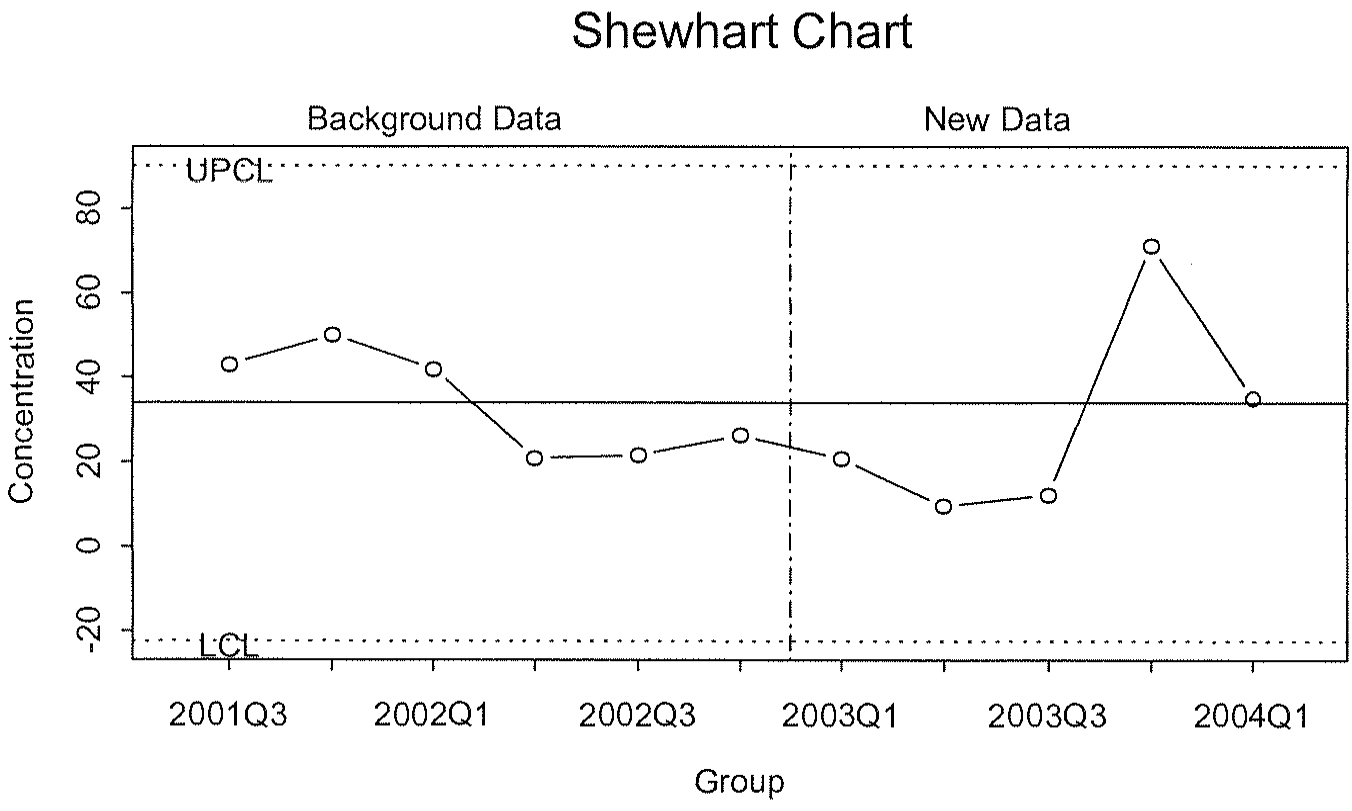
GENERATION DATE: 06/15/04	GW-24 Sulfate mg/l	Geomega



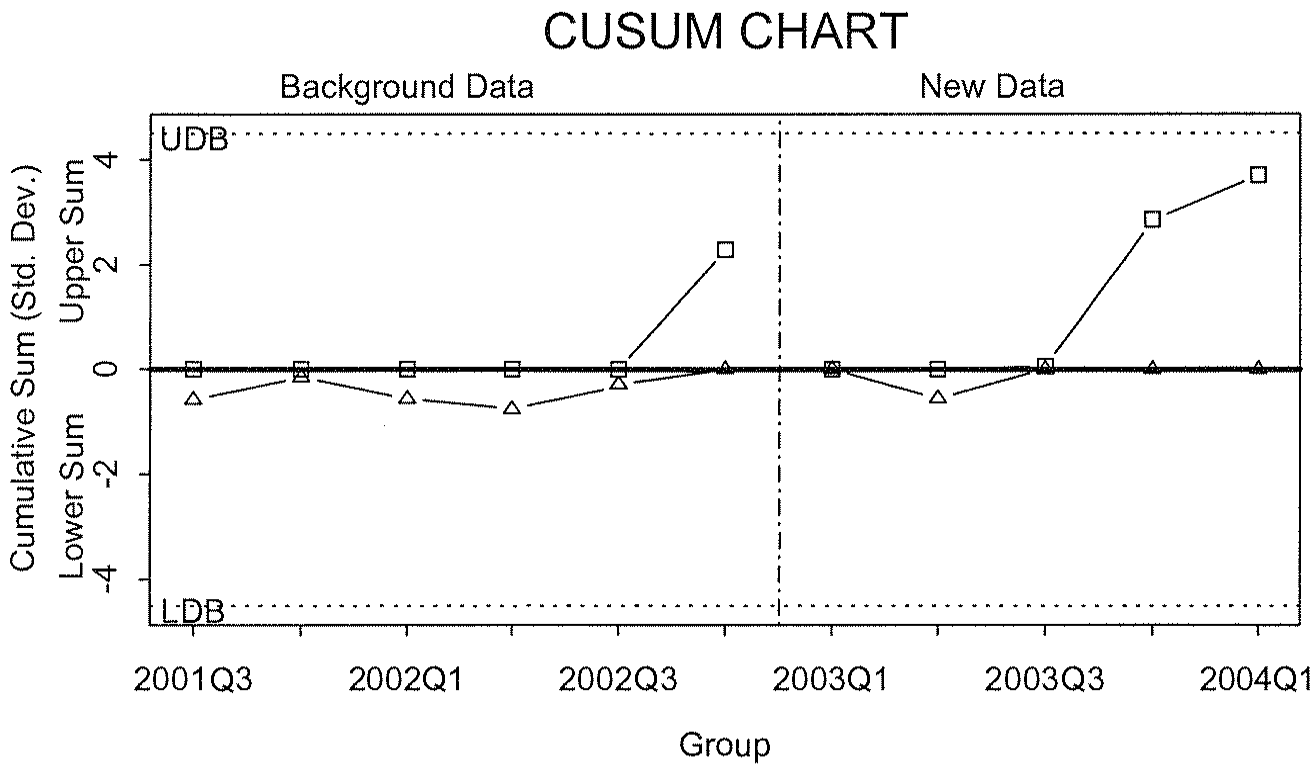


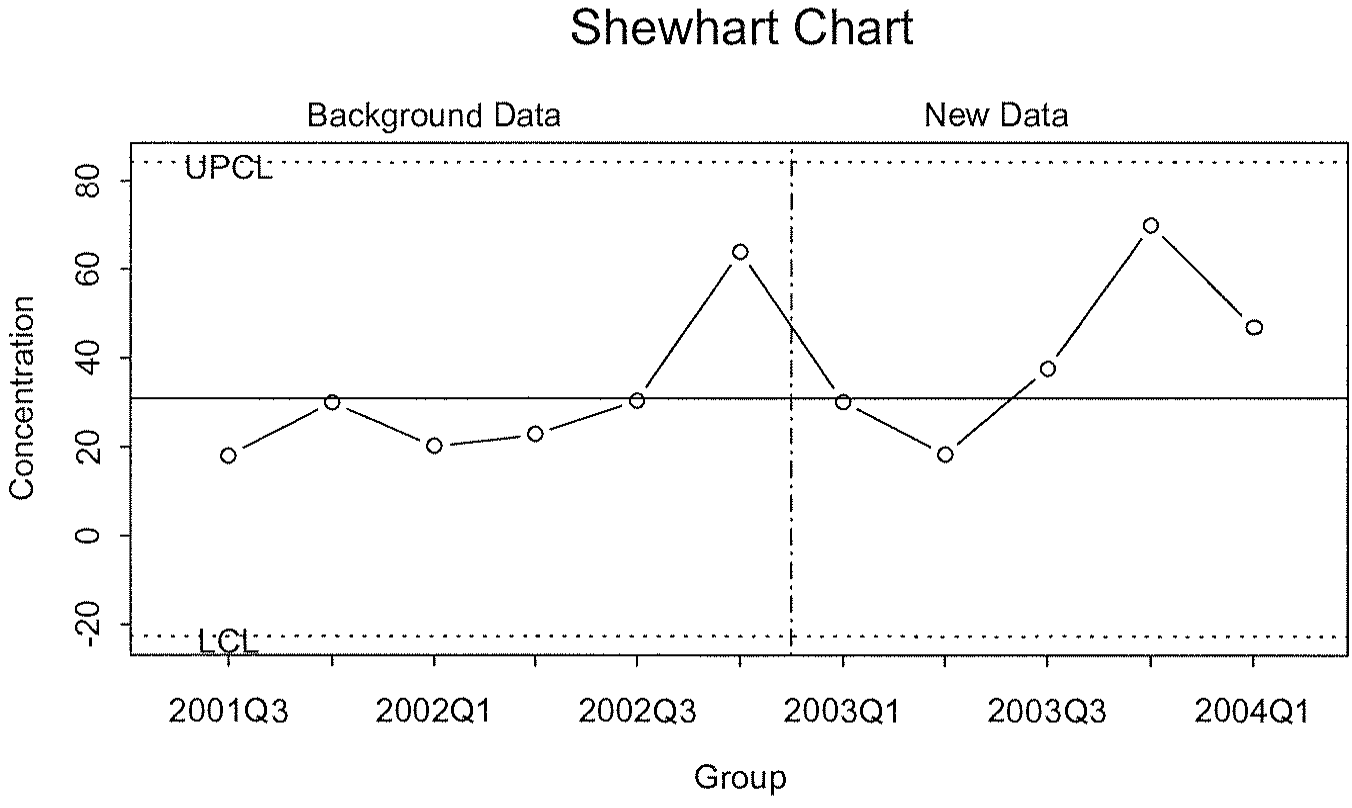
GENERATION DATE: 06/15/04	GW-24 pH mg/l	Geomega



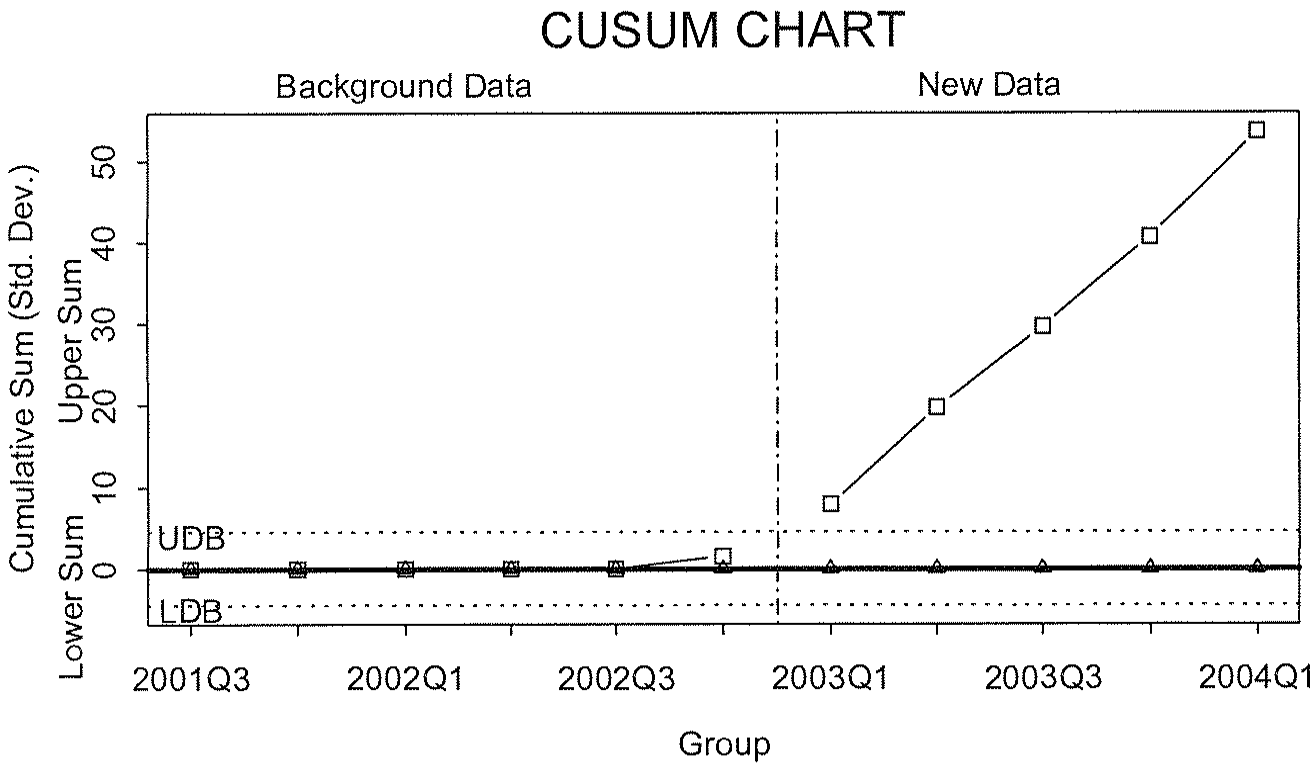


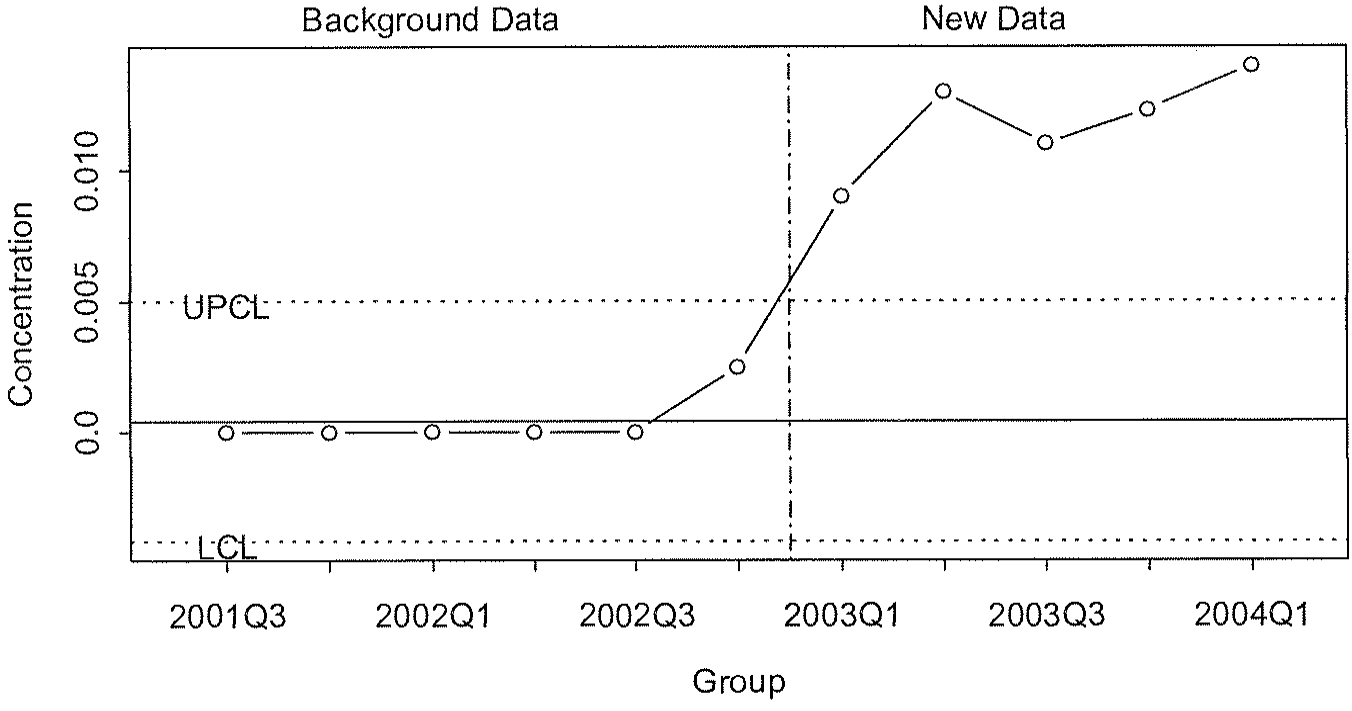
GENERATION DATE: 06/15/04	GW-25 Ammonia mg/l	Geomega



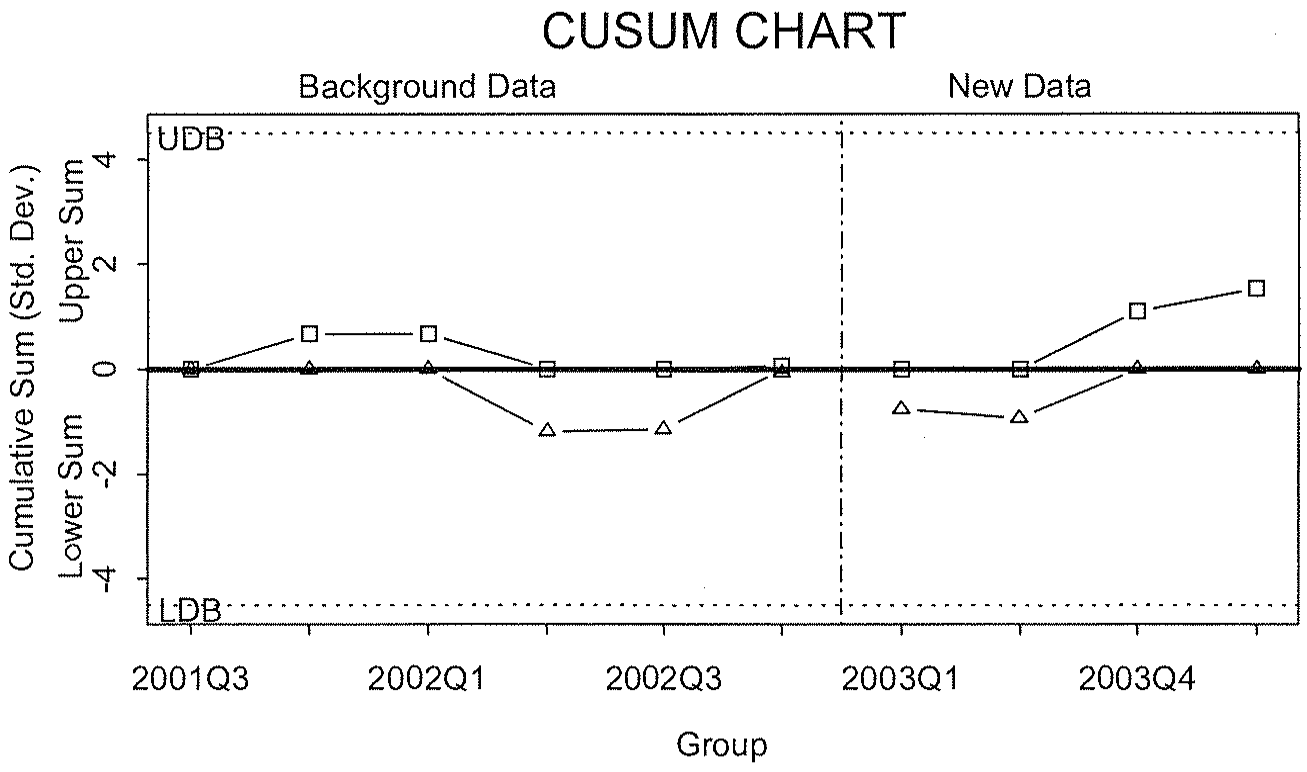


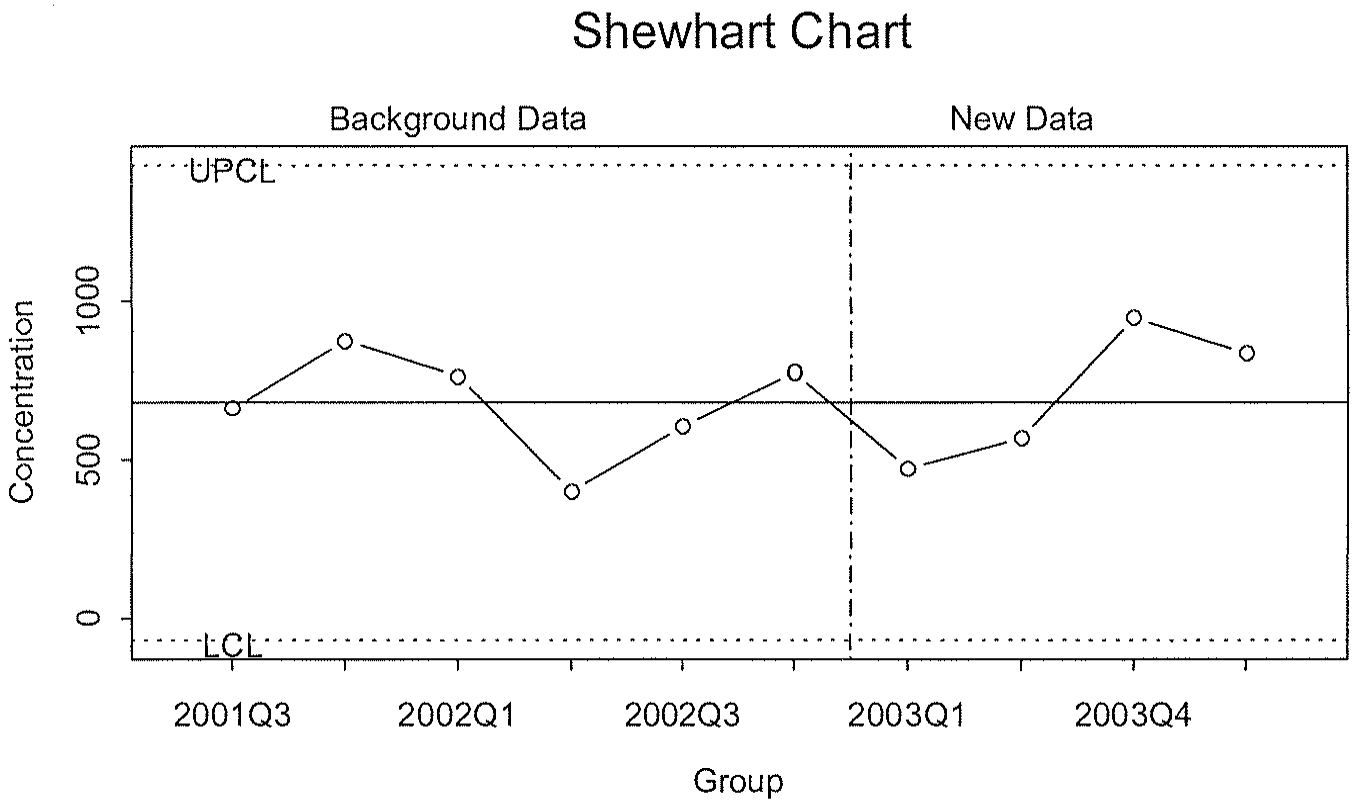
GENERATION DATE: 06/15/04	GW-25 Chloride mg/l	Geomega



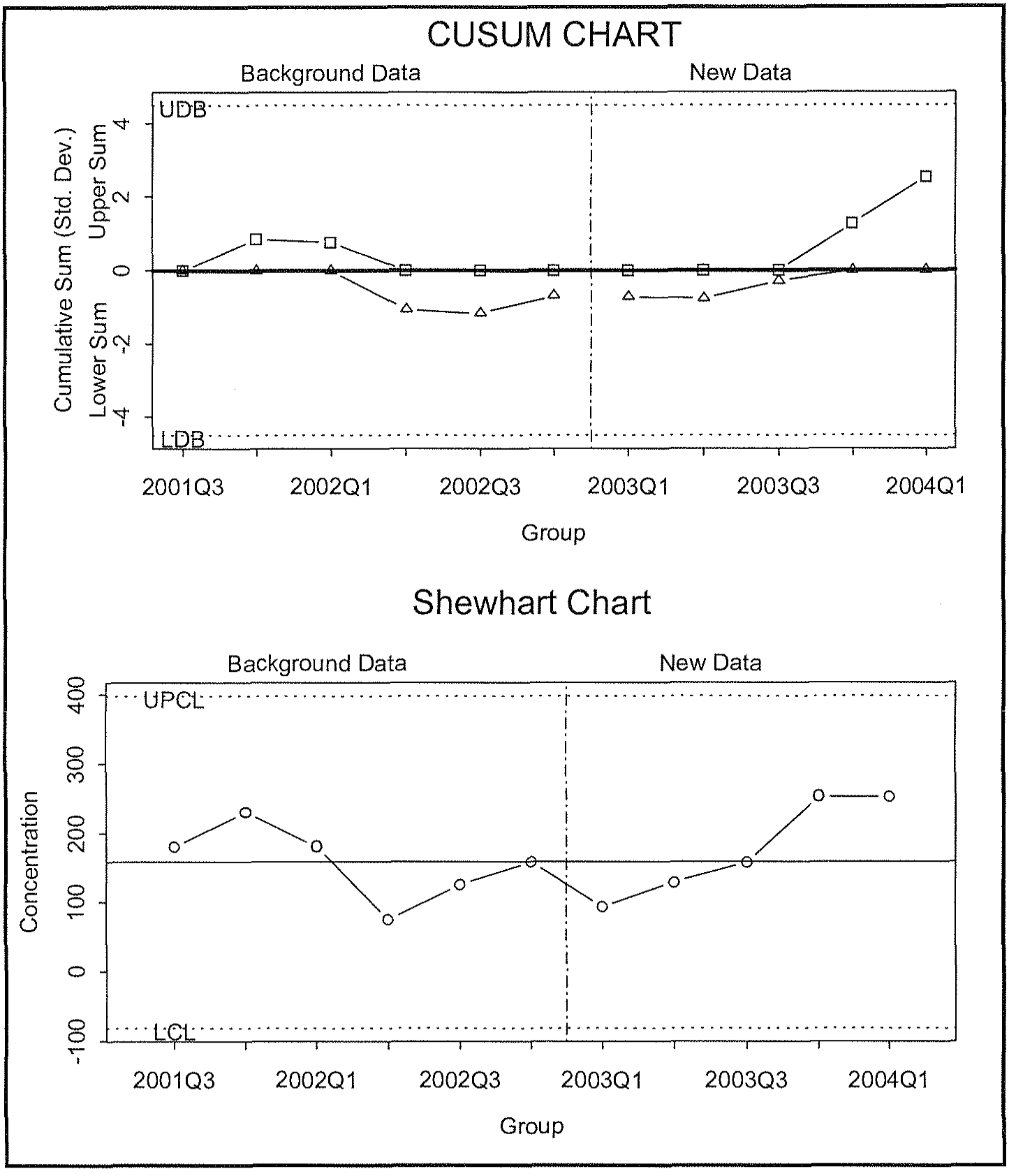


GENERATION DATE: 06/15/04	GW-25 Chromium, Dissolved mg/l	Geomega

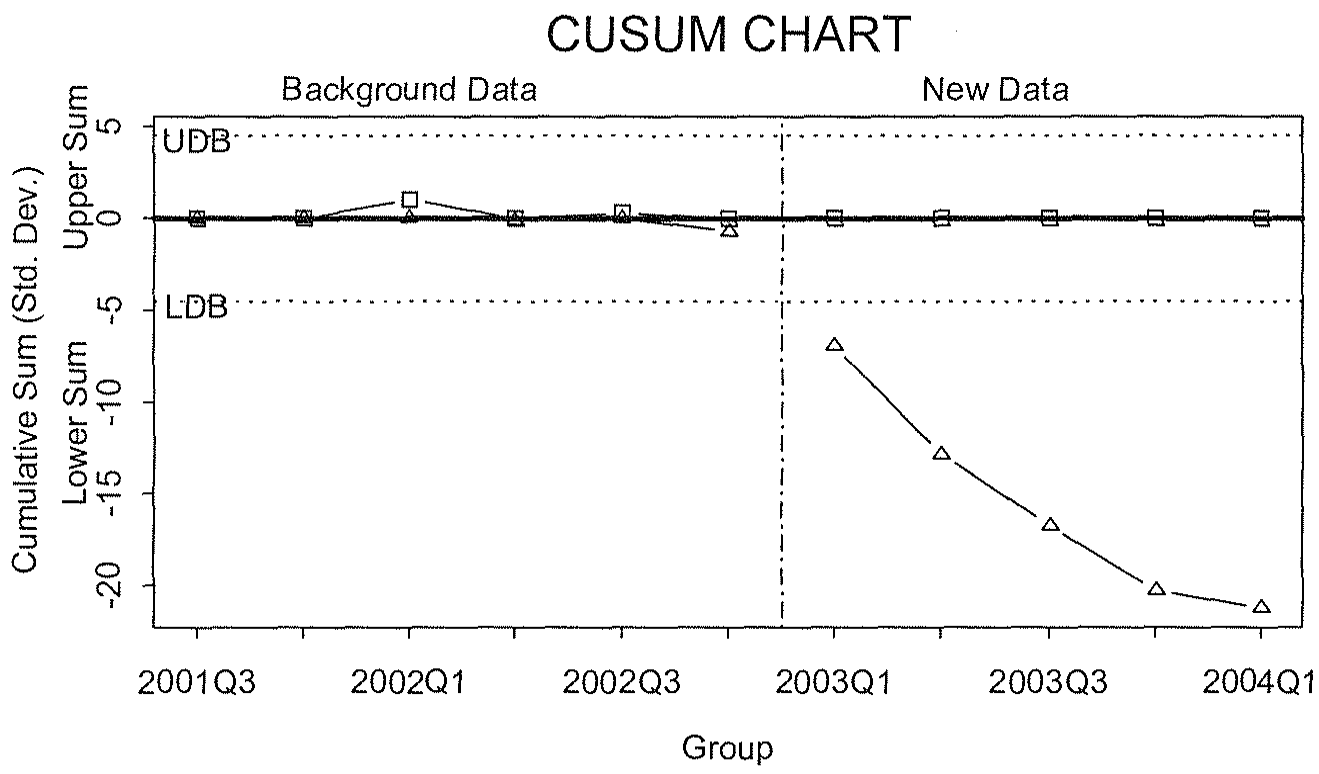


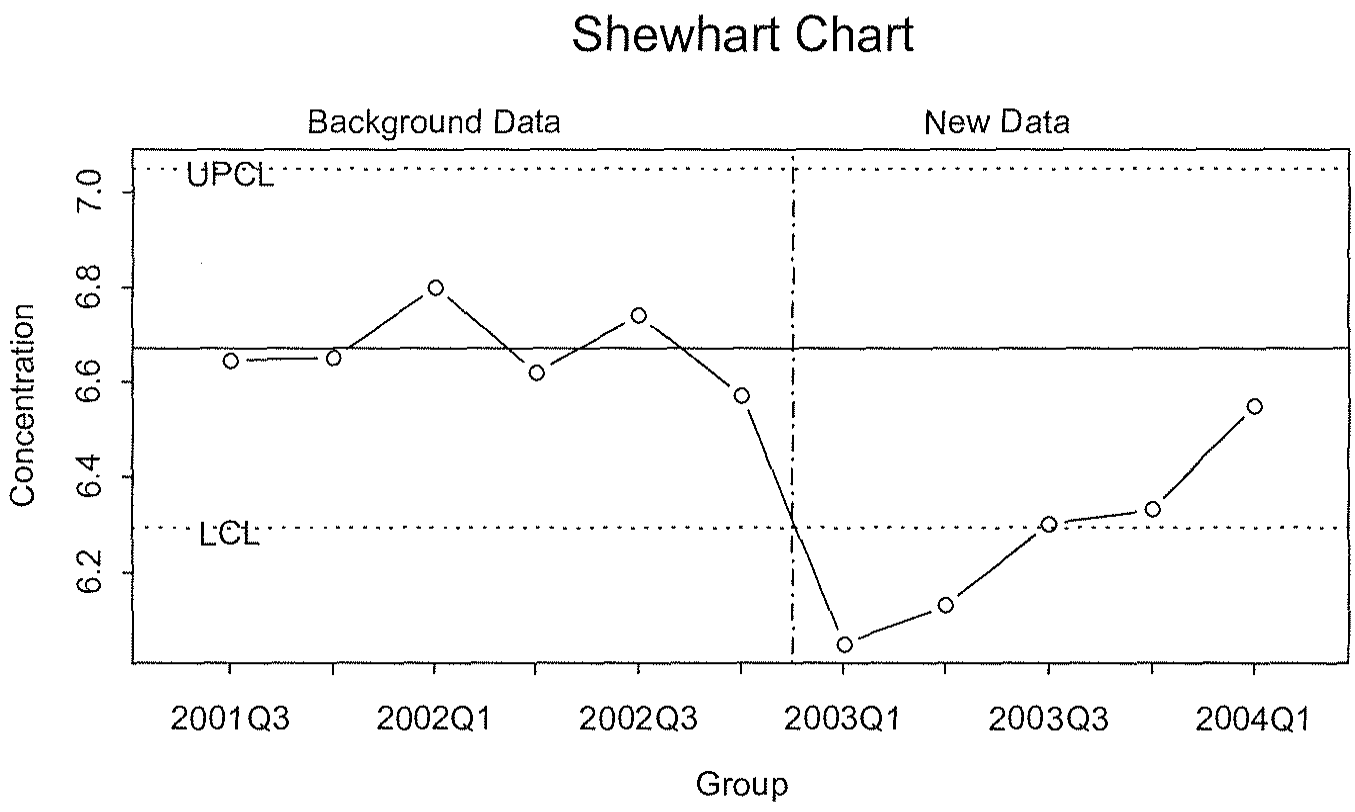


GENERATION DATE: 06/15/04	GW-25 Specific Conductance umhos/cm	Geomega

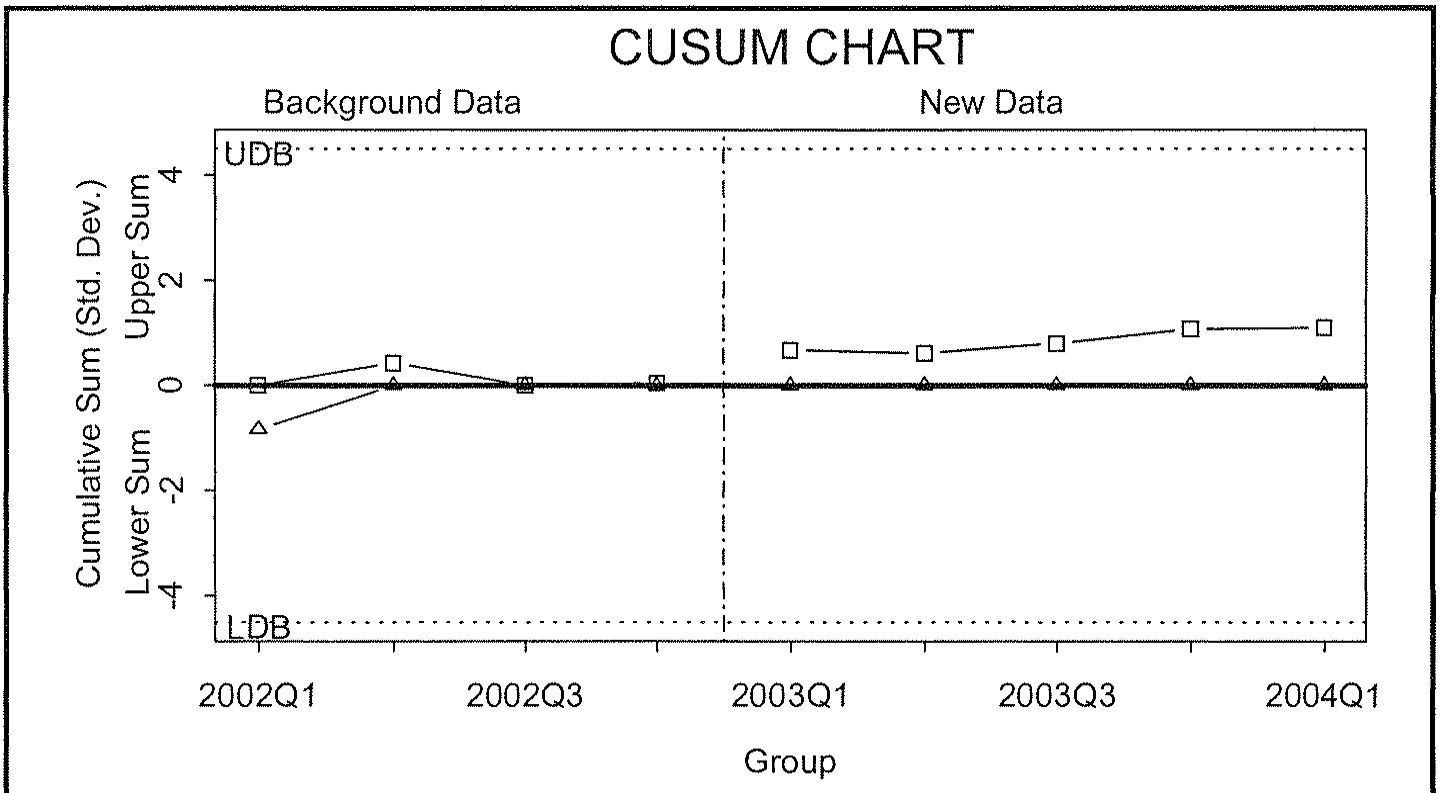


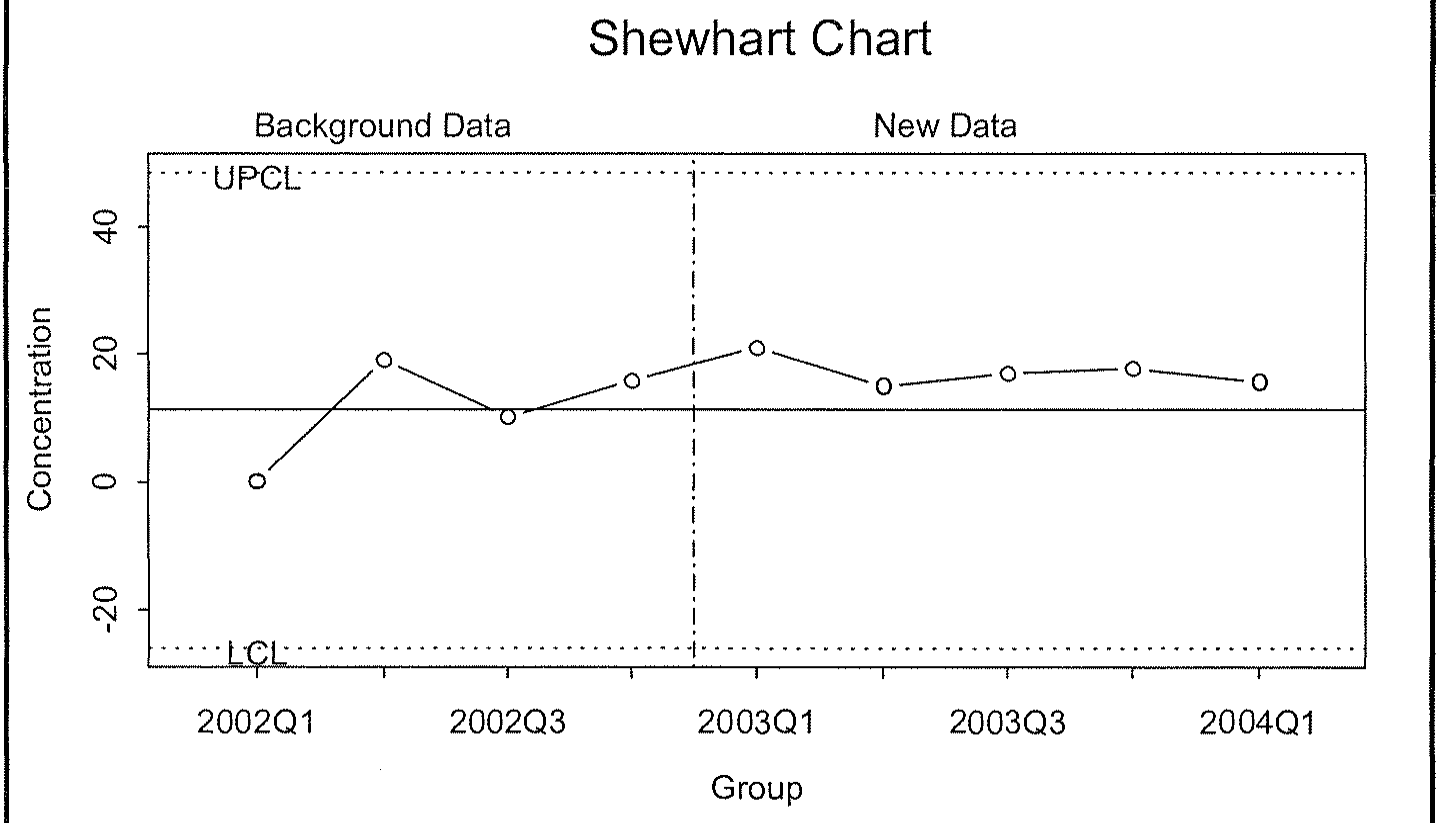
GENERATION DATE: 06/15/04	GW-25 Sulfate mg/l	Geomega



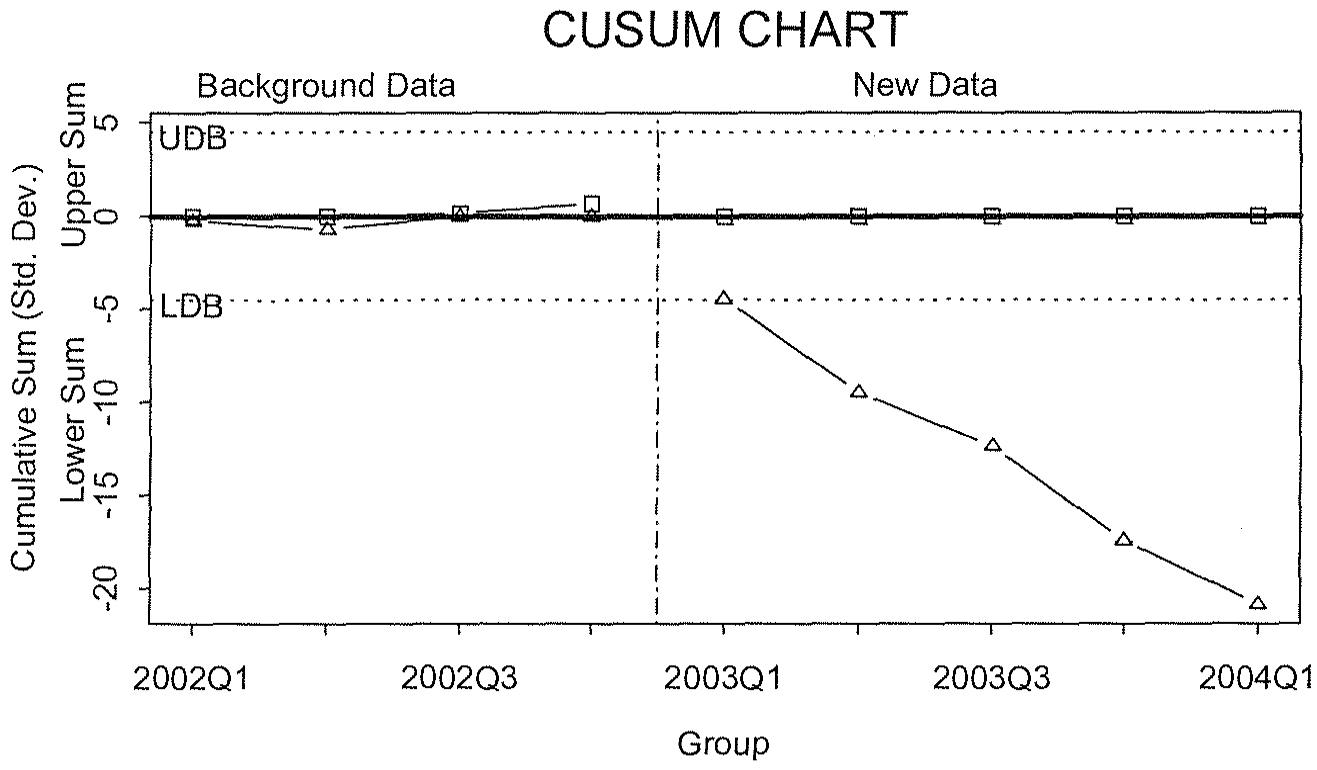


GENERATION DATE: 06/15/04	GW-25 pH mg/l	Geomega





GENERATION DATE: 06/15/04	GW-34D Ammonia mg/l	Geomega



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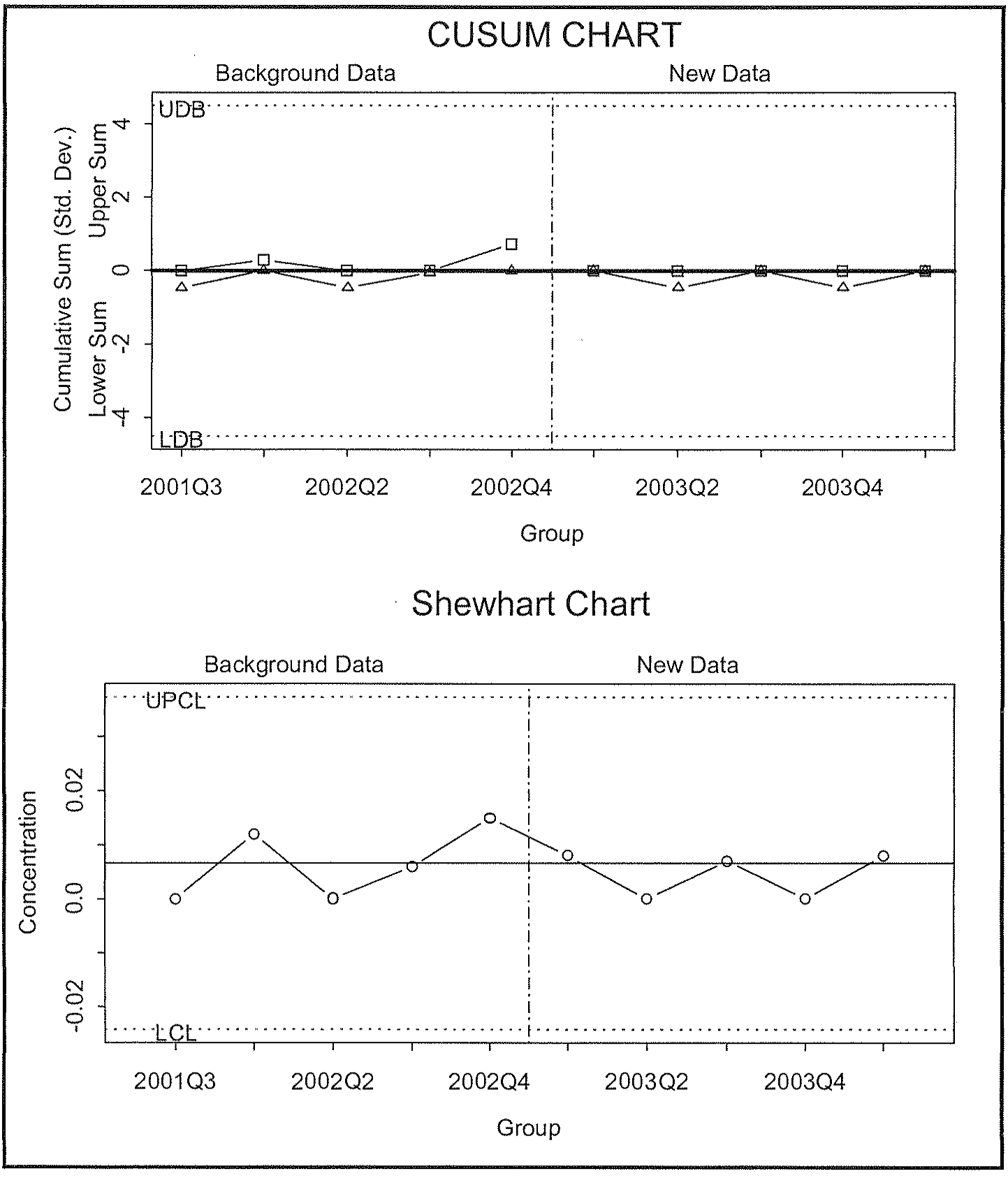
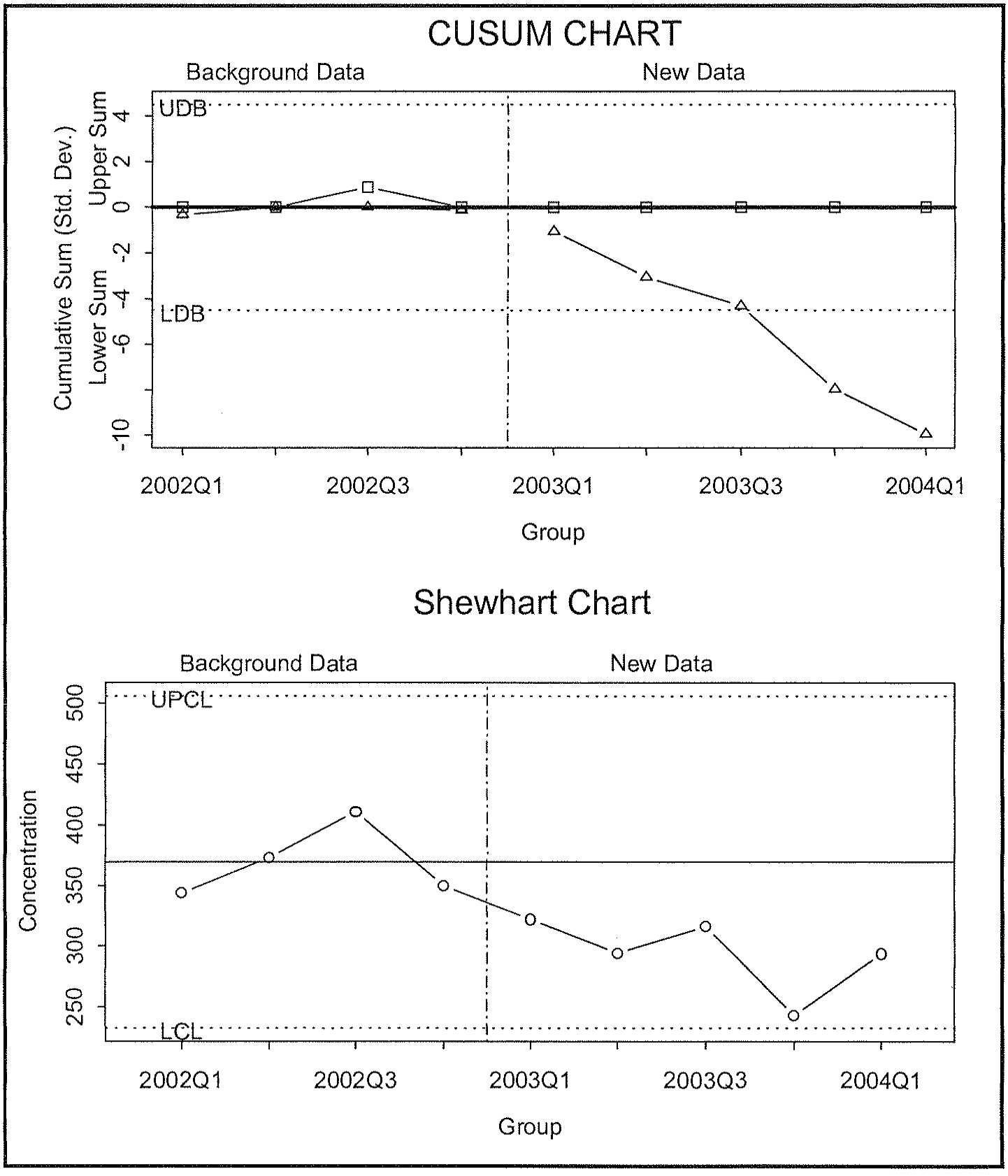
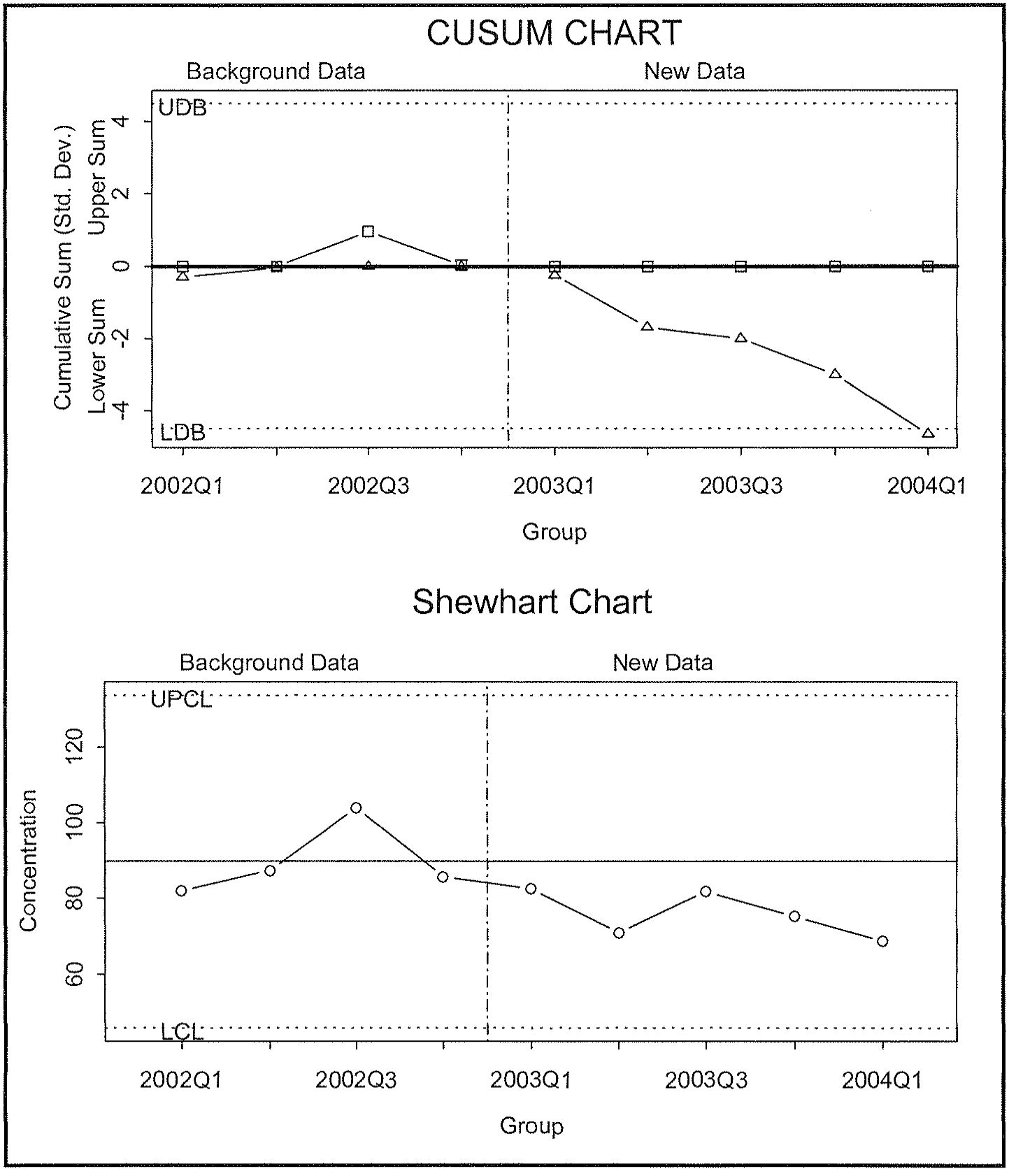


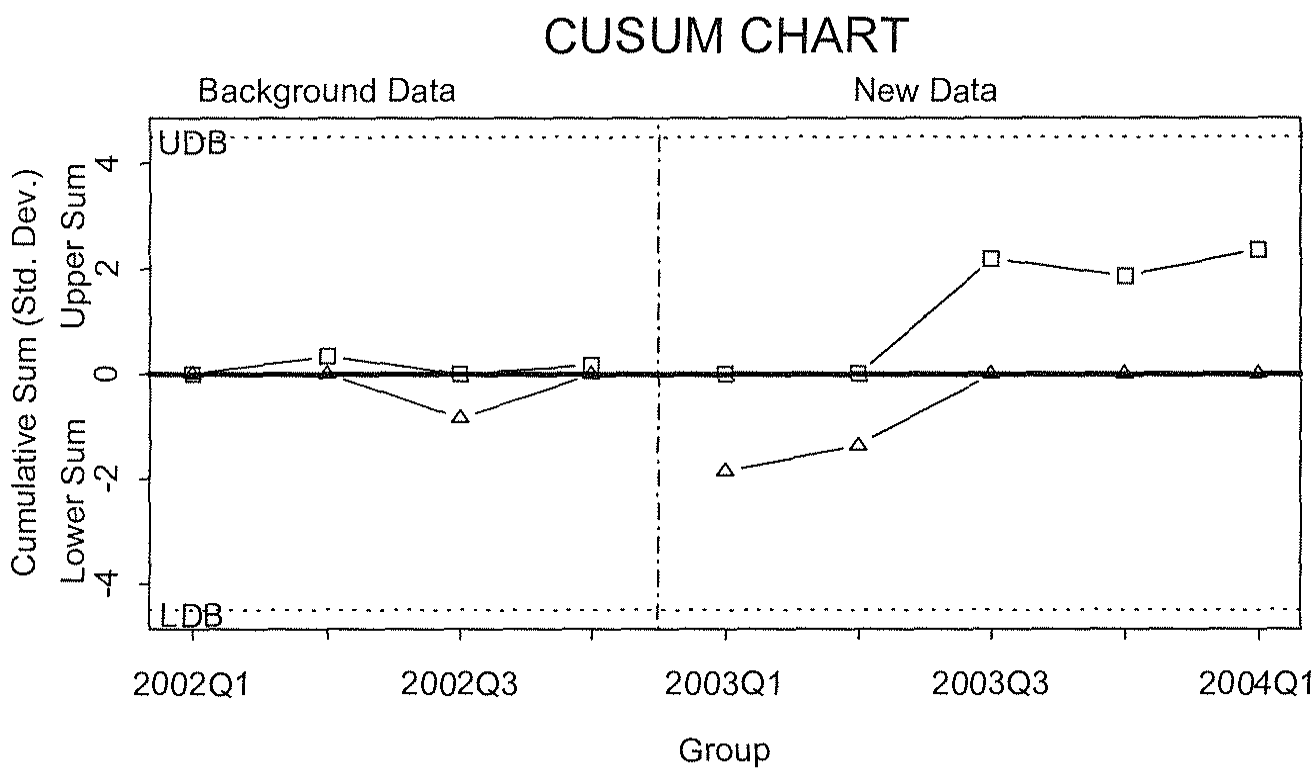
GENERATION DATE: 06/15/04	GW-34D Chromium, Dissolved mg/l	Geomega

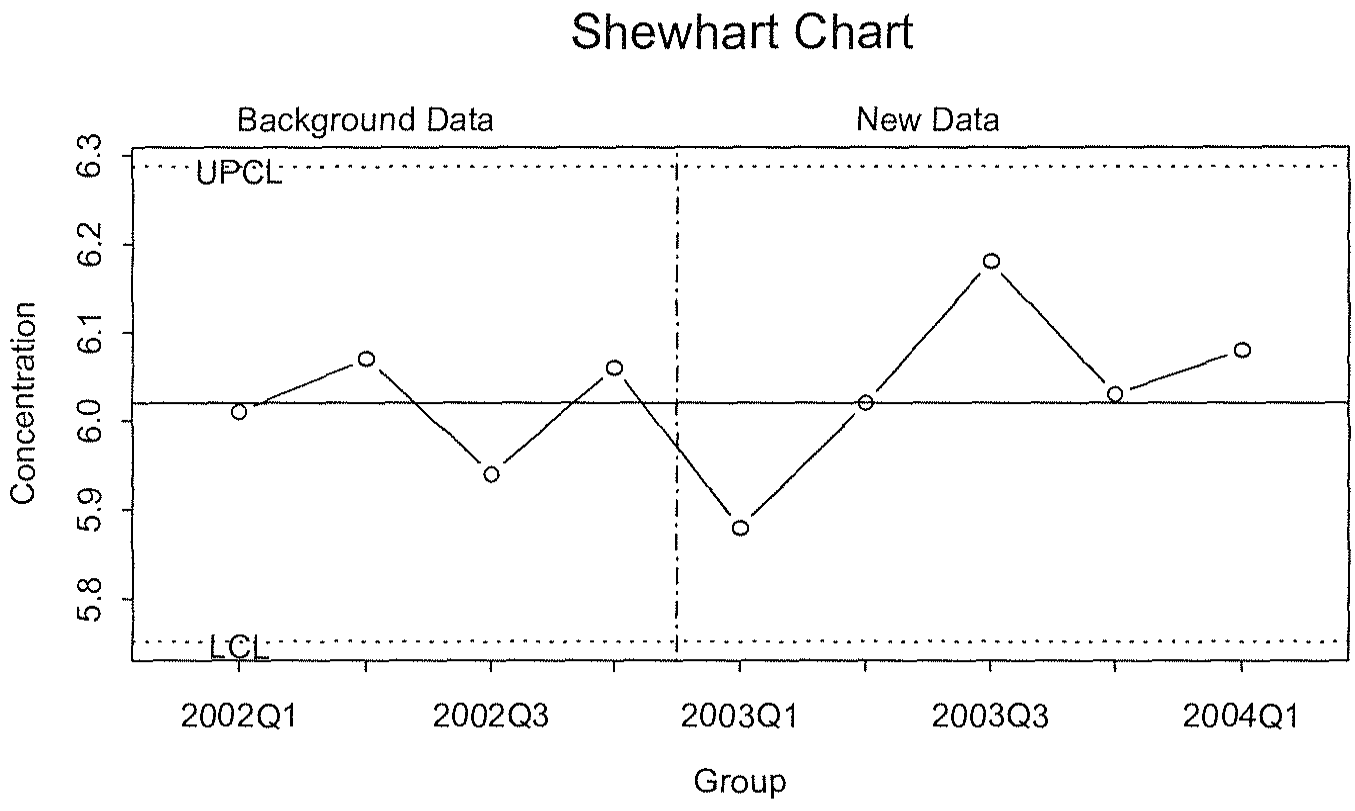


GENERATION DATE: **06/15/04**	GW-34D Specific Conductance umhos/cm	Geomega



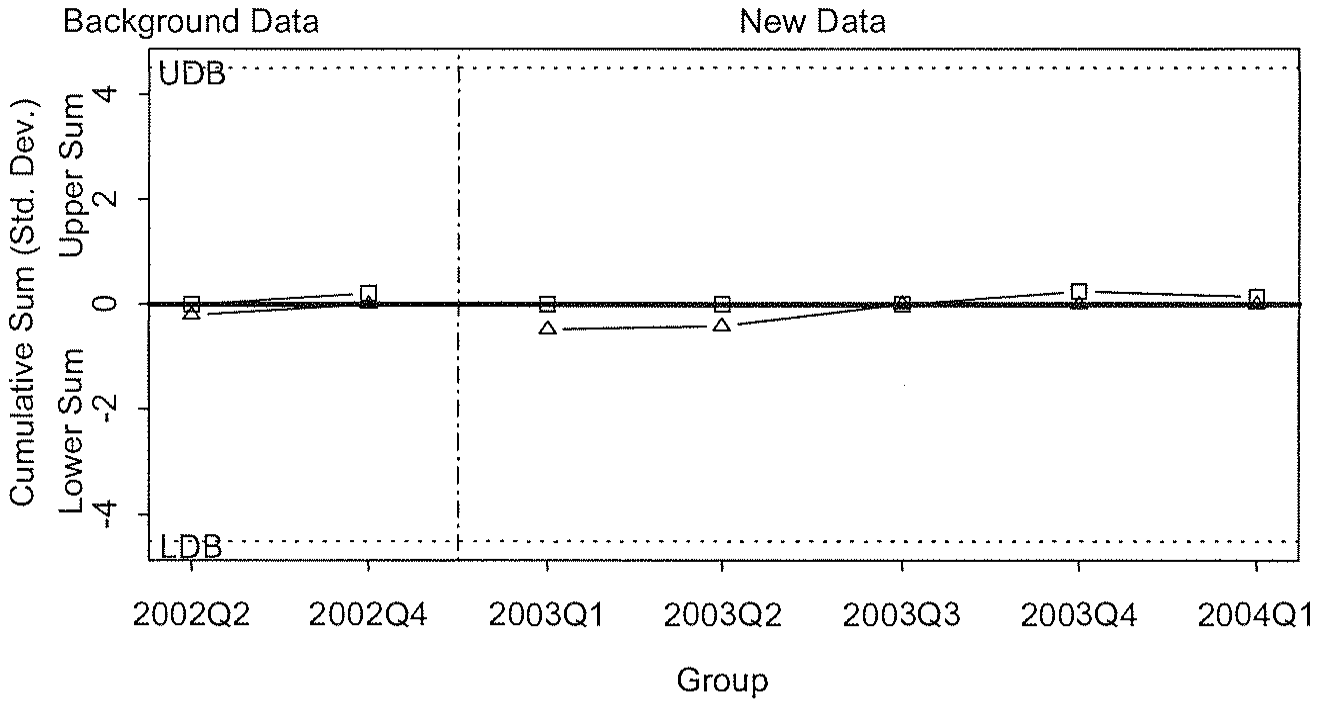
GENERATION DATE: 06/15/04	GW-34D Sulfate mg/l	Geomega



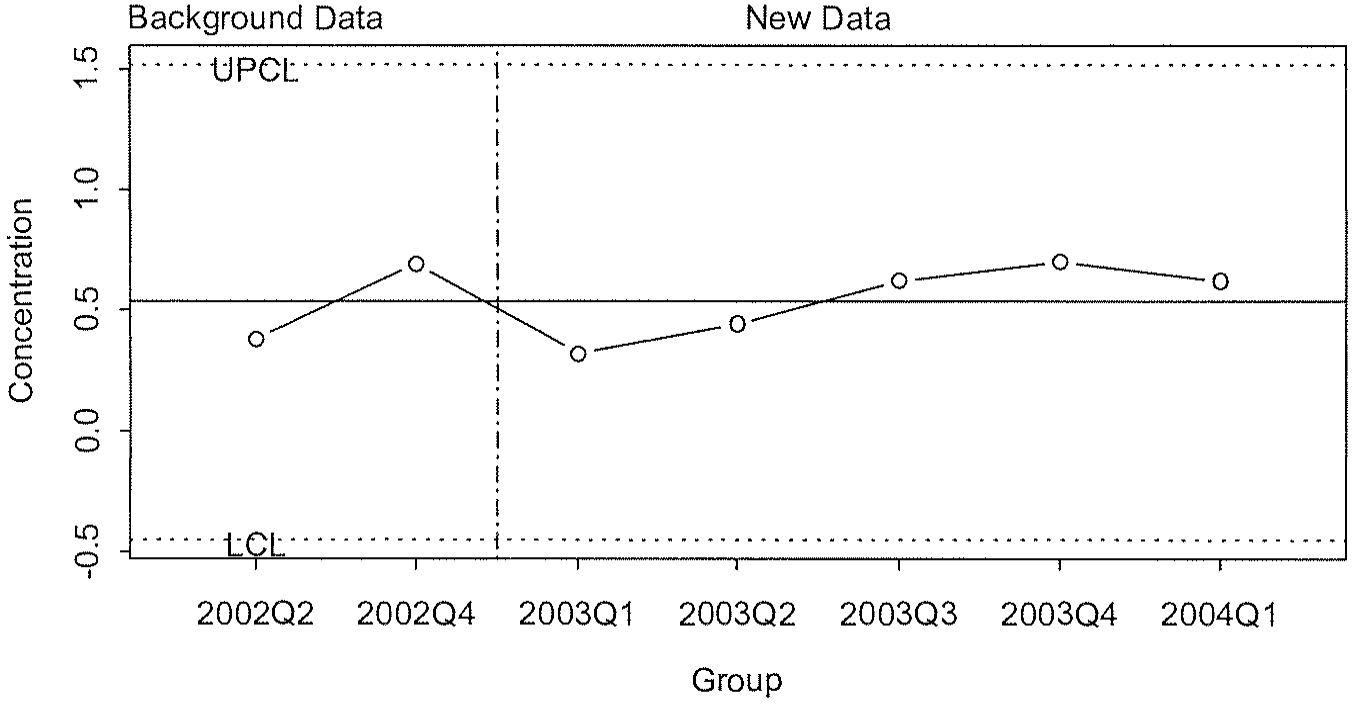


GENERATION DATE: 06/15/04	GW-34D pH mg/l	Geomega

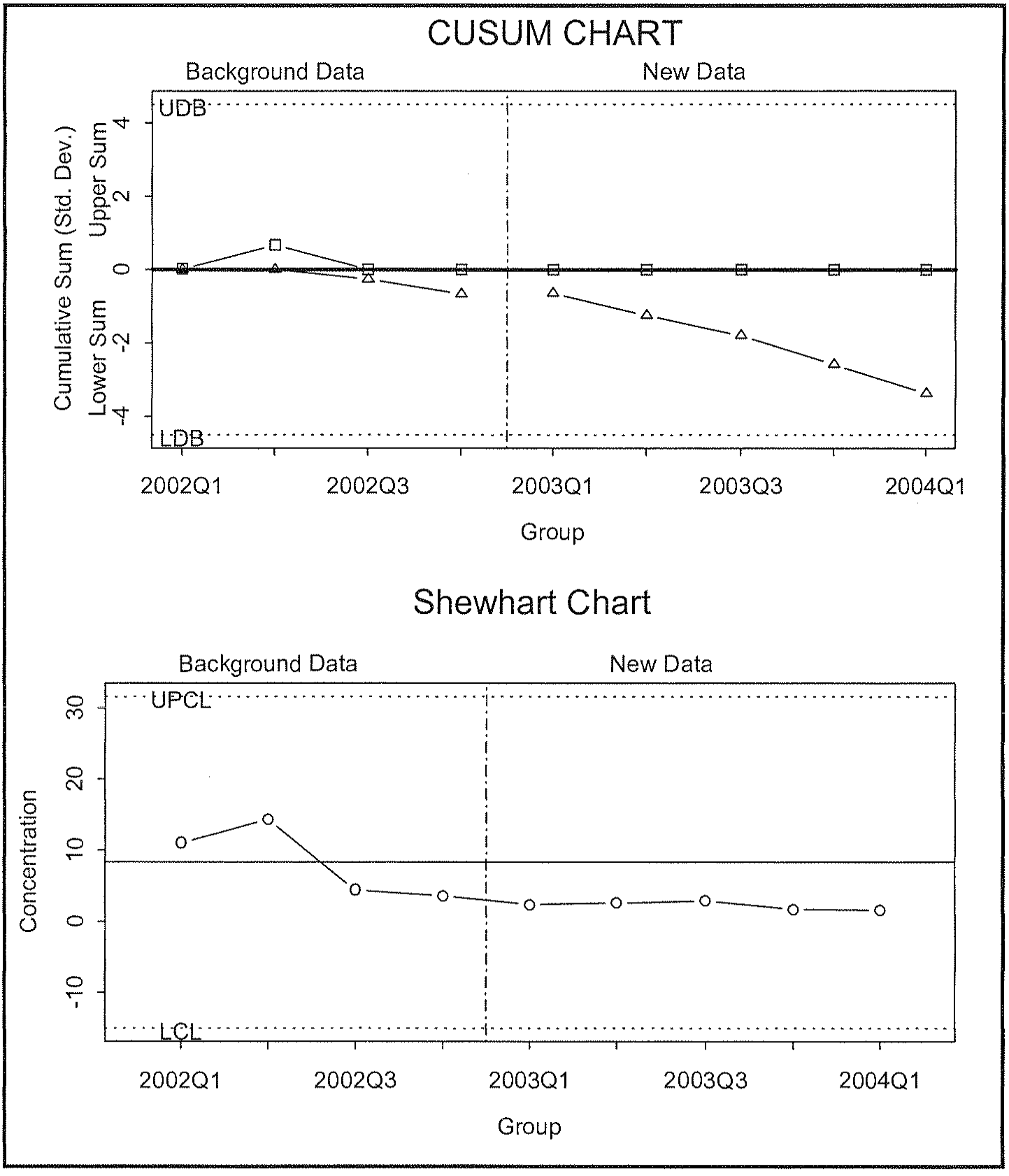
CUSUM CHART



Shewhart Chart

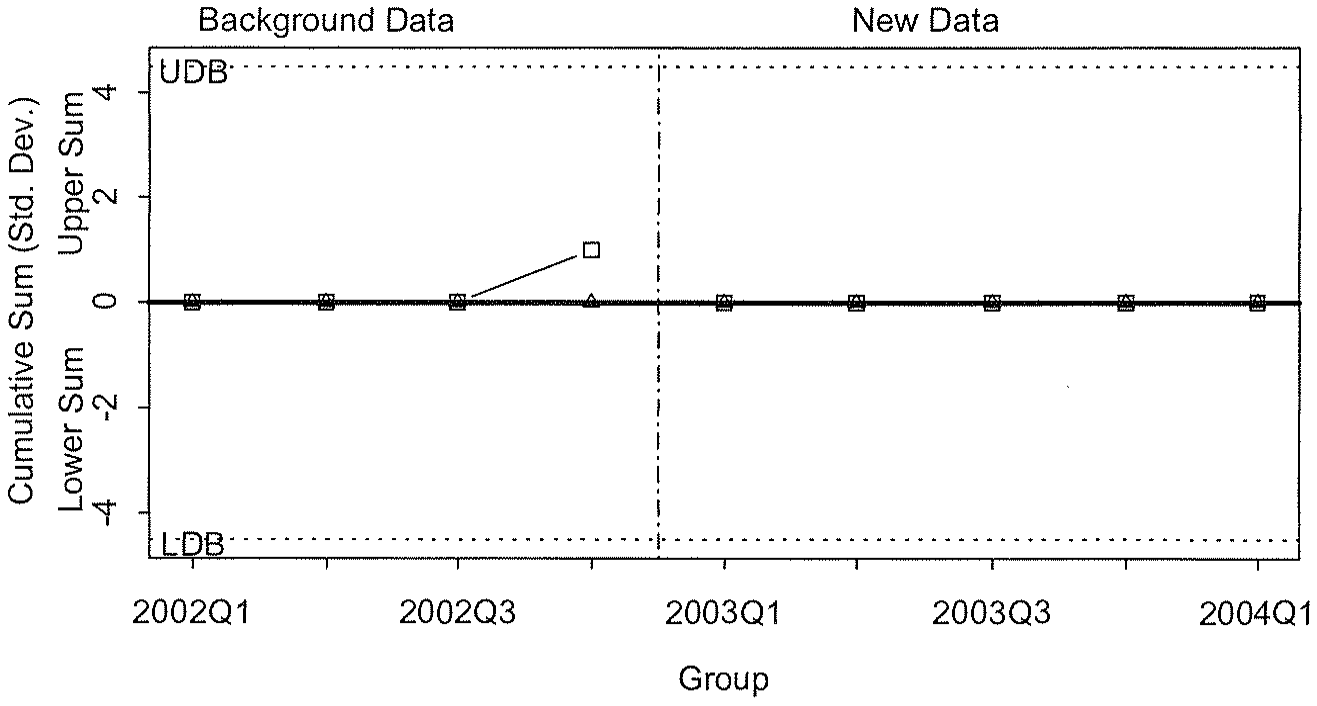


GENERATION DATE: 06/15/04	GW-34SR Ammonia mg/l	Geomega

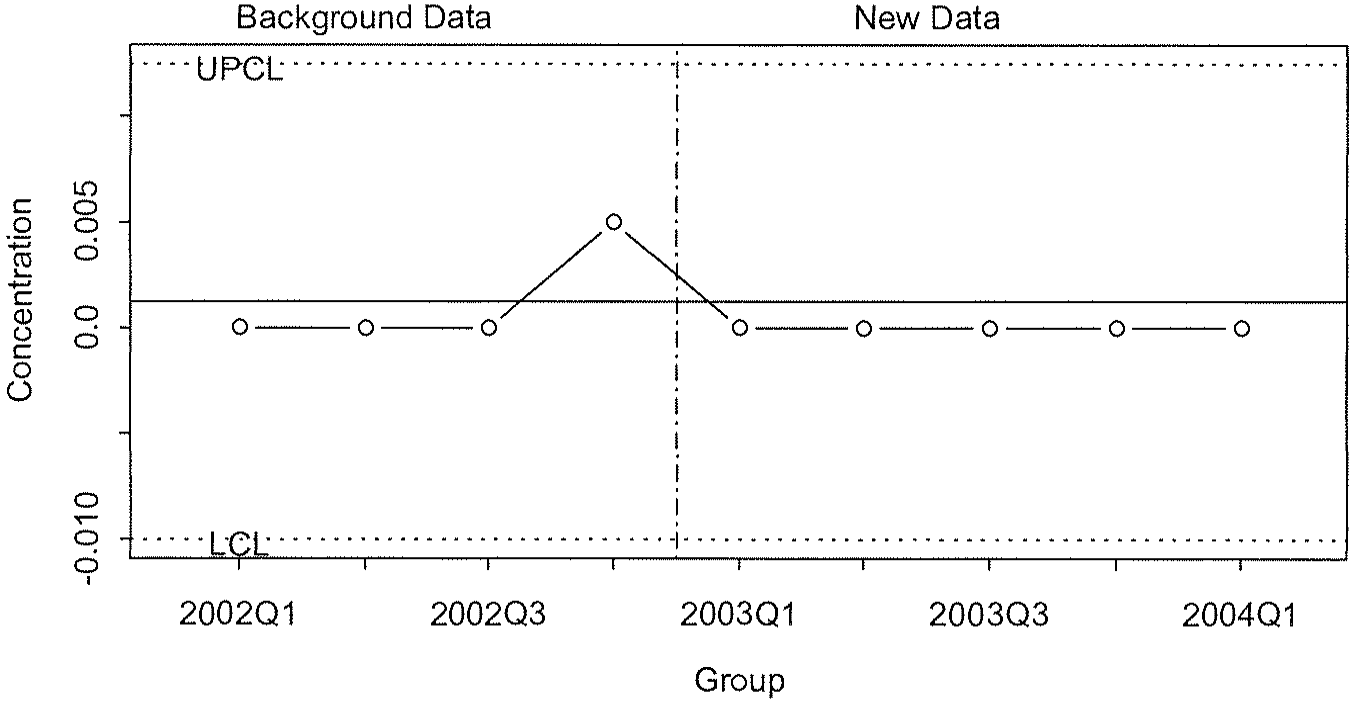


GENERATION DATE: 06/15/04	GW-34SR Chloride mg/l	Geomega

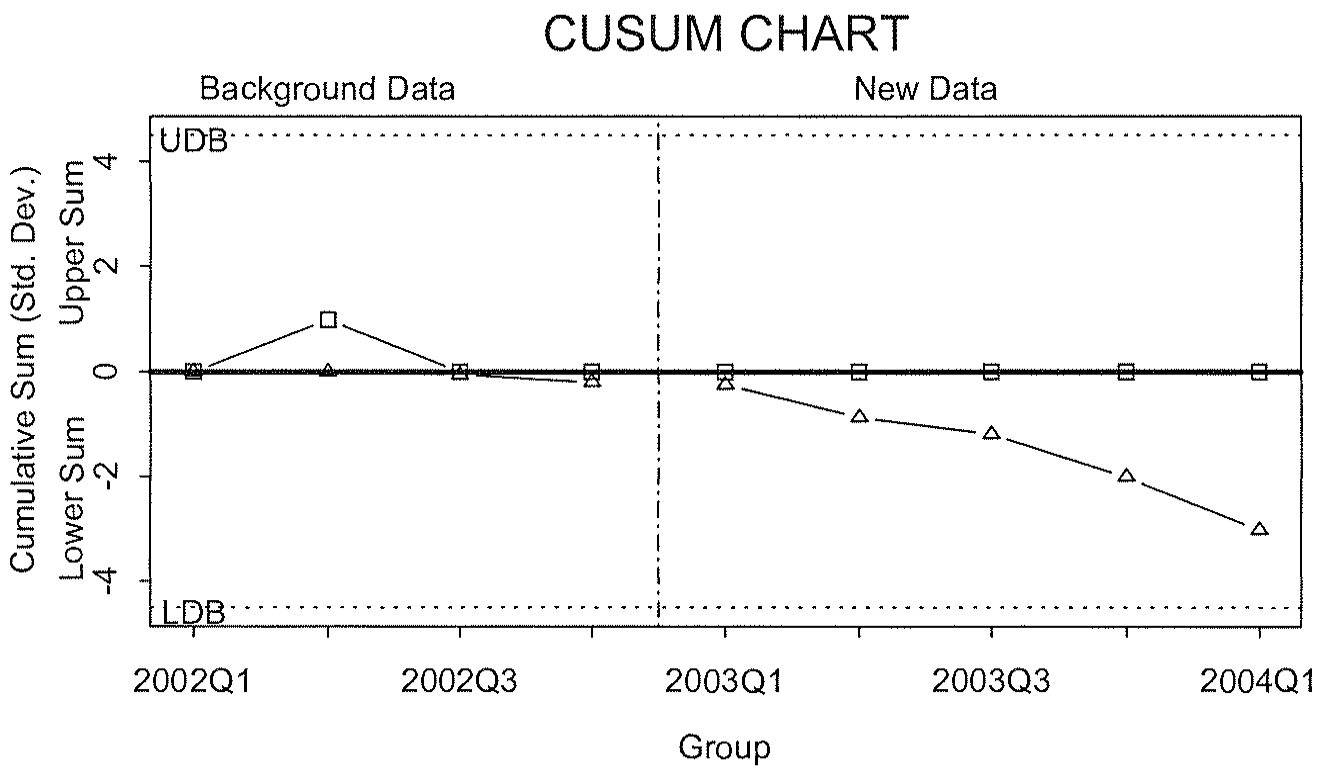
CUSUM CHART

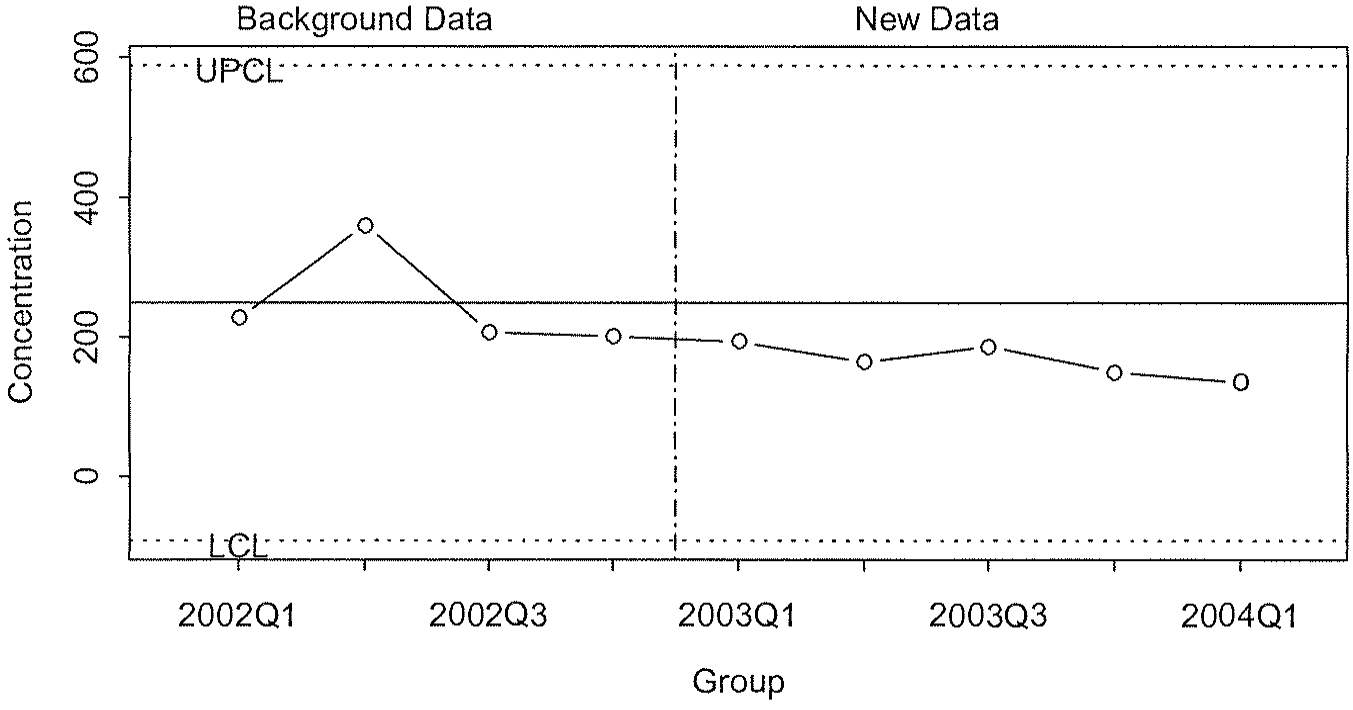


Shewhart Chart

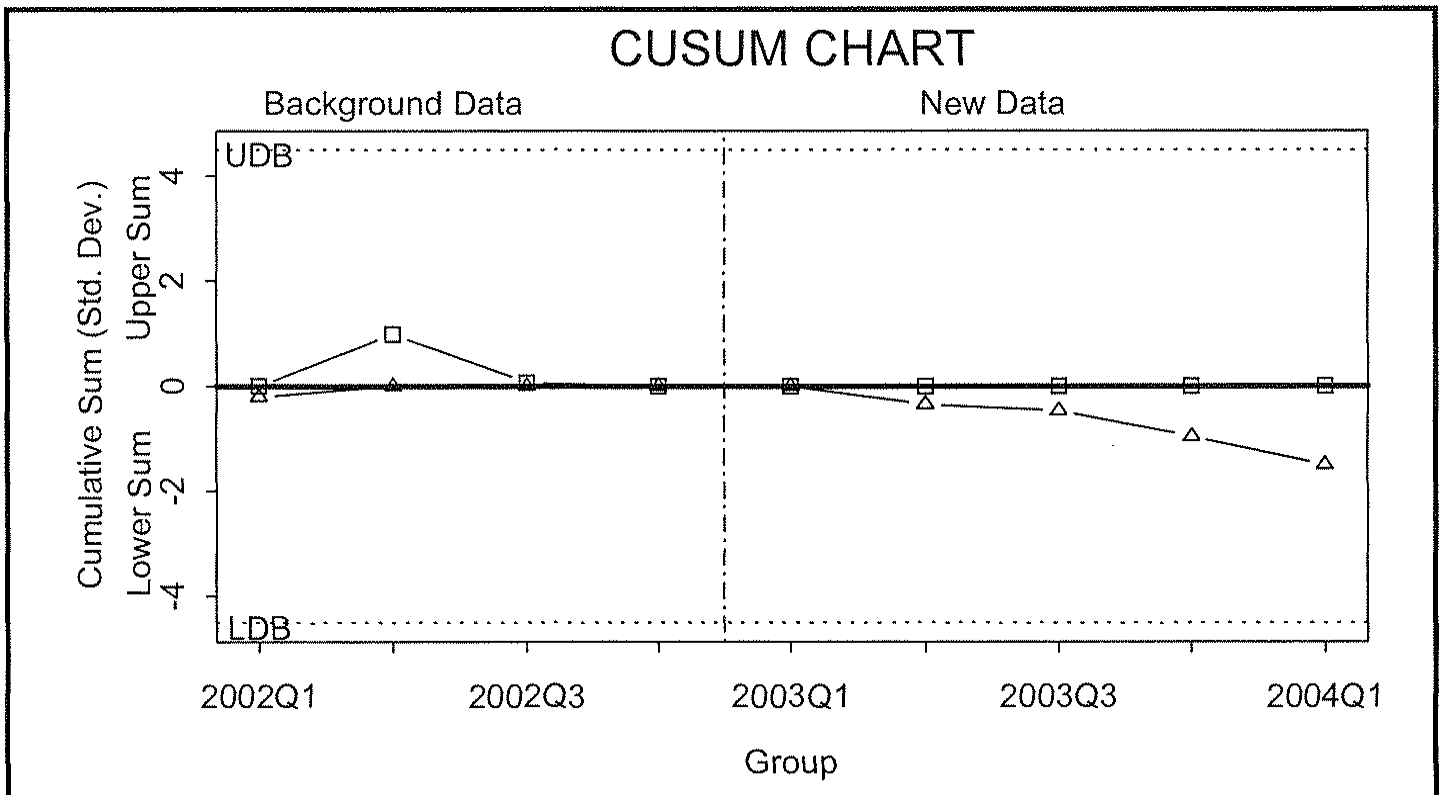


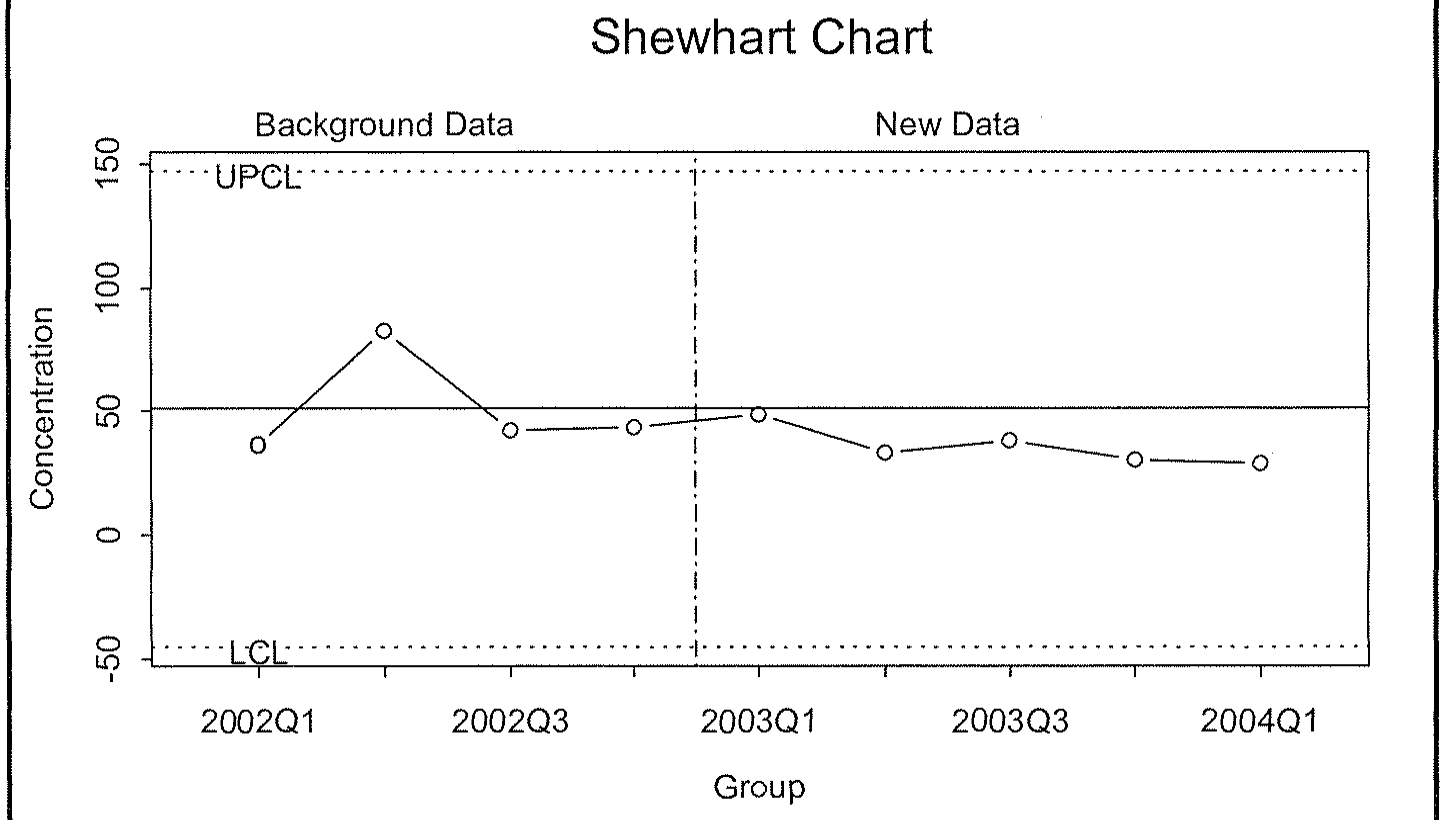
GENERATION DATE: 06/15/04	GW-34SR Chromium, Dissolved mg/l	Geomega



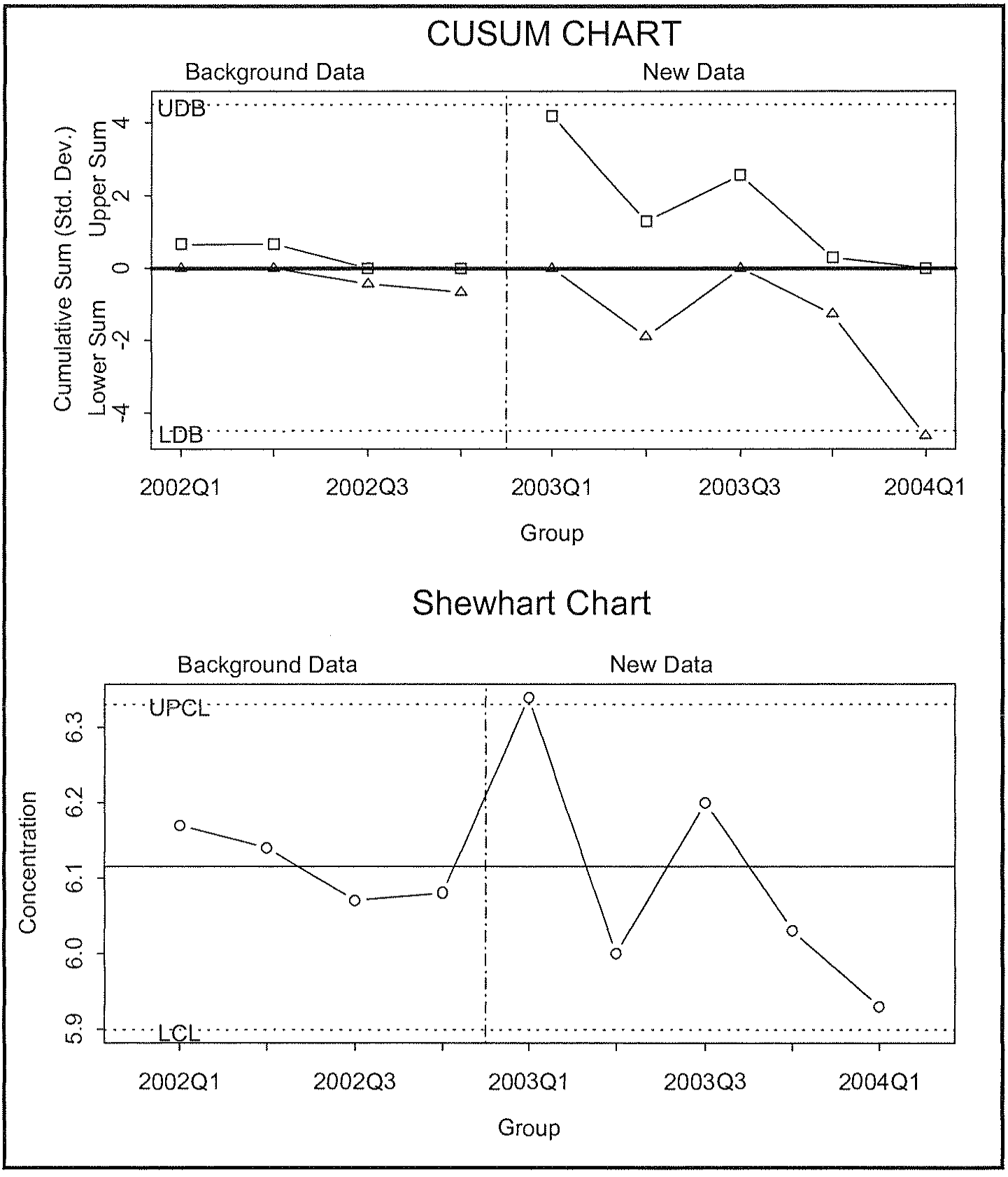


GENERATION DATE: 06/15/04	GW-34SR Specific Conductance umhos/cm	Geomega

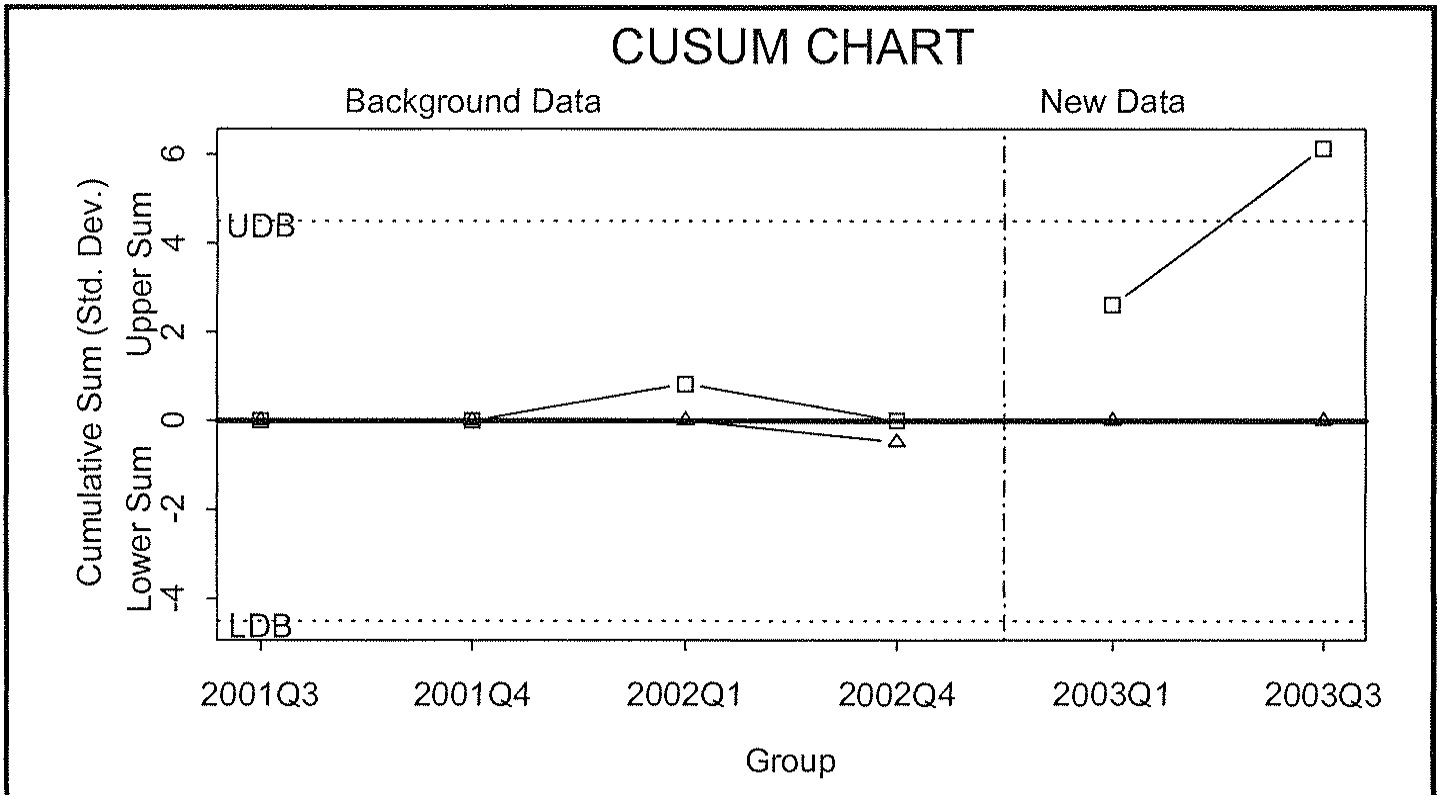


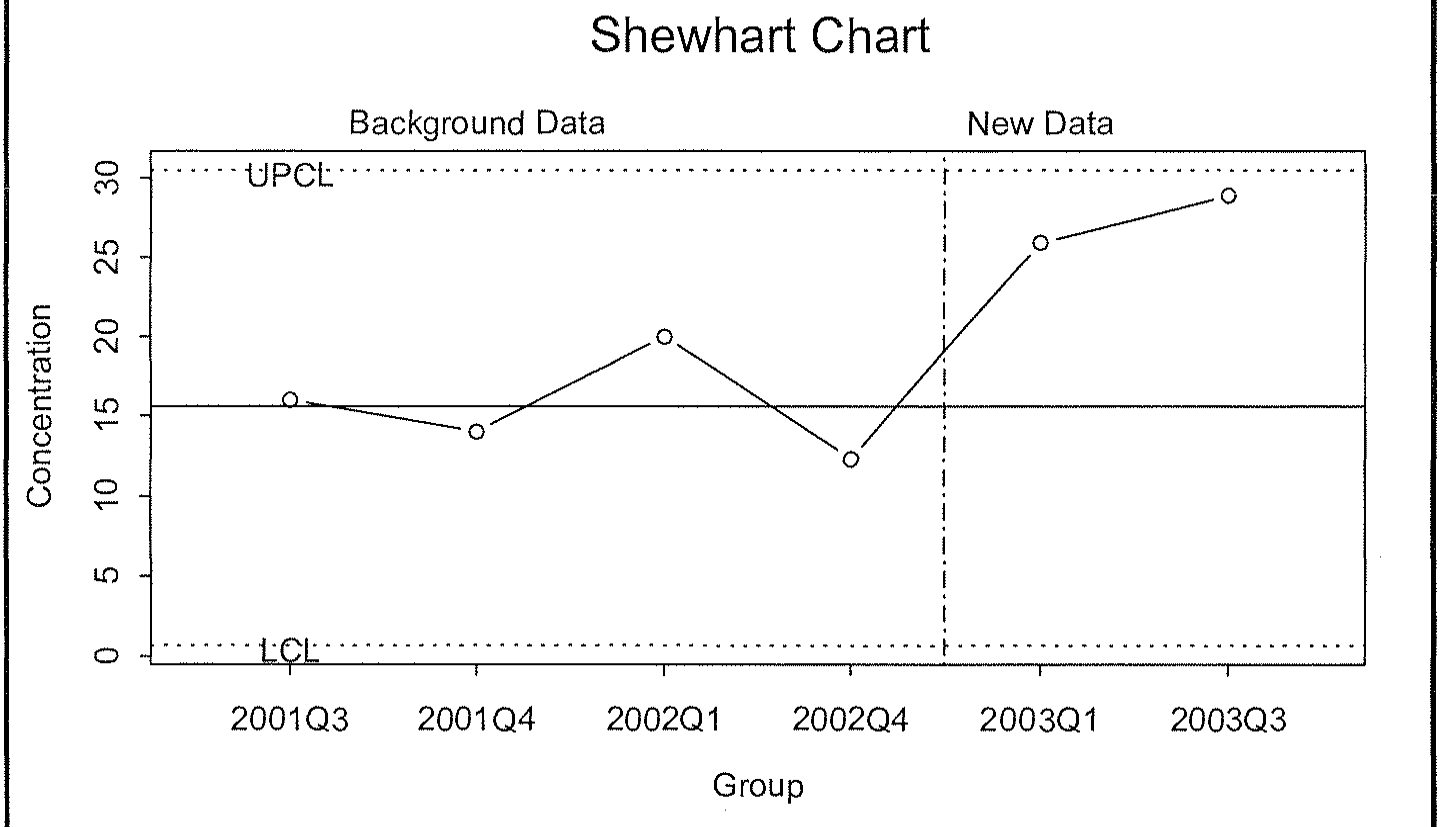


GENERATION DATE: 06/15/04	GW-34SR Sulfate mg/l	Geomega

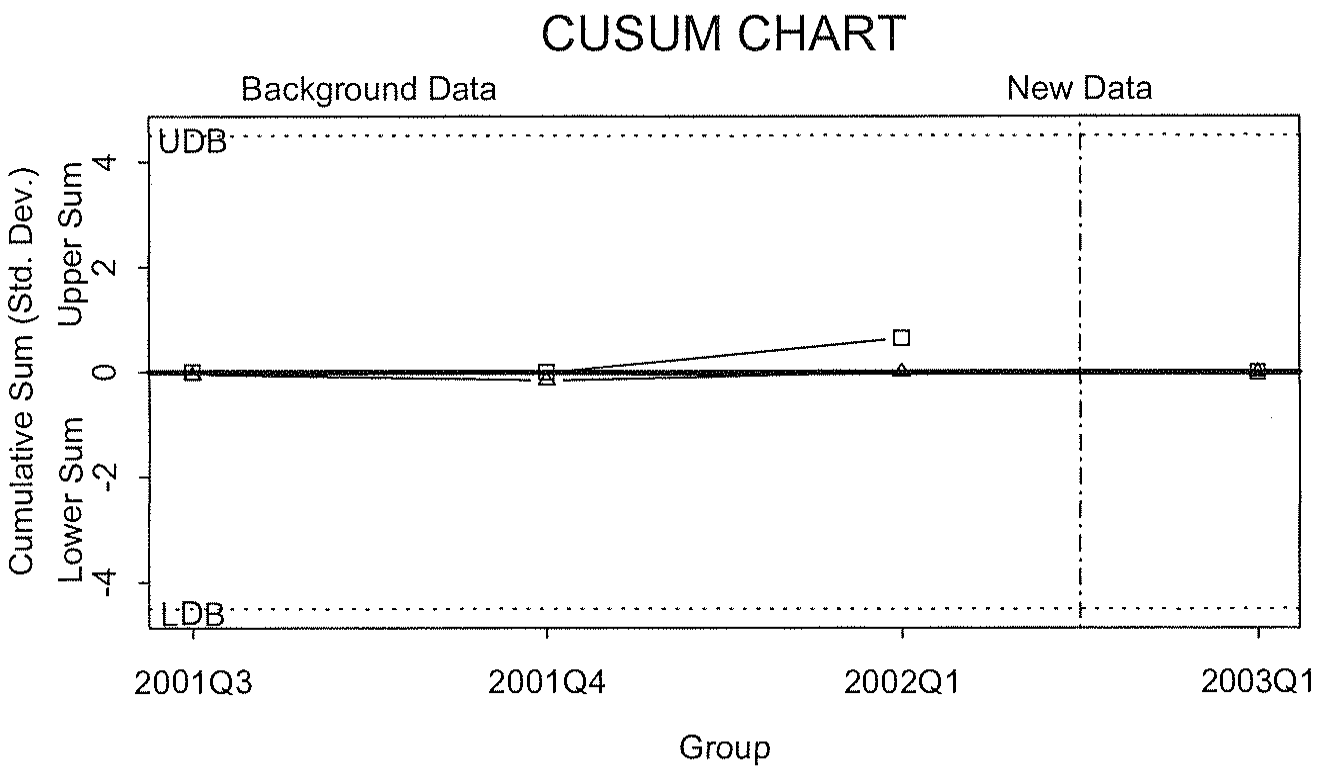


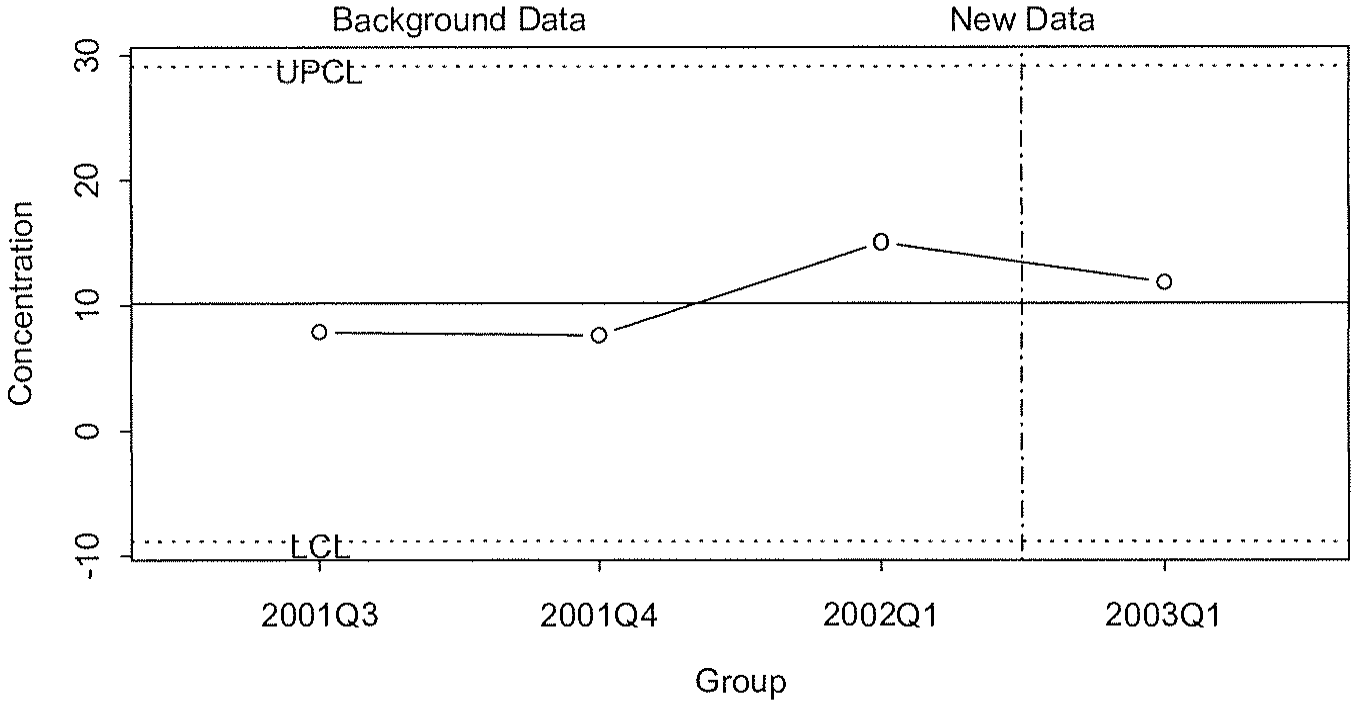
GENERATION DATE: 06/15/04	GW-34SR pH mg/l	Geomega



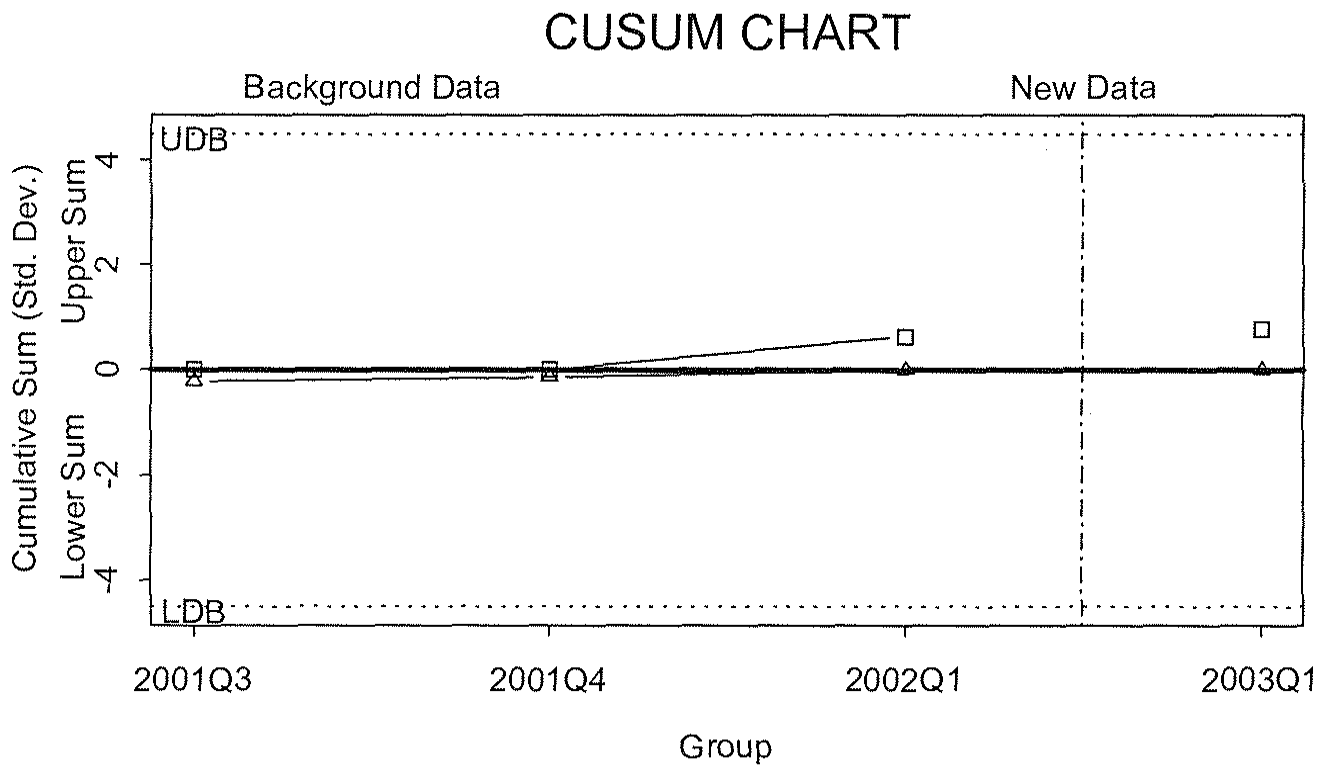


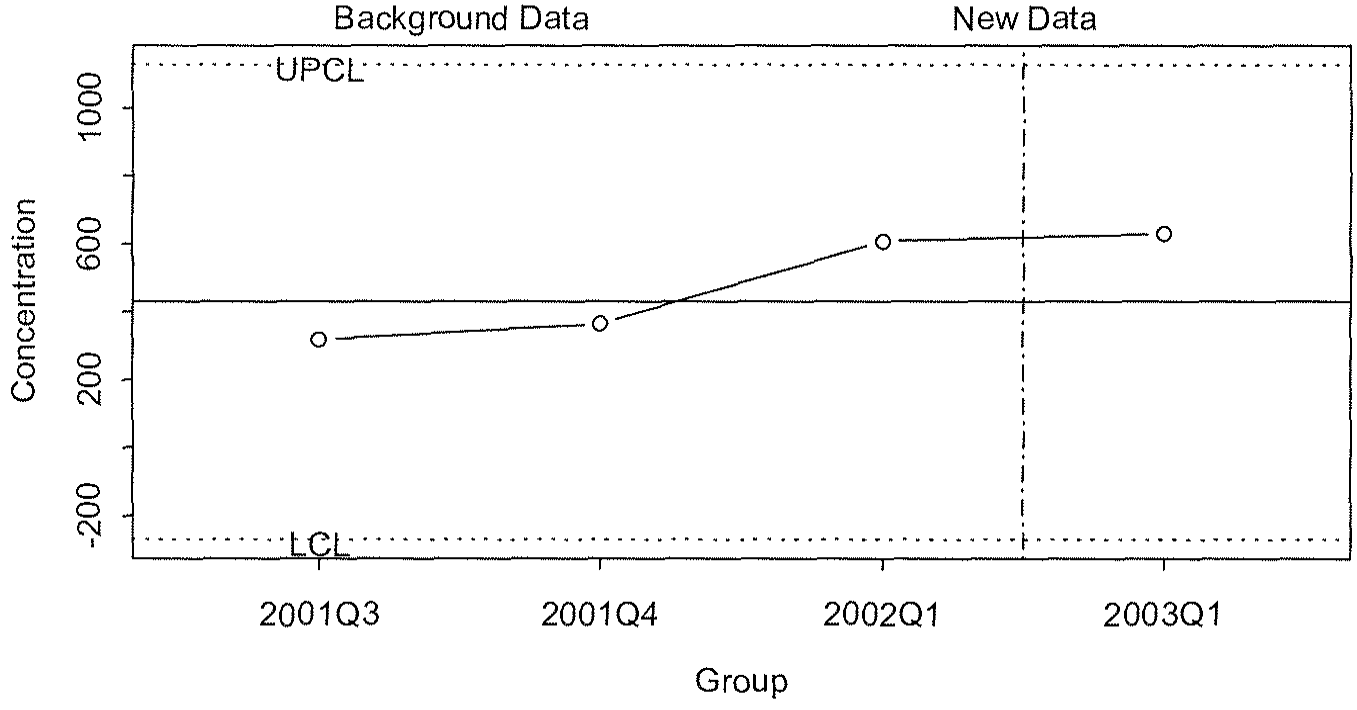
GENERATION DATE: 06/15/04	GW-76S Ammonia mg/l	Geomega



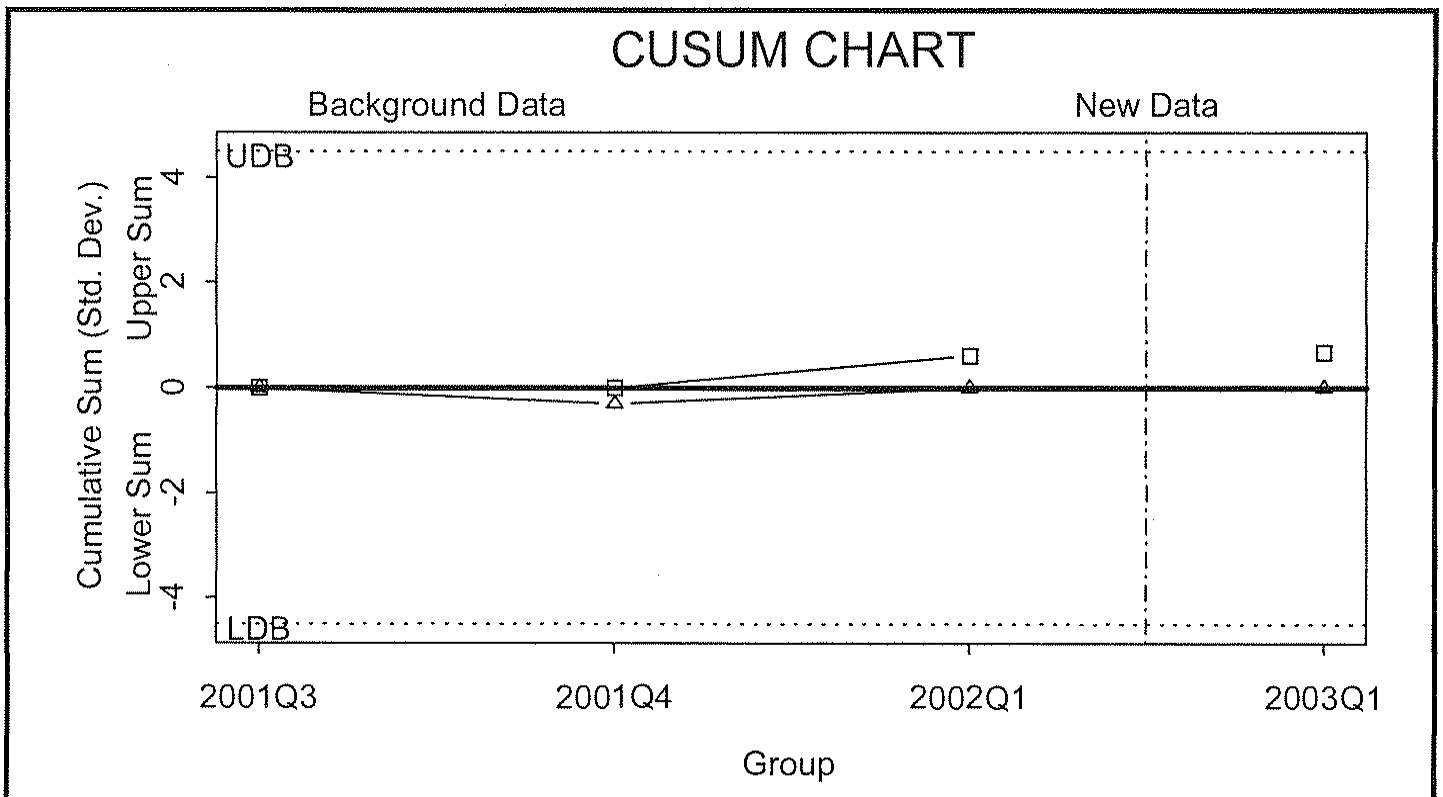


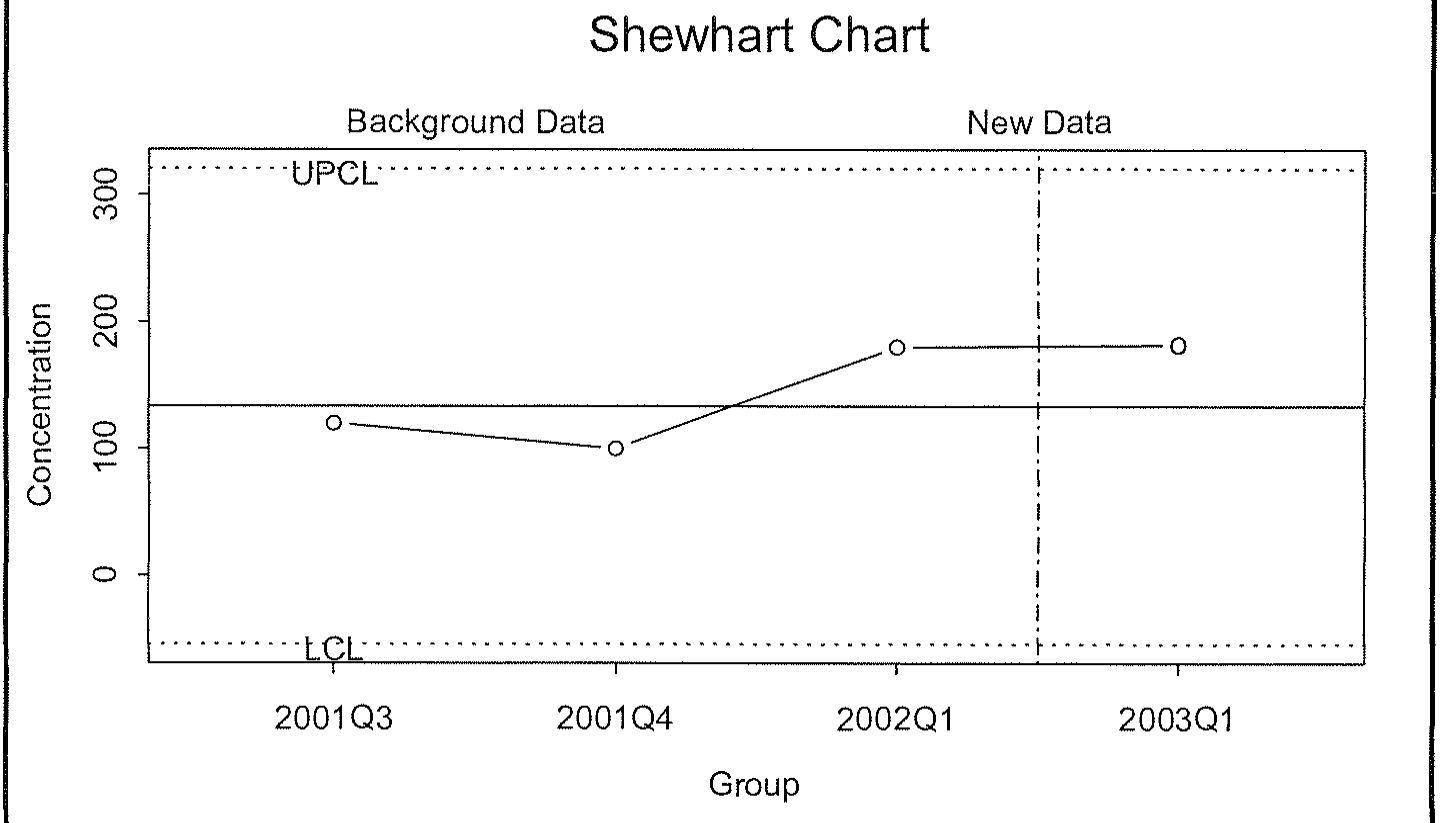
GENERATION DATE: 06/15/04	GW-76S Chloride mg/l	Geomega



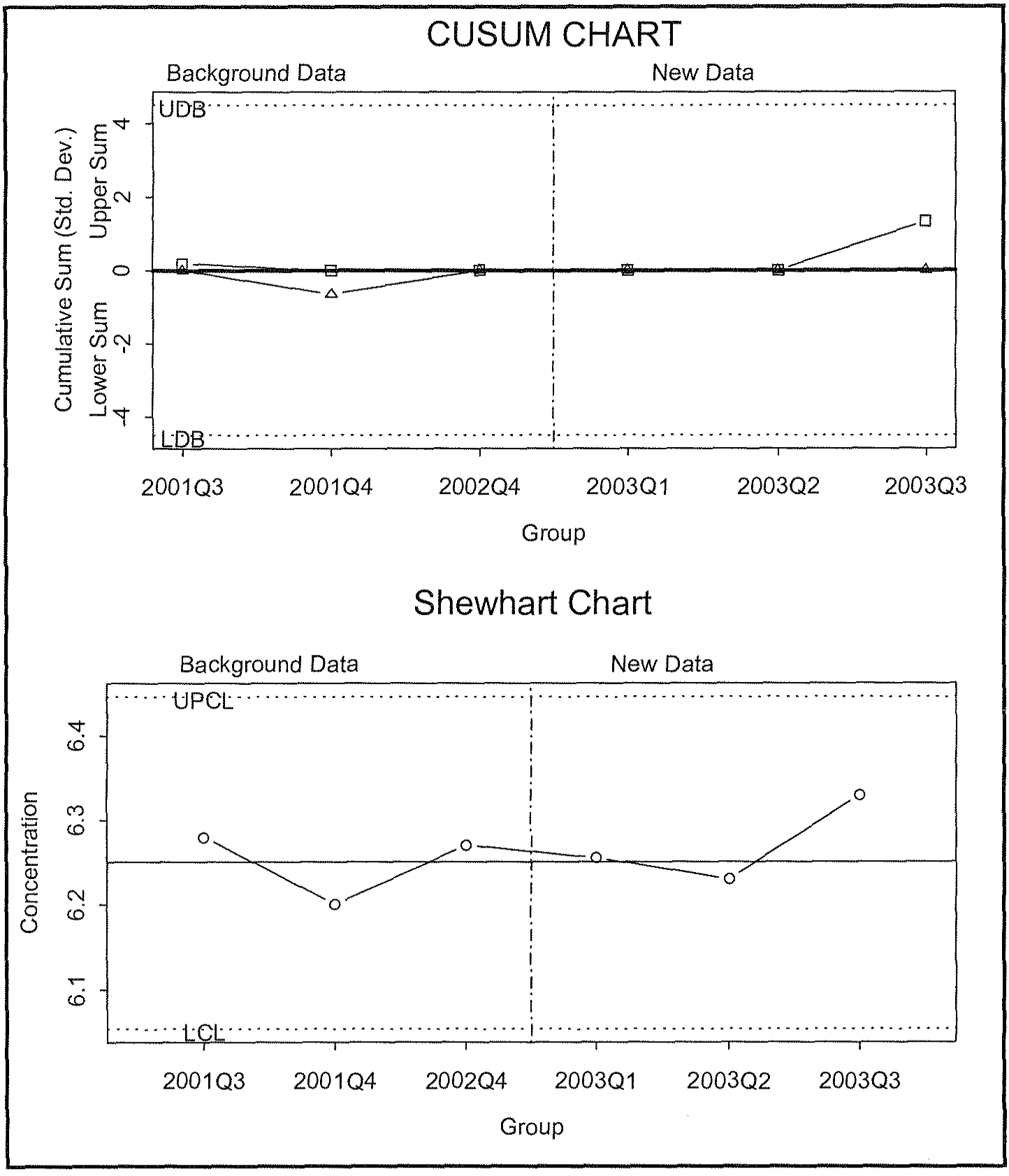


GENERATION DATE: 06/15/04	GW-76S Specific Conductance umhos/cm	Geomega

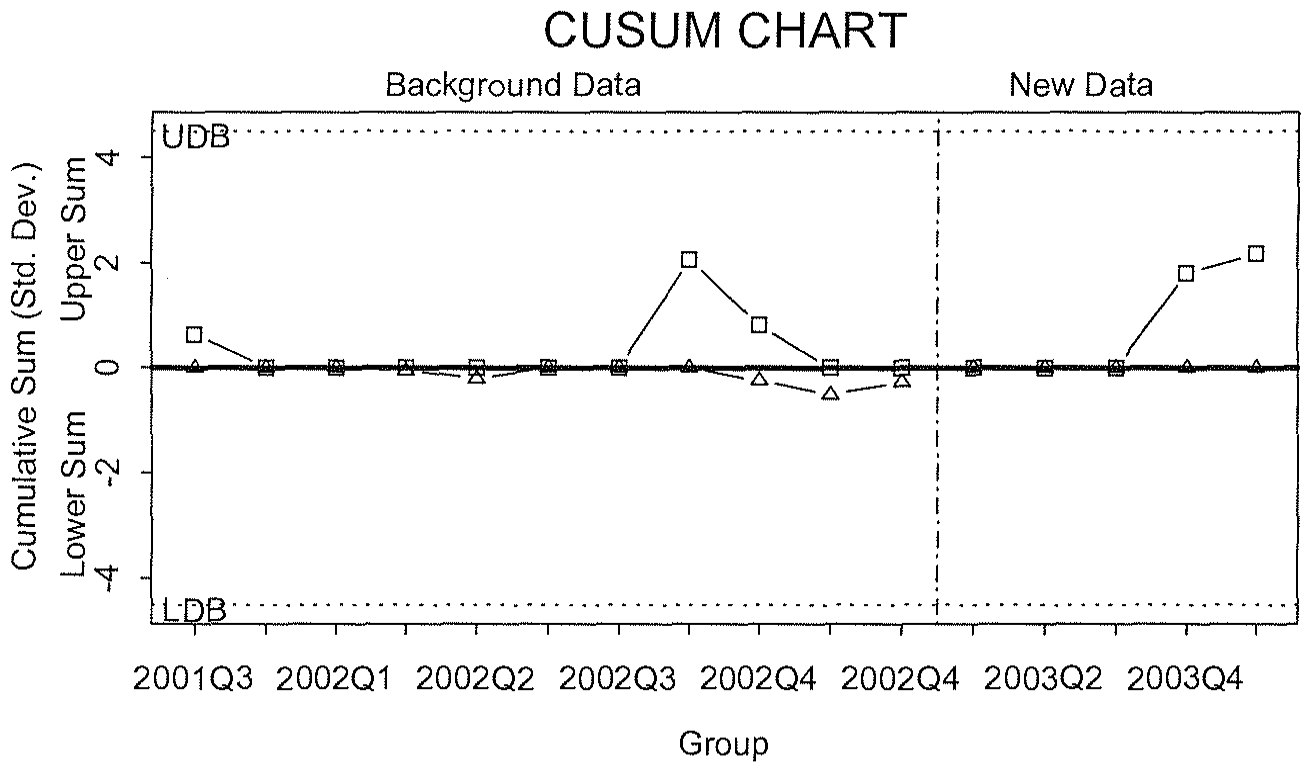


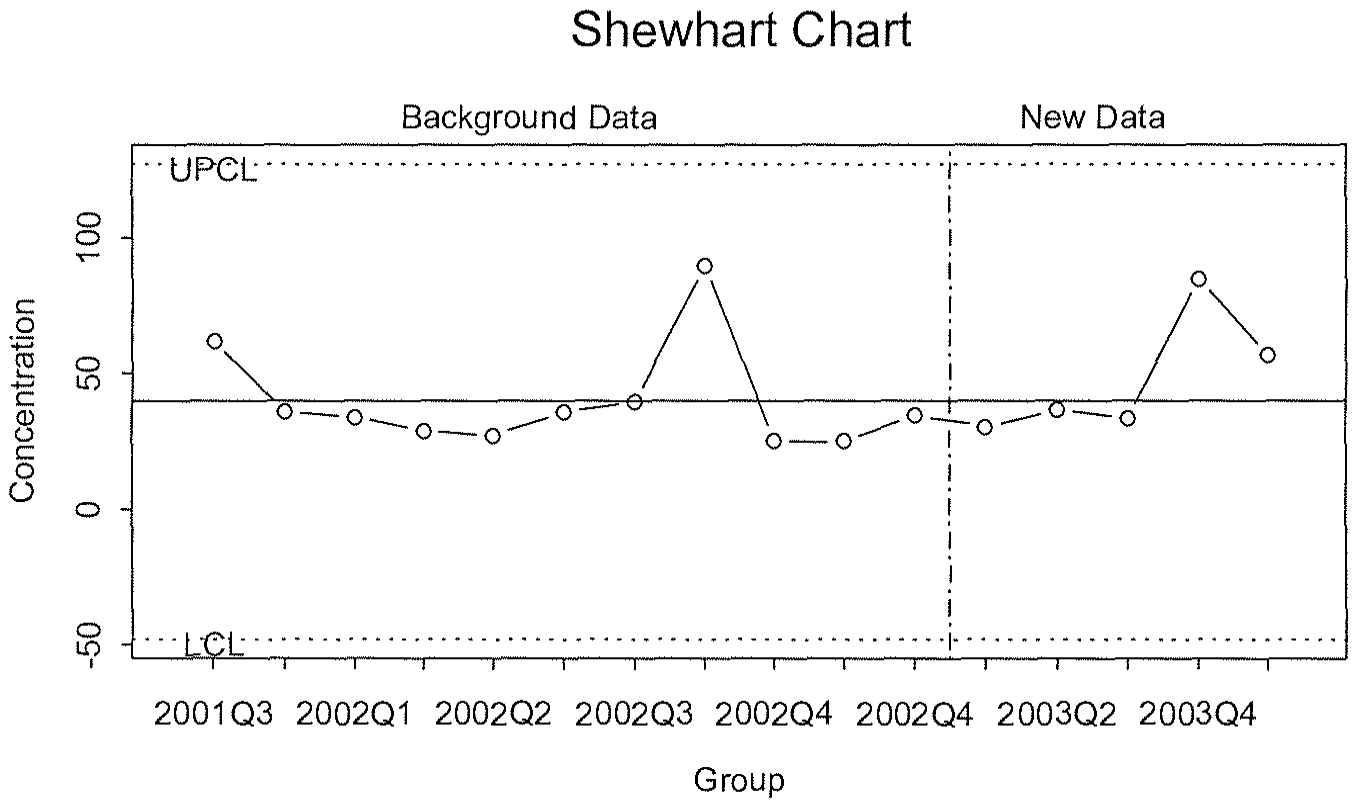


GENERATION DATE: 06/15/04	GW-76S Sulfate mg/l	Geomega

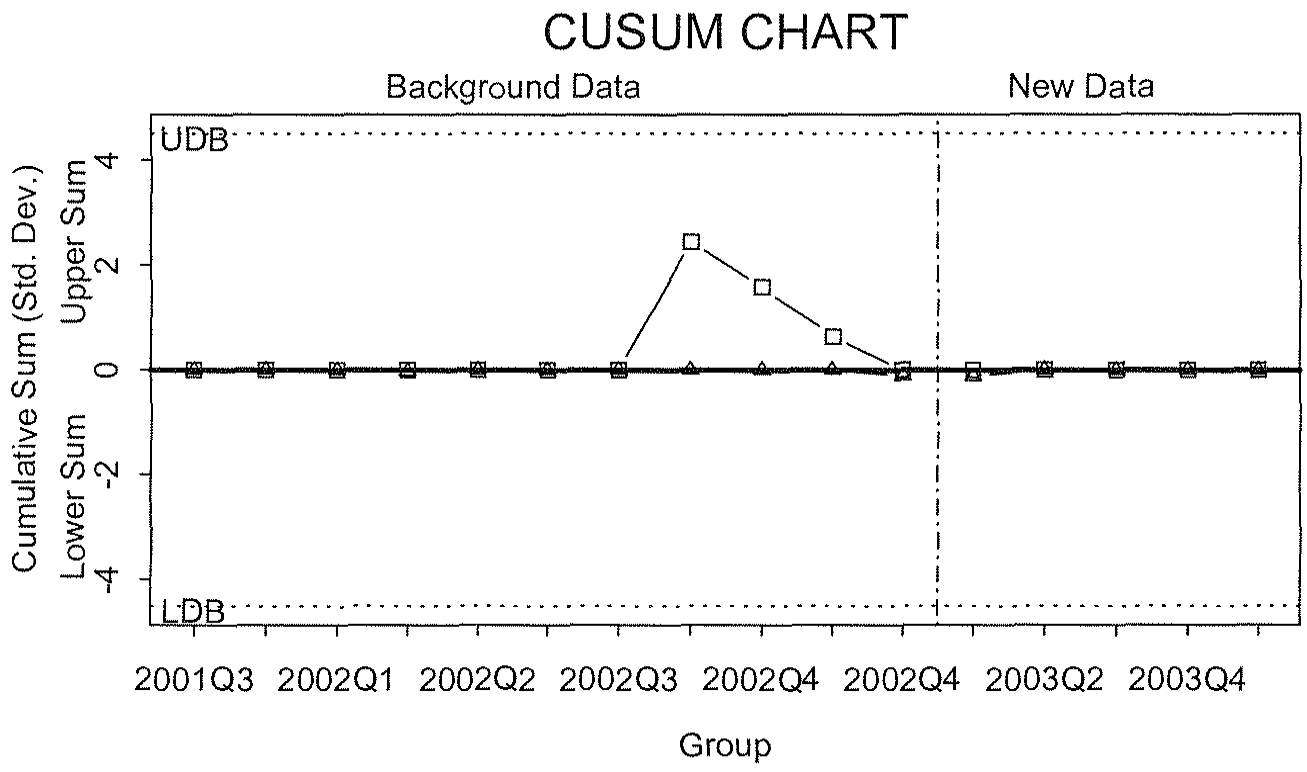


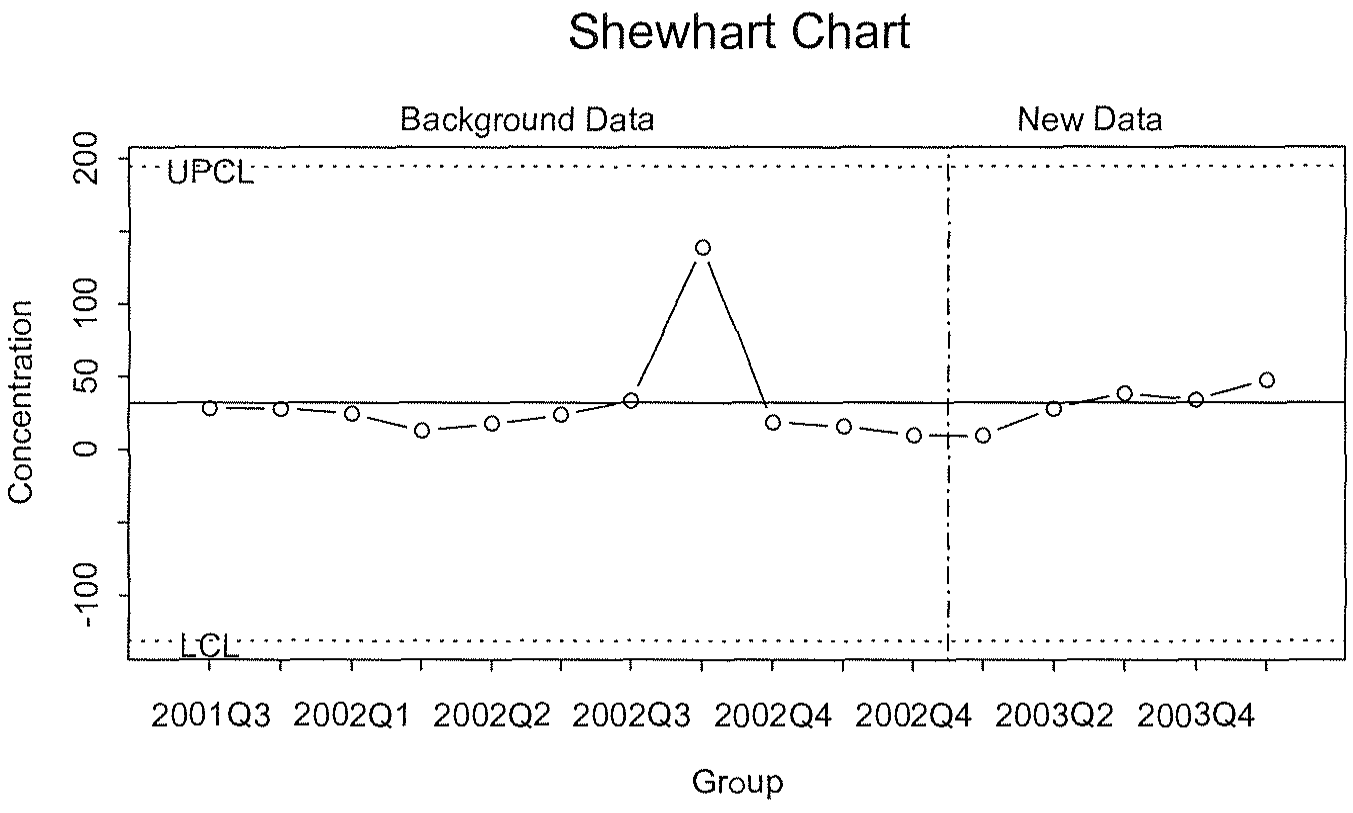
GENERATION DATE: 06/15/04	GW-76S pH mg/l	Geomega



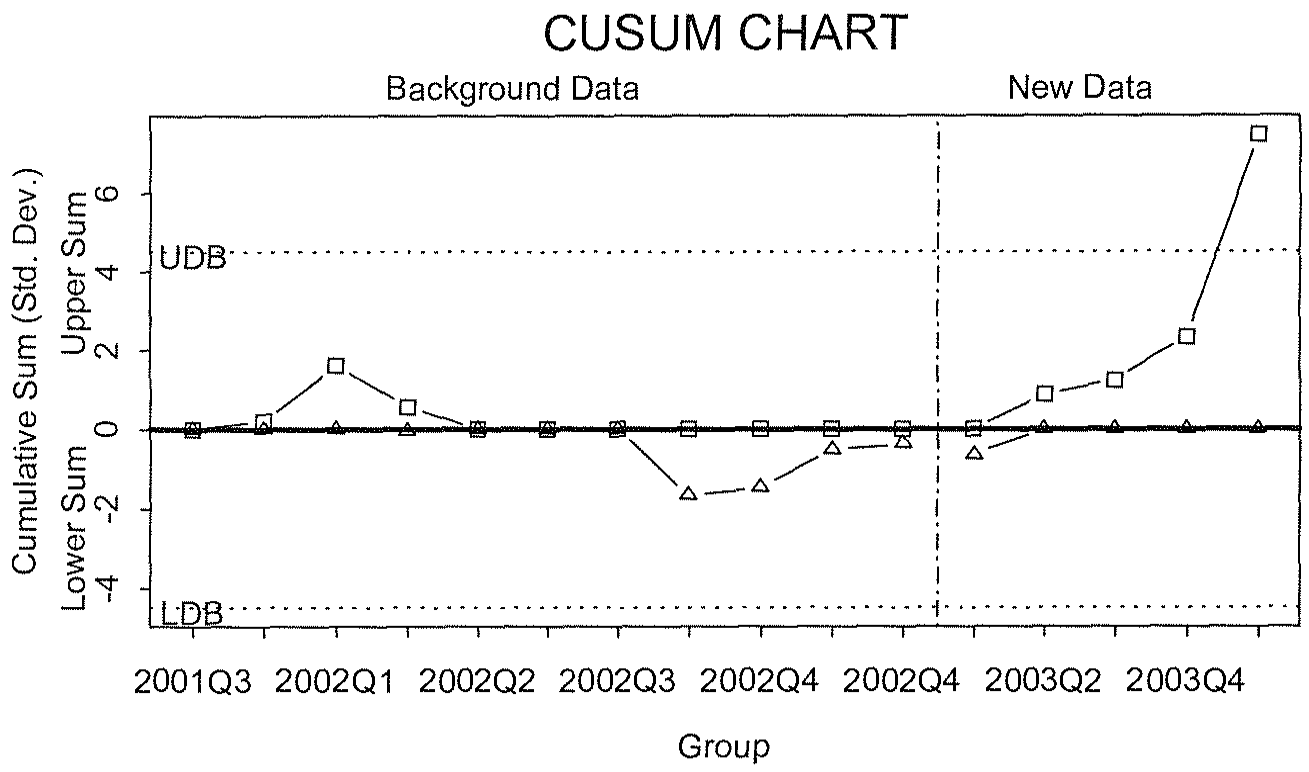


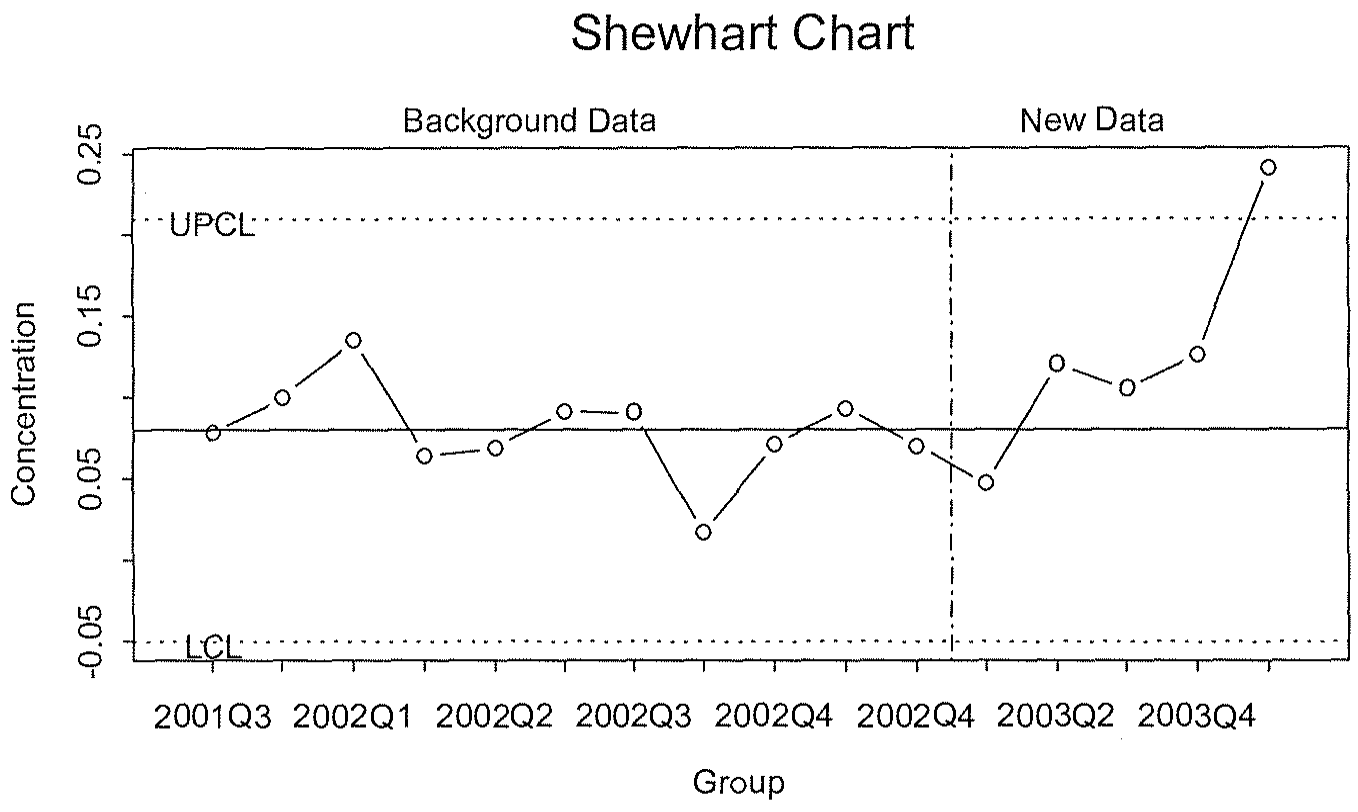
GENERATION DATE: 06/15/04	GW-78S Ammonia mg/l	Geomega



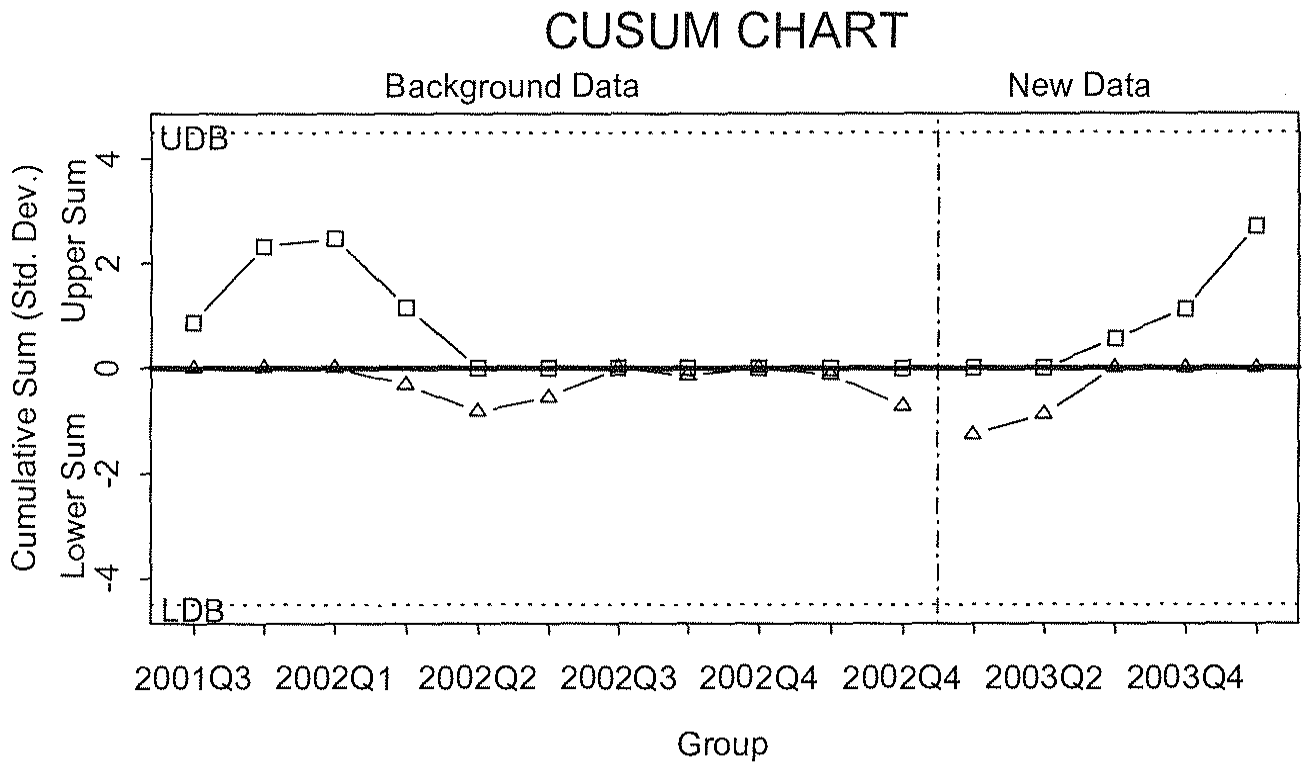


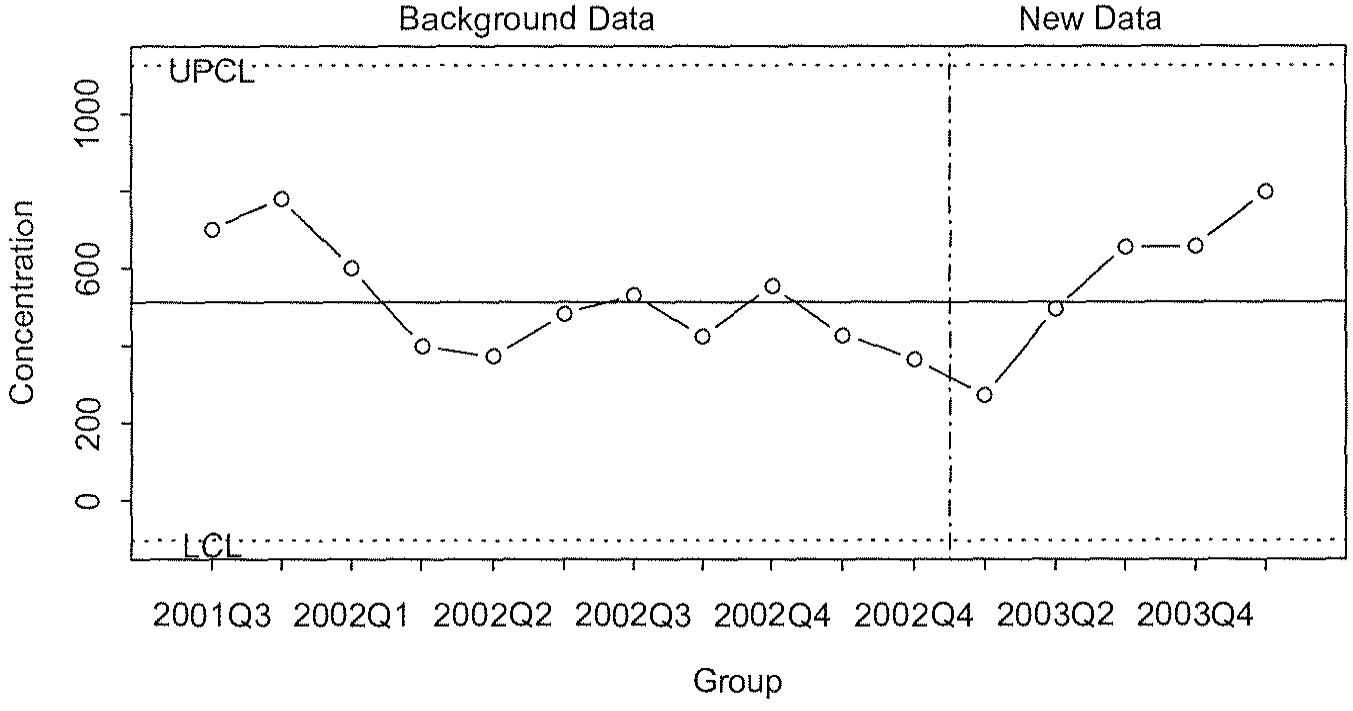
GENERATION DATE: 06/15/04	GW-78S Chloride mg/l	Geomega



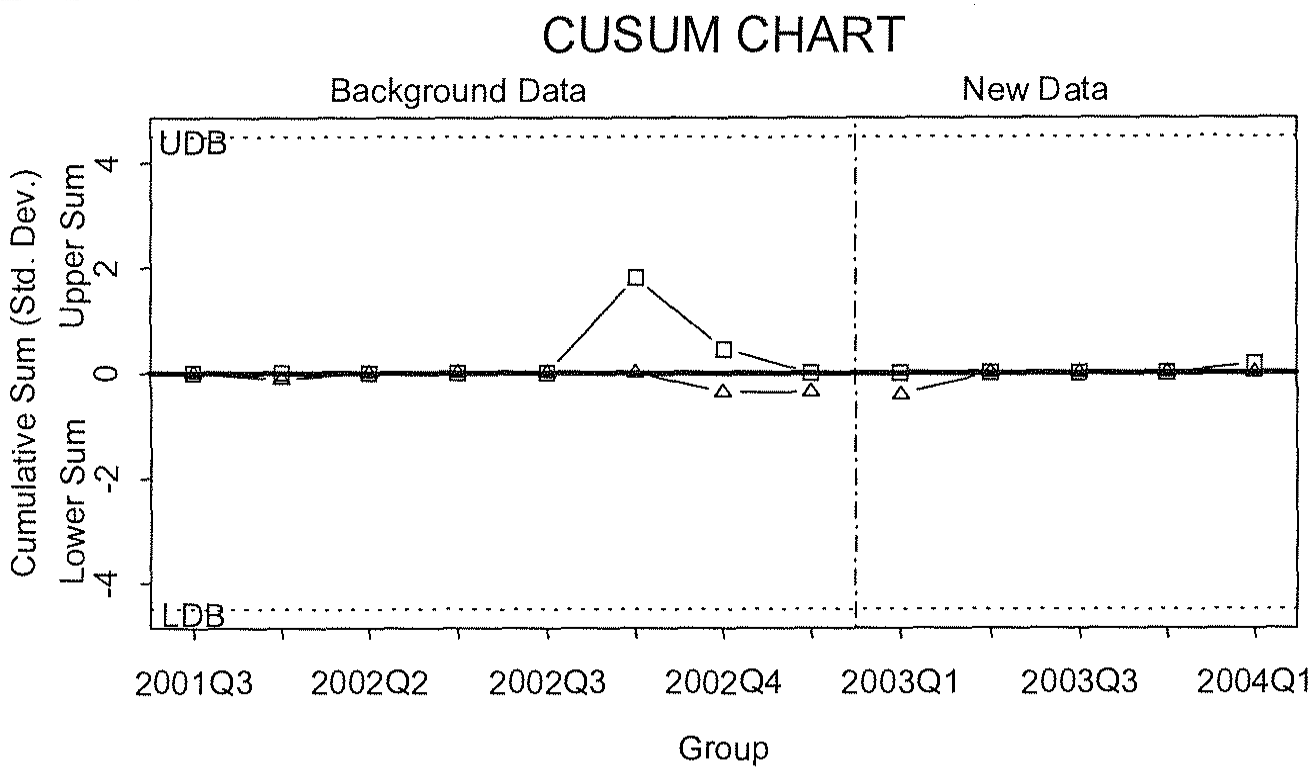


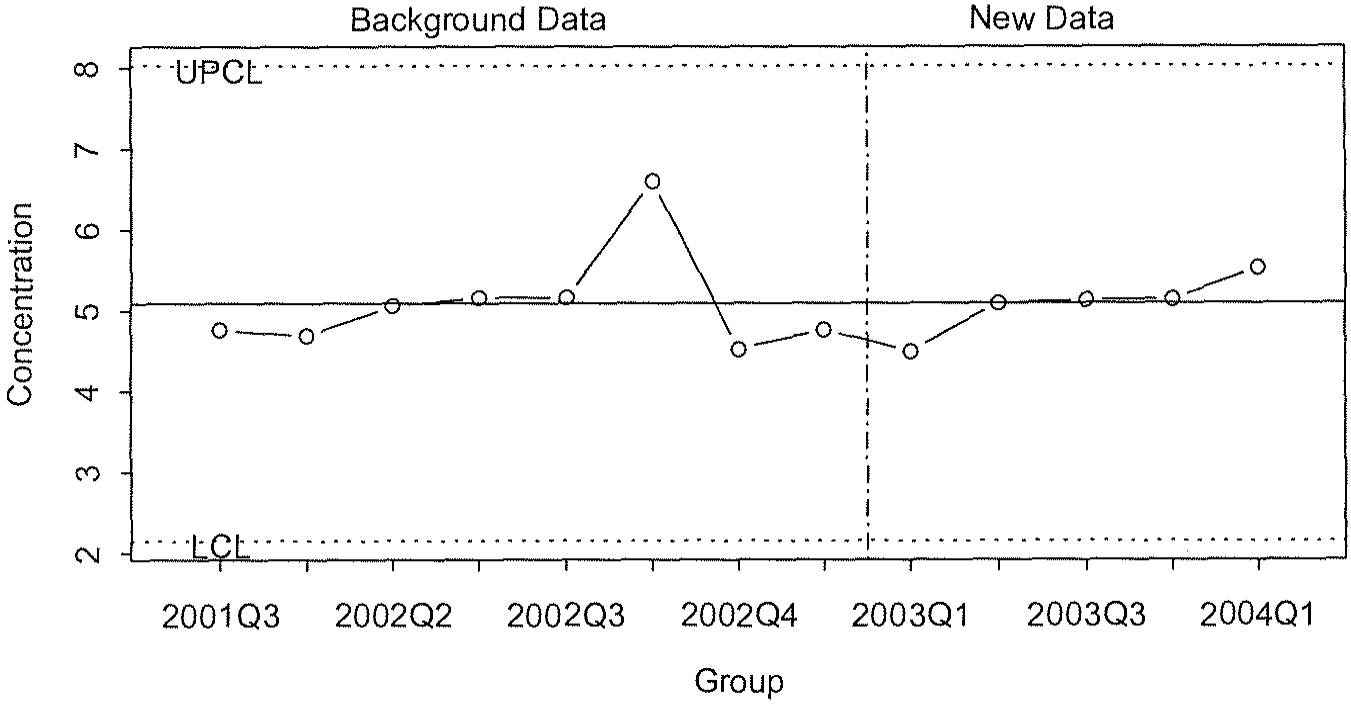
GENERATION DATE: 06/15/04	GW-78S Chromium, Dissolved mg/l	Geomega



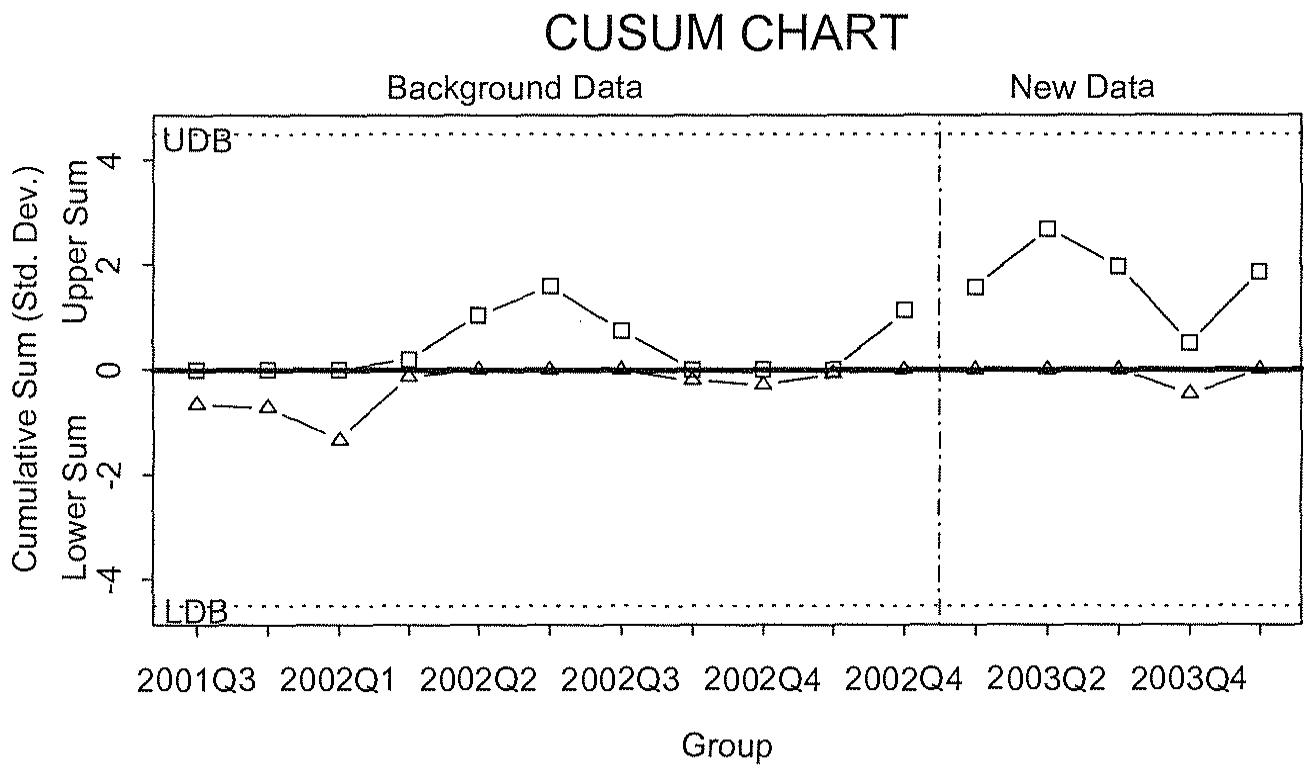


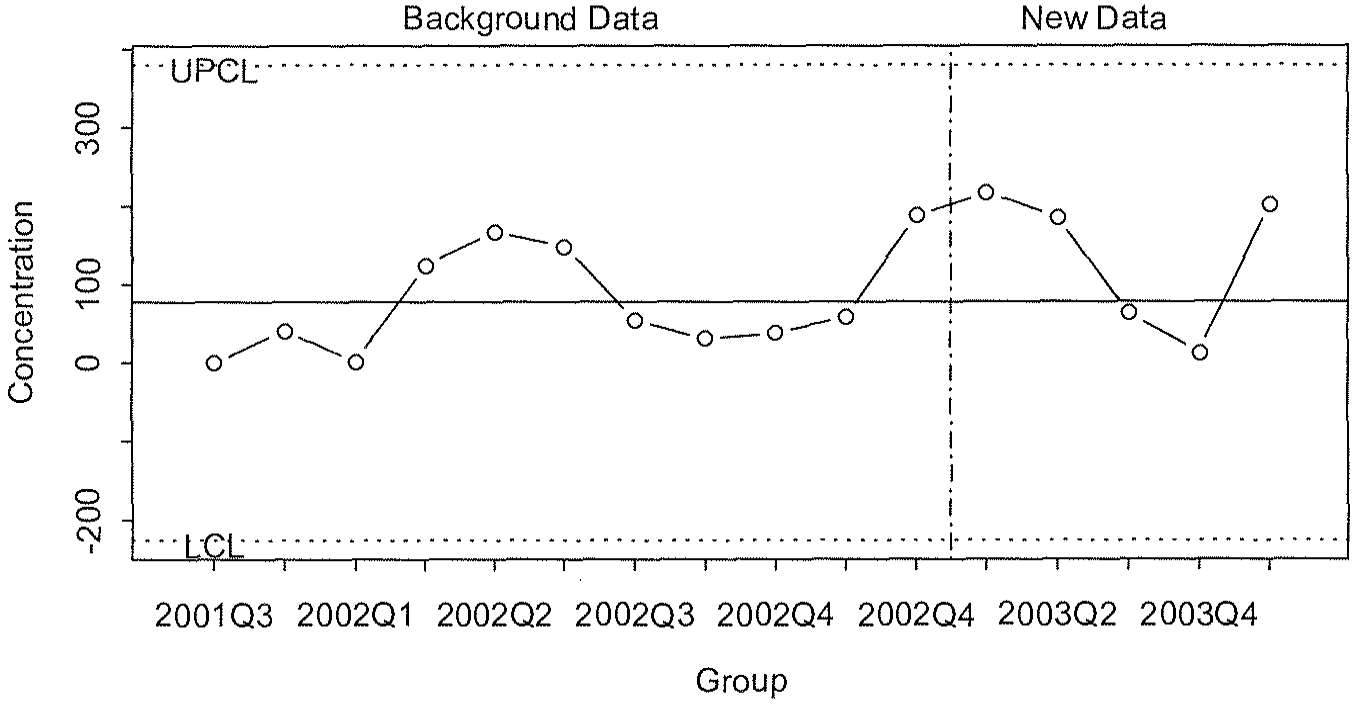
GENERATION DATE: 06/15/04	GW-78S Sulfate mg/l	Geomega



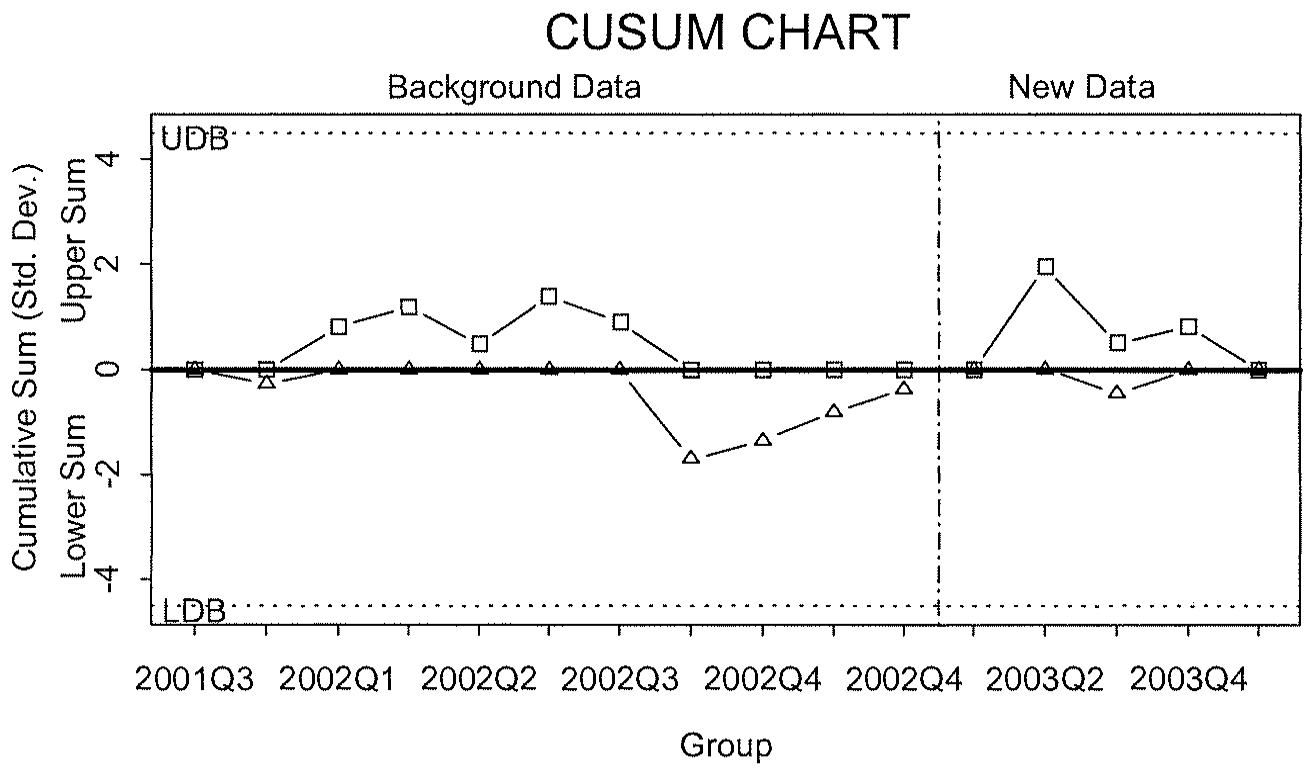


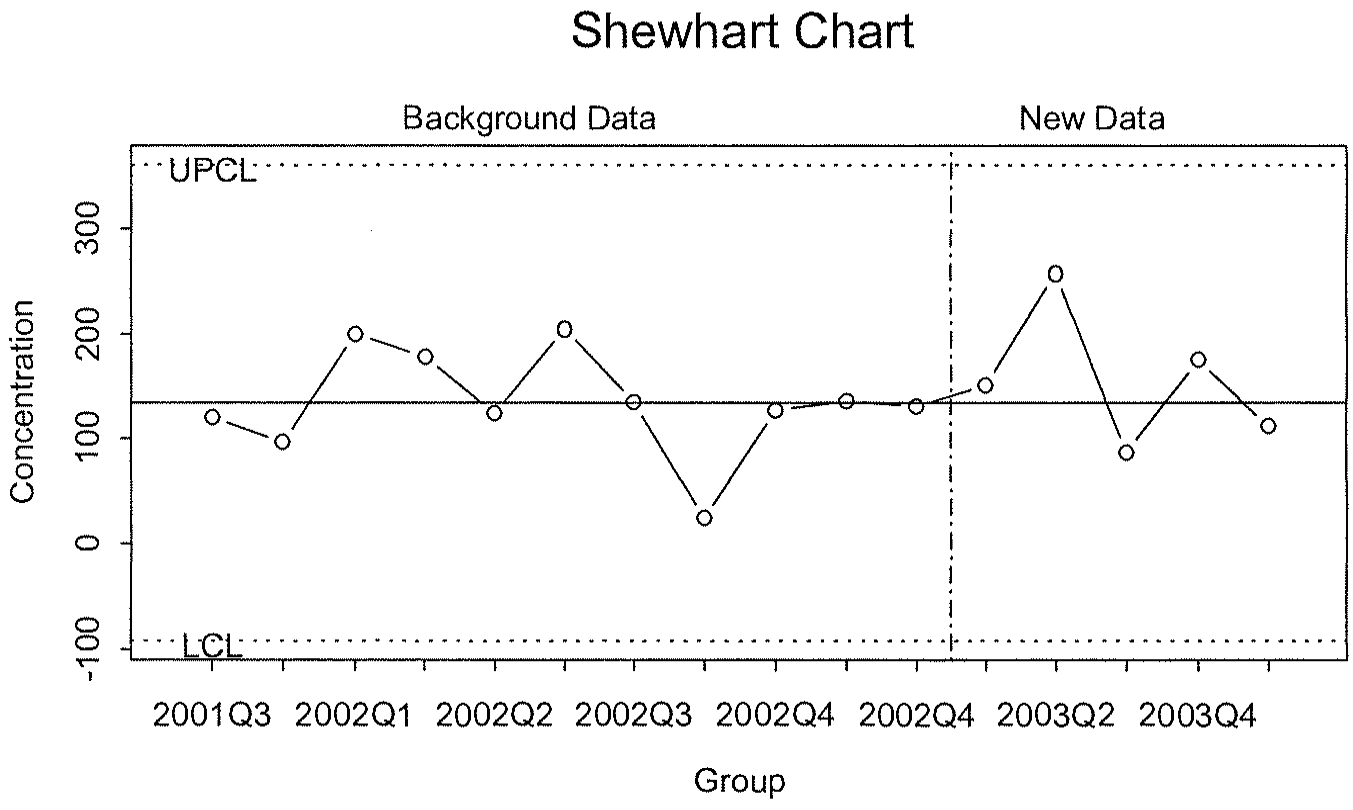
GENERATION DATE: 06/15/04	GW-78S pH mg/l	Geomega



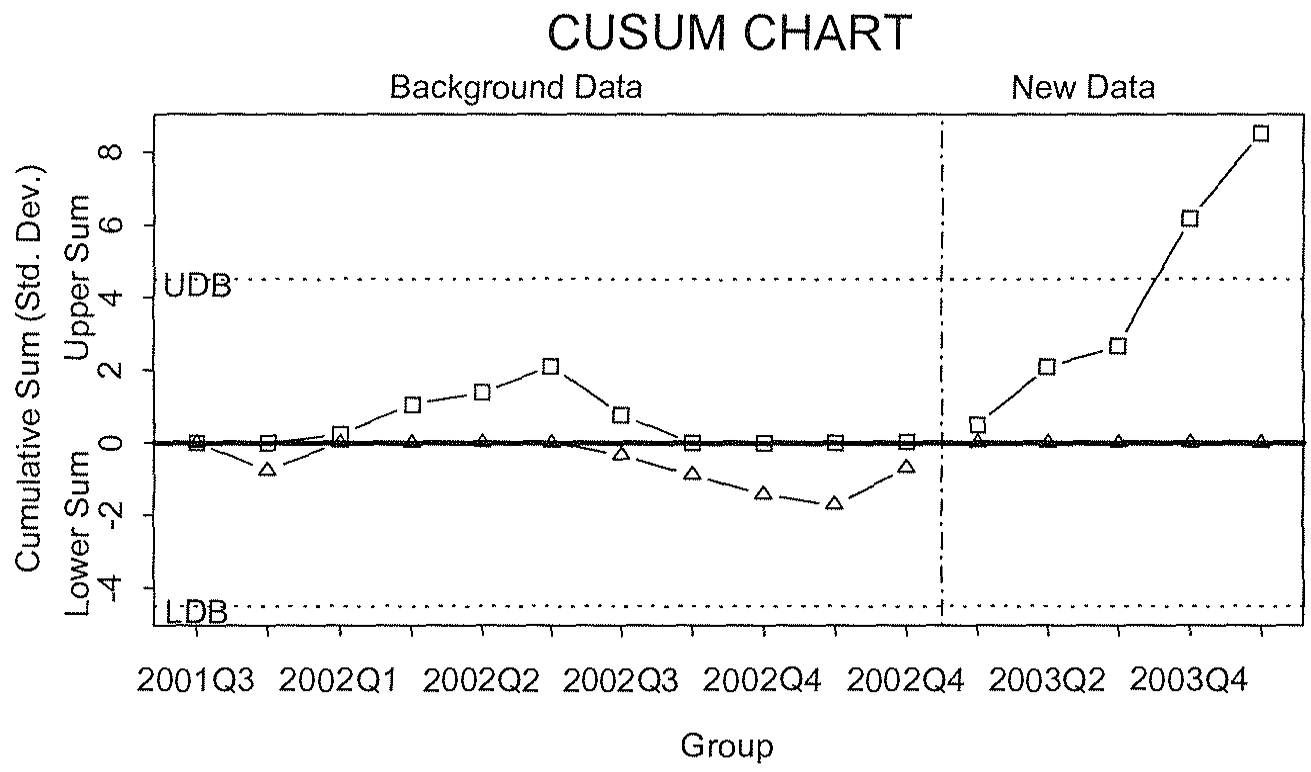


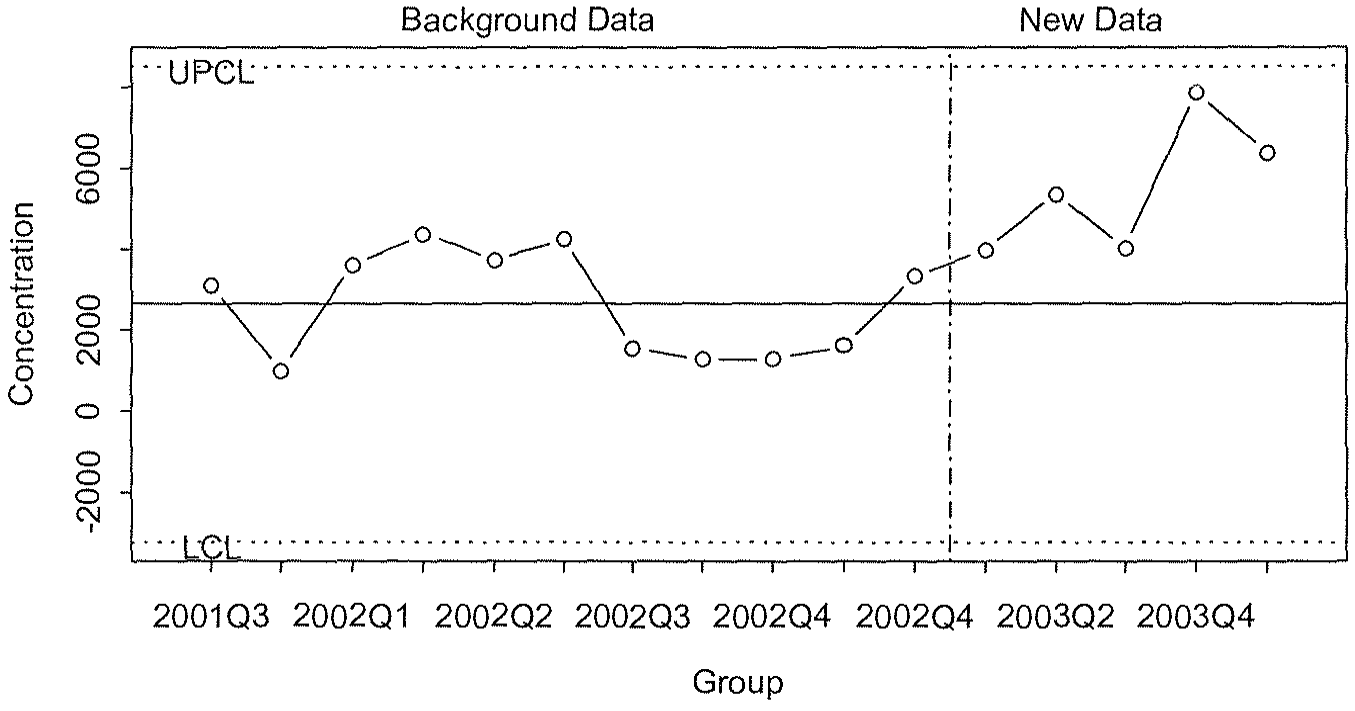
GENERATION DATE: 06/15/04	GW-79S Ammonia mg/l	Geomega



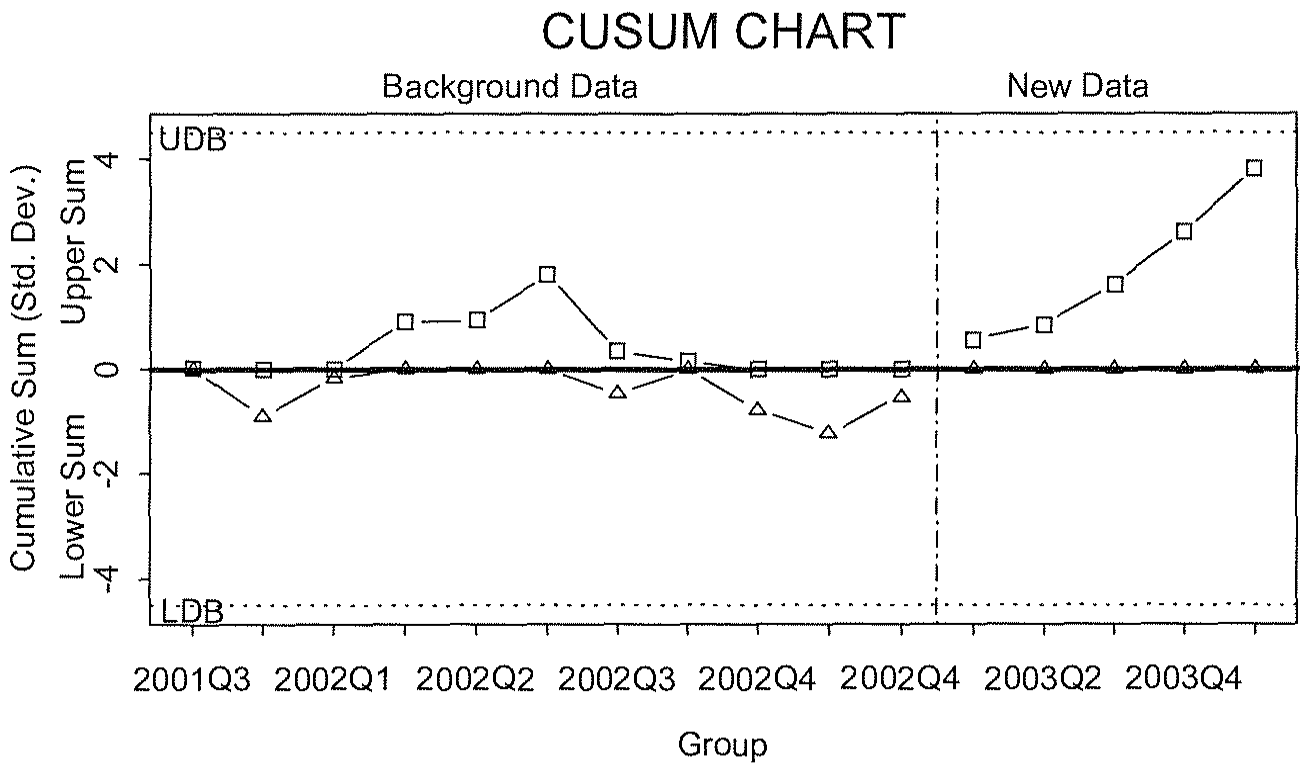


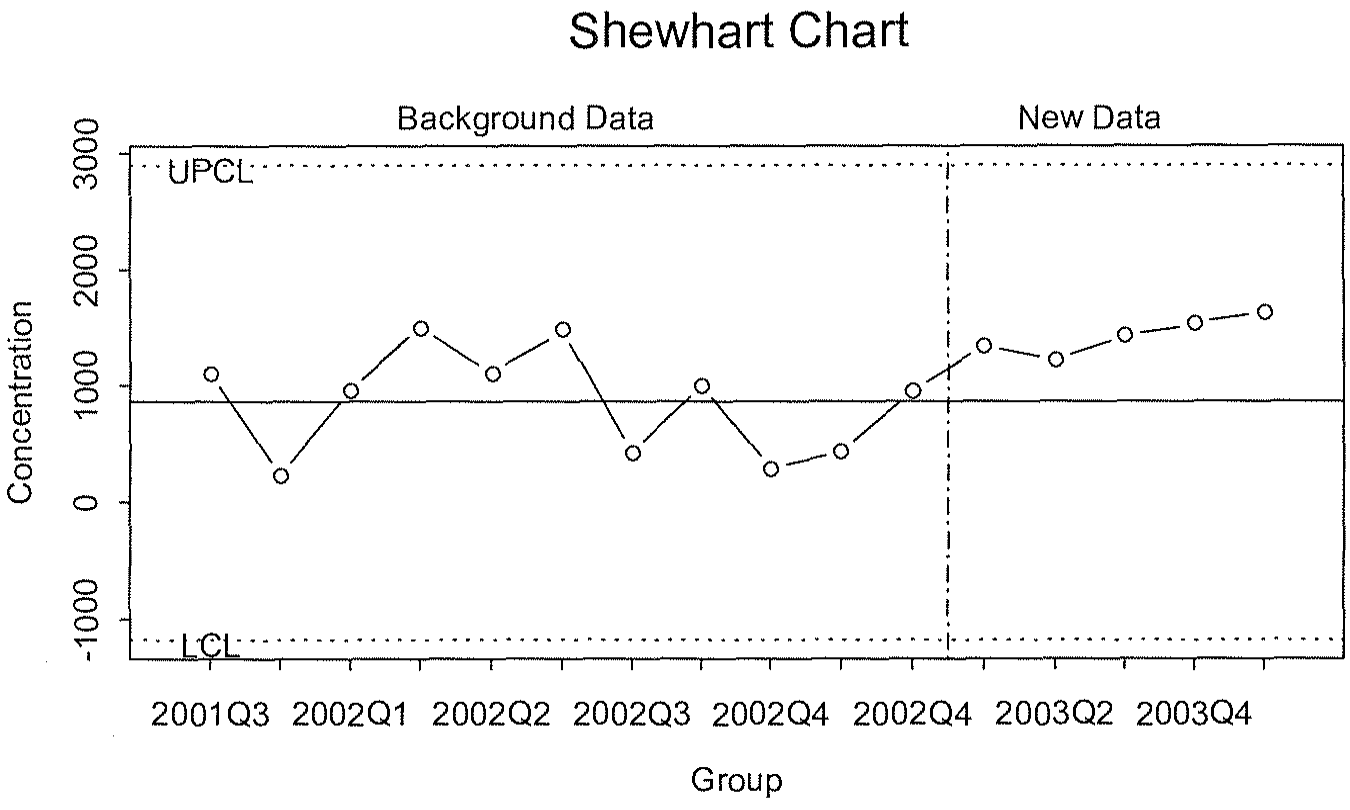
GENERATION DATE: 06/15/04	GW-79S Chloride mg/l	Geomega



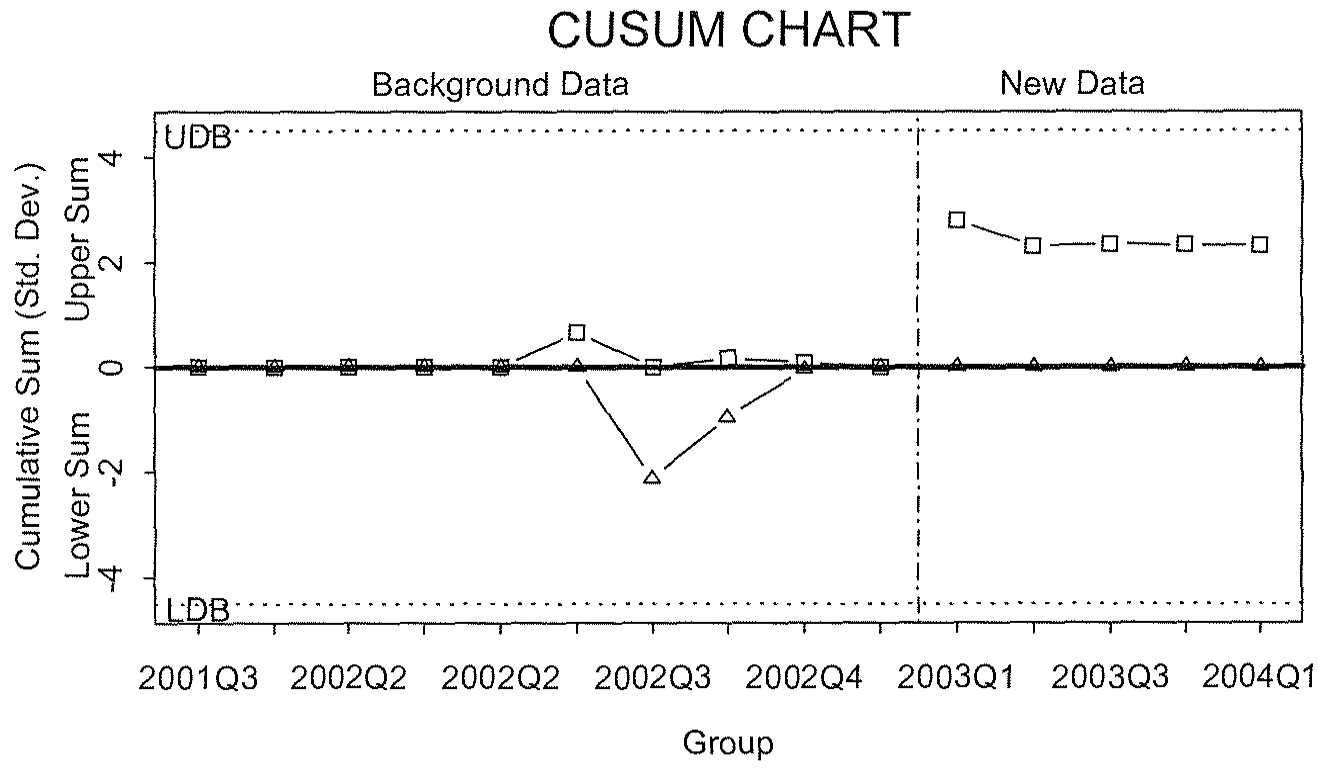


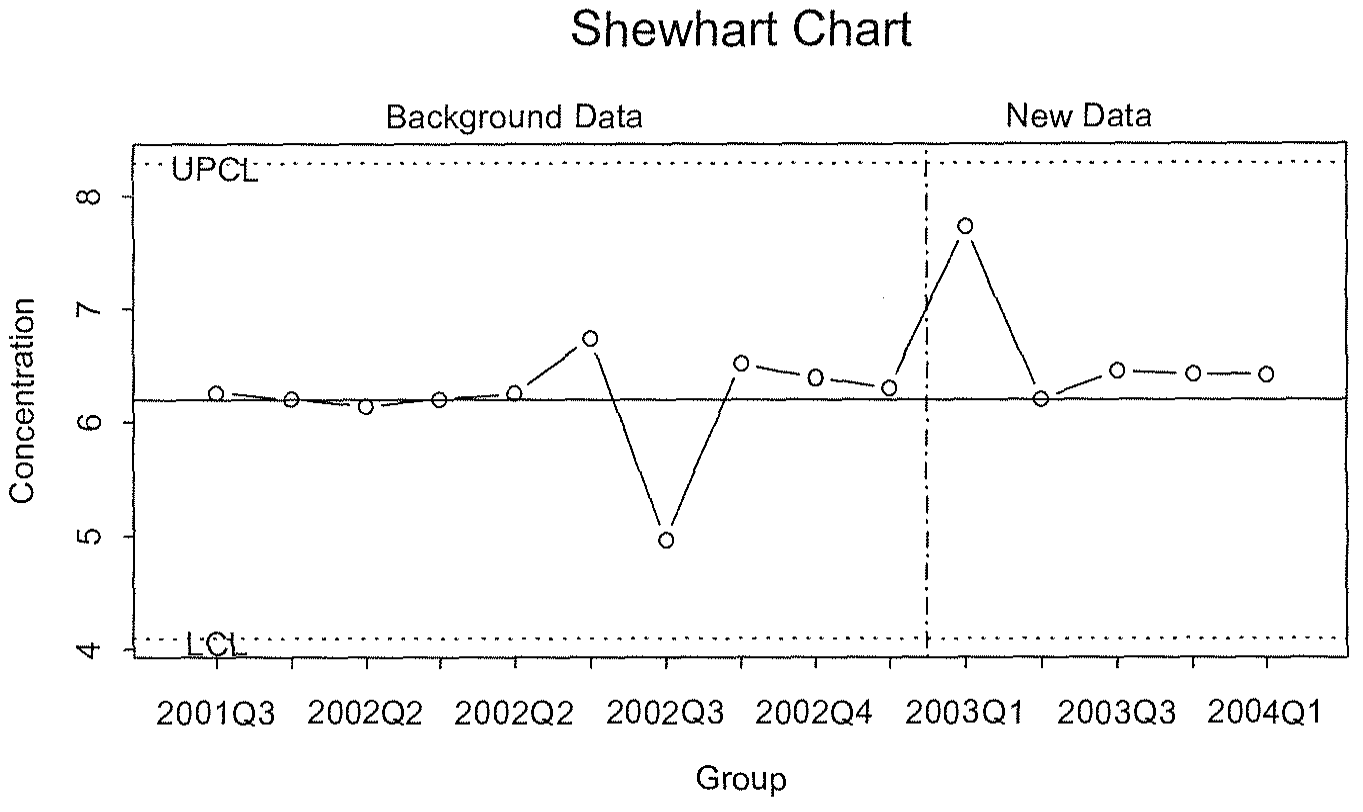
GENERATION DATE: 06/15/04	GW-79S Specific Conductance umhos/cm	Geomega



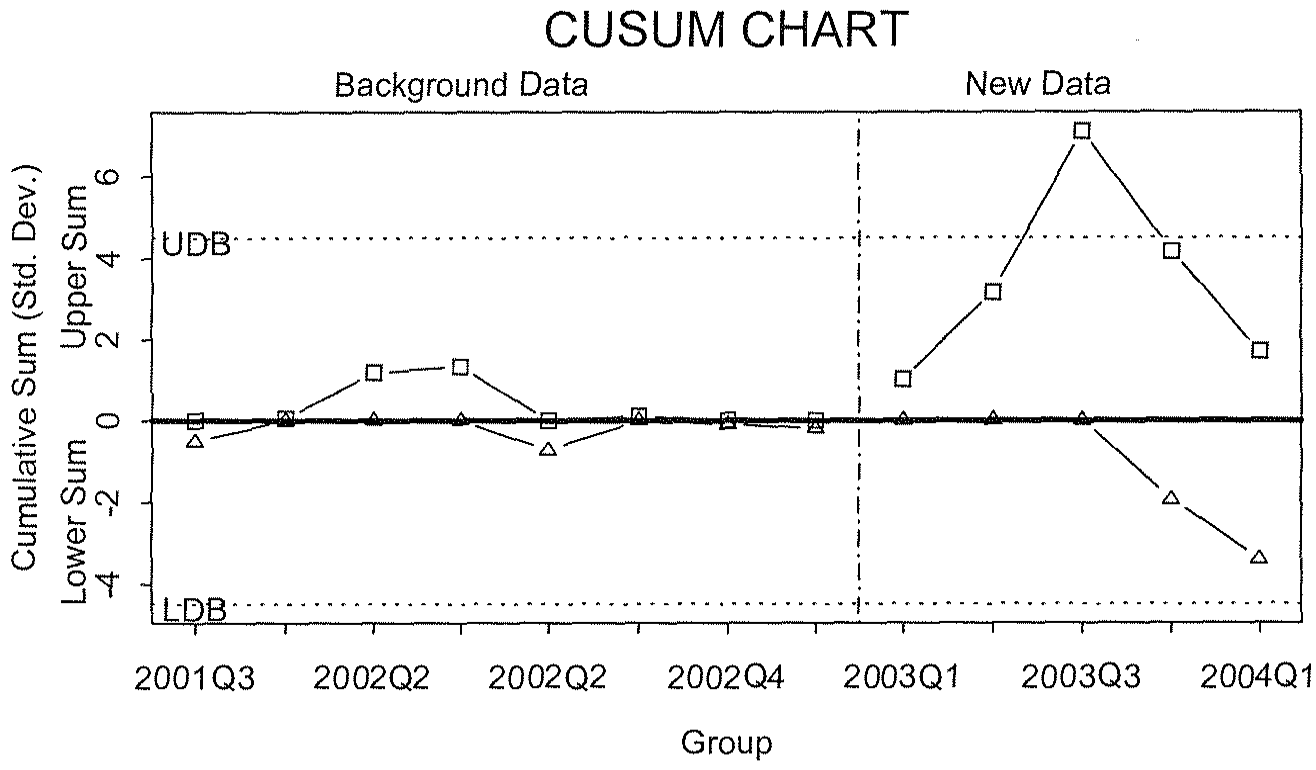


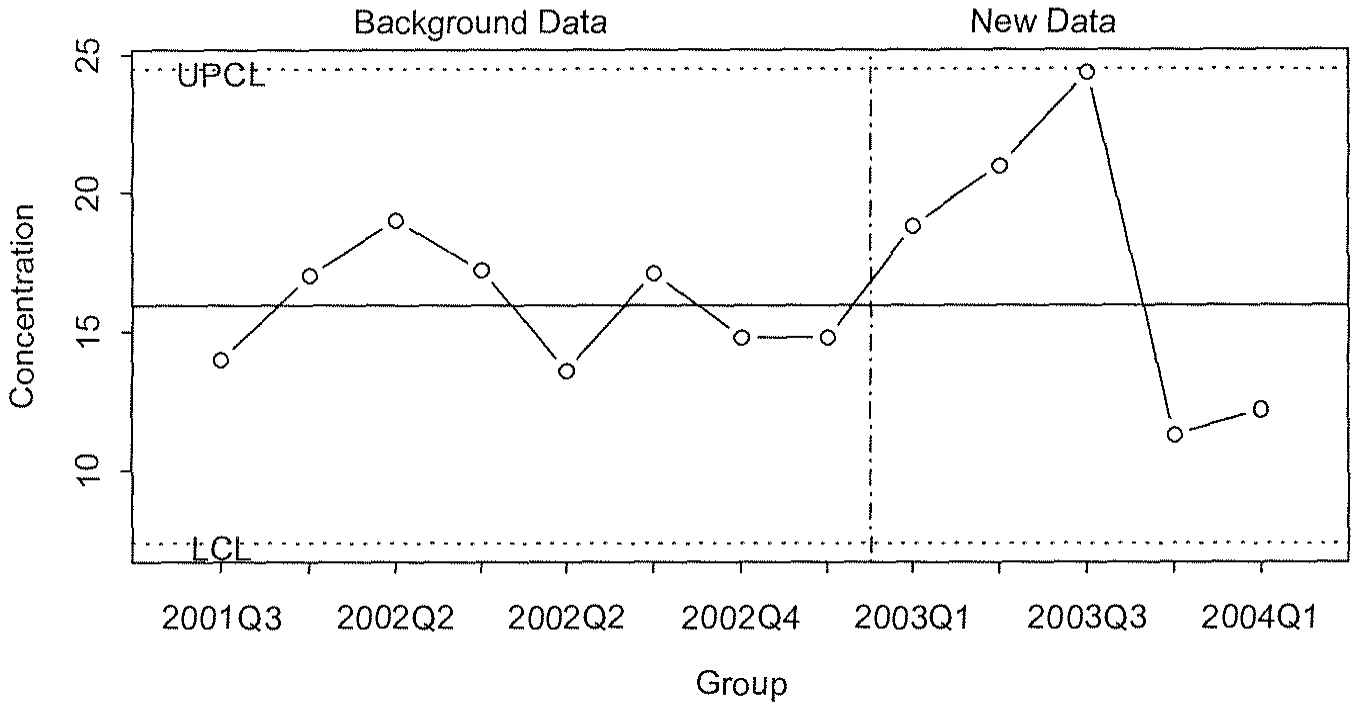
GENERATION DATE: 06/15/04	GW-79S Sulfate mg/l	Geomega



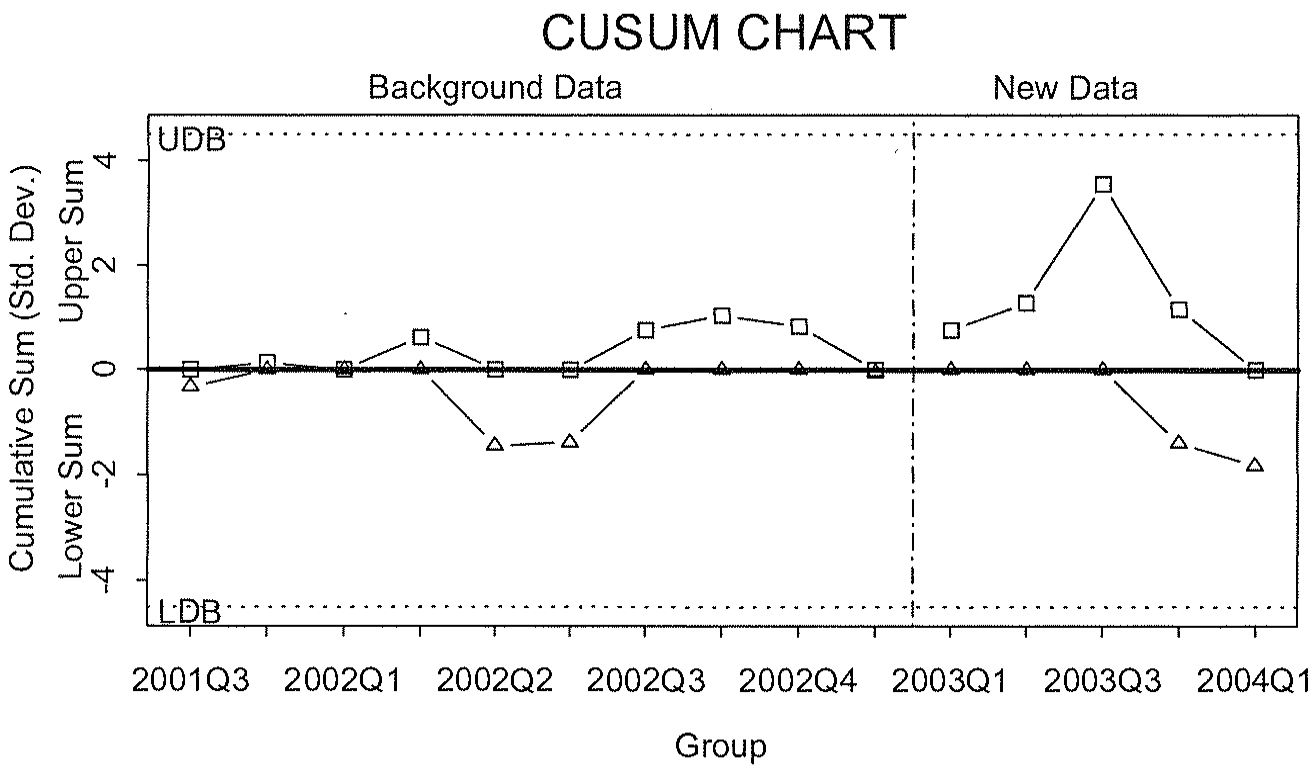


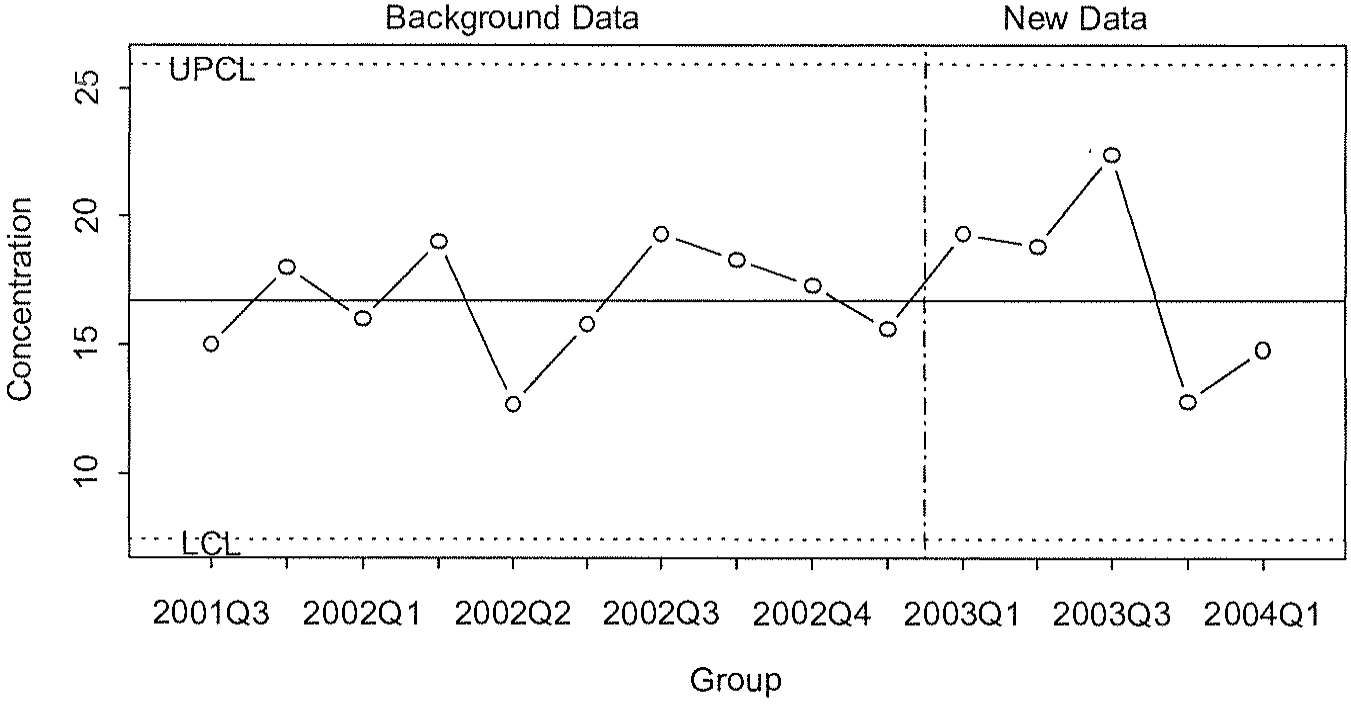
GENERATION DATE: 06/15/04	GW-79S pH mg/l	Geomega



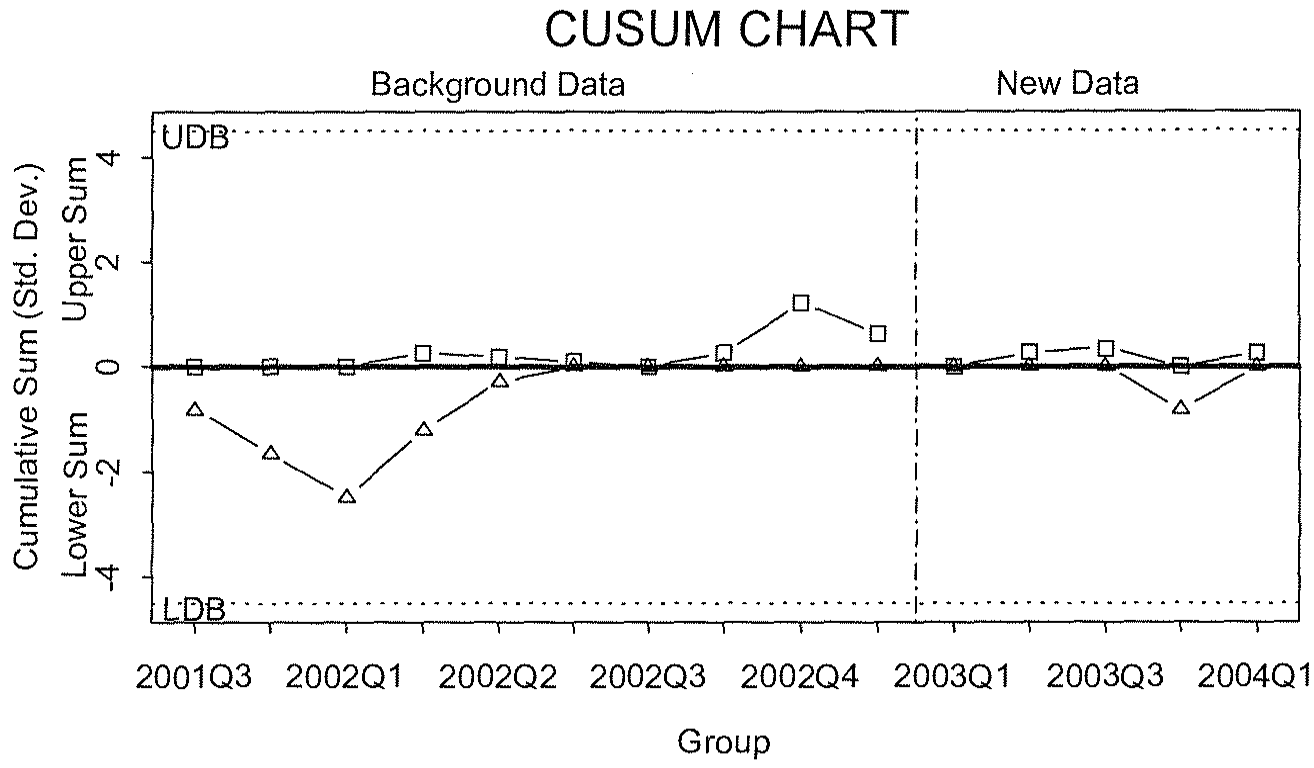


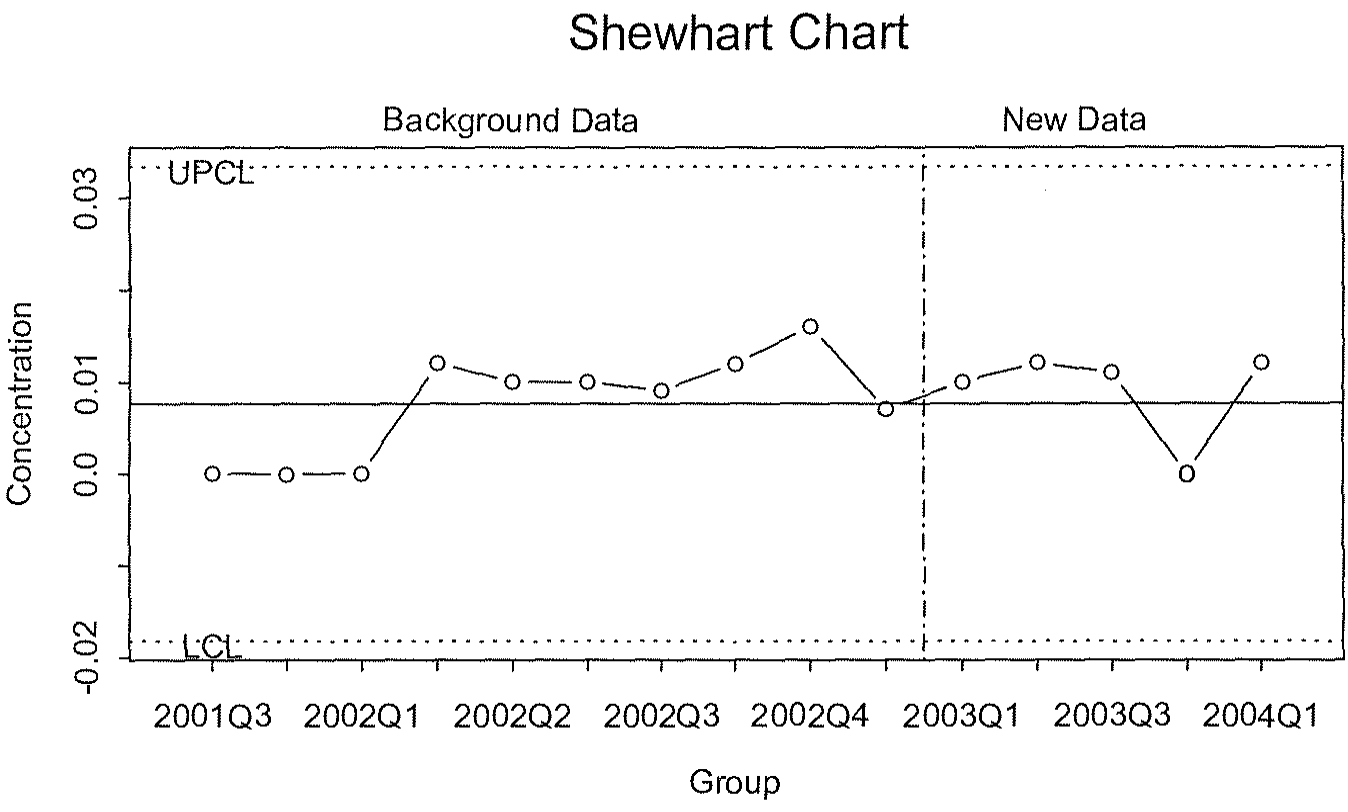
GENERATION DATE: 06/15/04	GW-CA1 Ammonia mg/l	Geomega



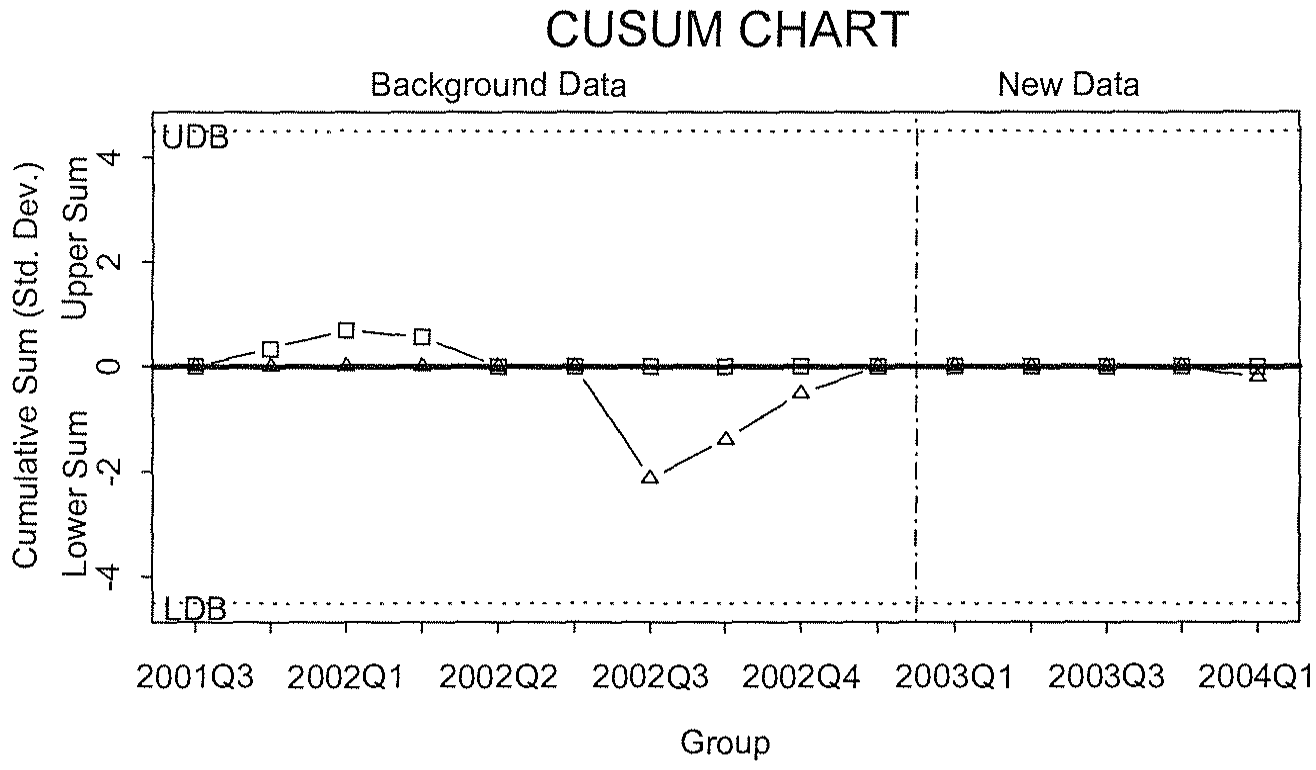


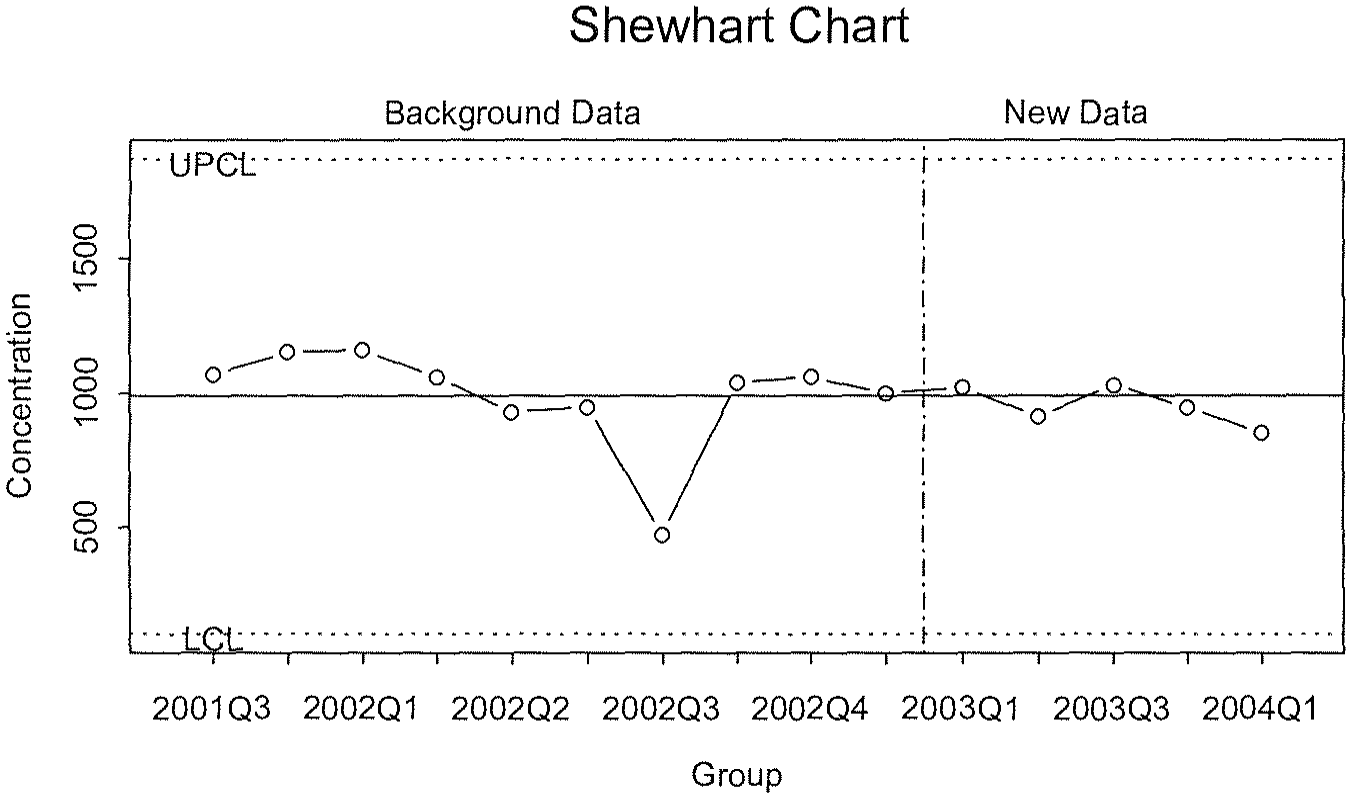
GENERATION DATE: 06/15/04	GW-CA1 Chloride mg/l	Geomega





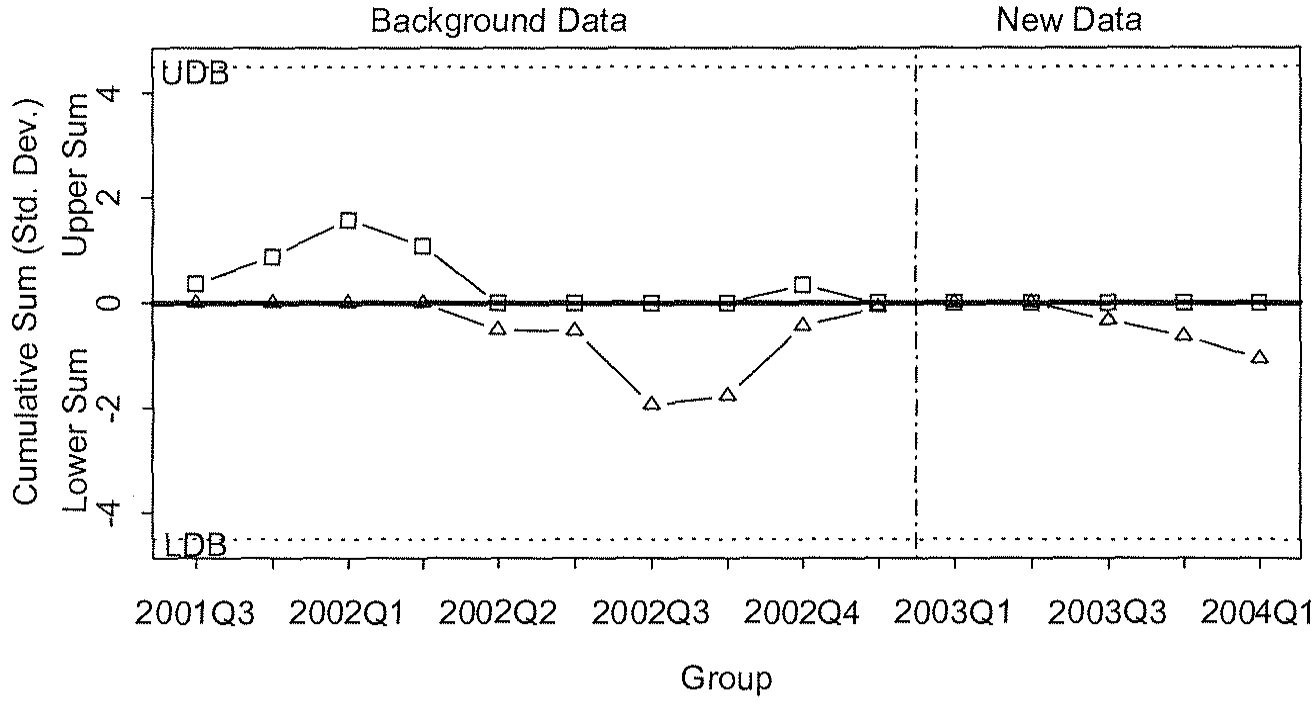
GENERATION DATE: 06/15/04	GW-CA1 Chromium, Dissolved mg/l	Geomega



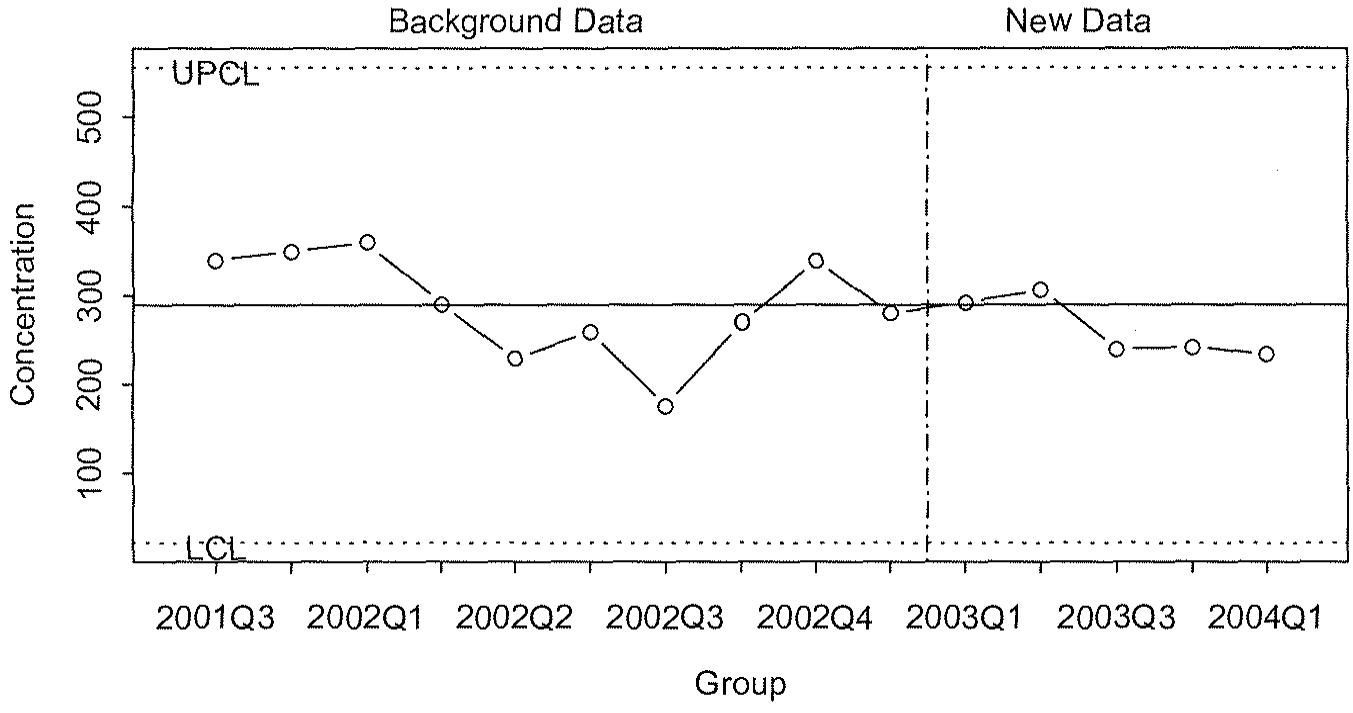


GENERATION DATE: 06/15/04	GW-CA1 Specific Conductance umhos/cm	Geomega

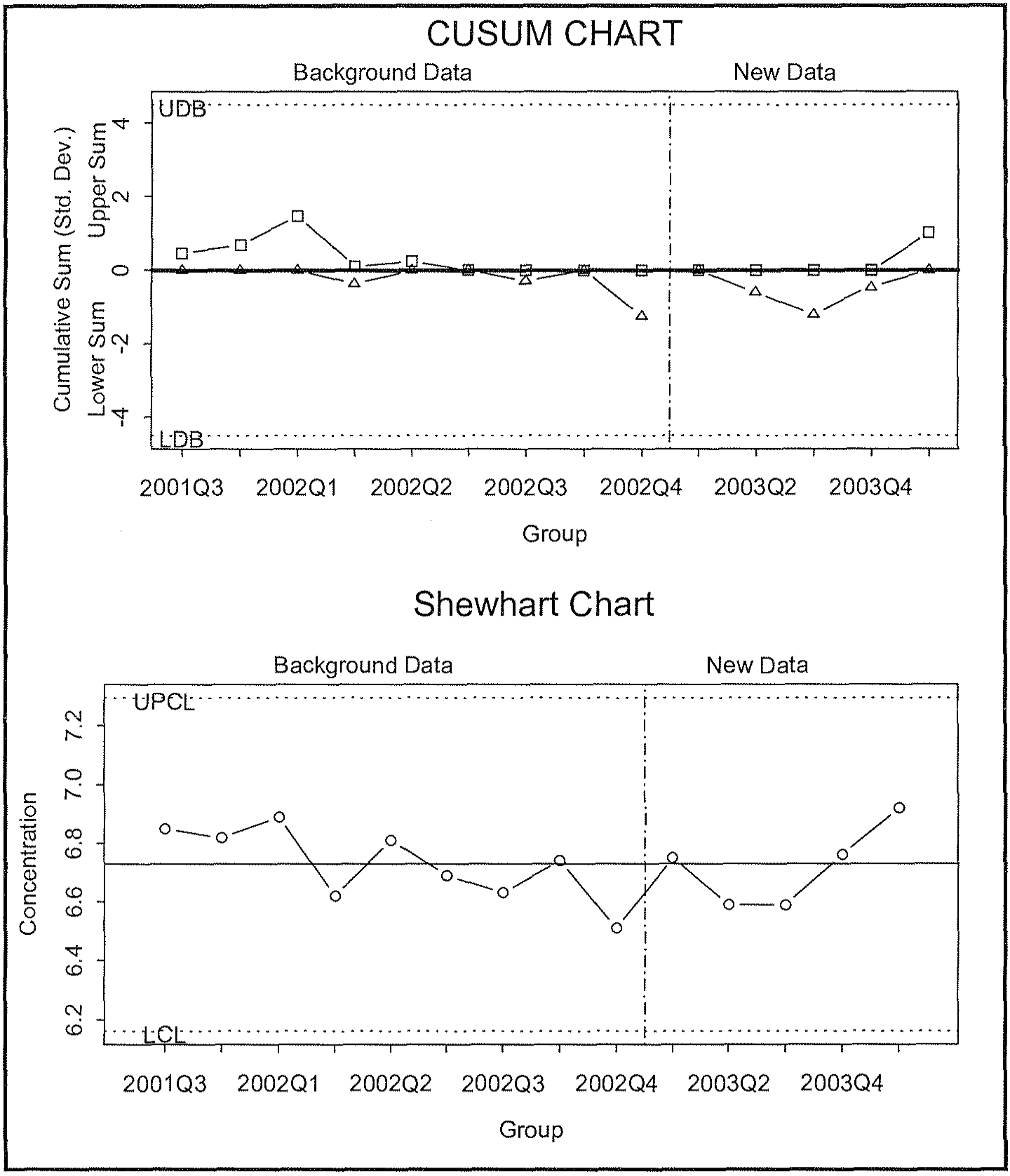
CUSUM CHART



Shewhart Chart



GENERATION DATE: 06/15/04	GW-CA1 Sulfate mg/l	Geomega

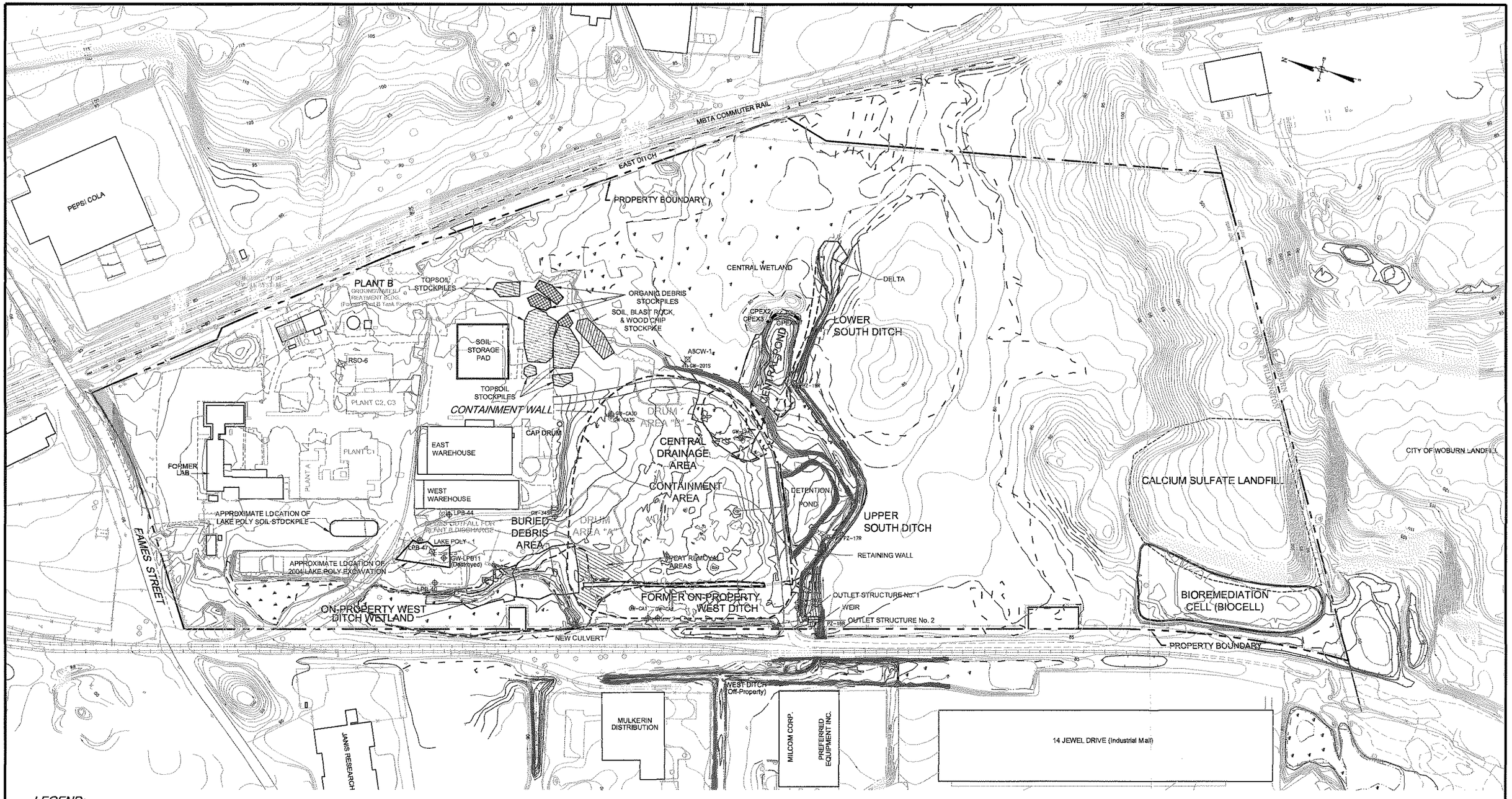


GENERATION DATE: 06/15/04	GW-CA1 pH mg/l	Geomega

Appendix G

As-Built Construction Plans

FIGURES



LEGEND:

- EXISTING CONTOURS (FT., NGVD)
- WETLANDS BOUNDARY DELINEATED DECEMBER 2003
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- PROPOSED LIMITS OF SEDIMENT EXCAVATION
- ACTUAL LIMITS OF SEDIMENT EXCAVATION
- SOIL "HOT SPOT" EXCAVATIONS
- GROUNDWATER MONITORING WELL / PIEZOMETER

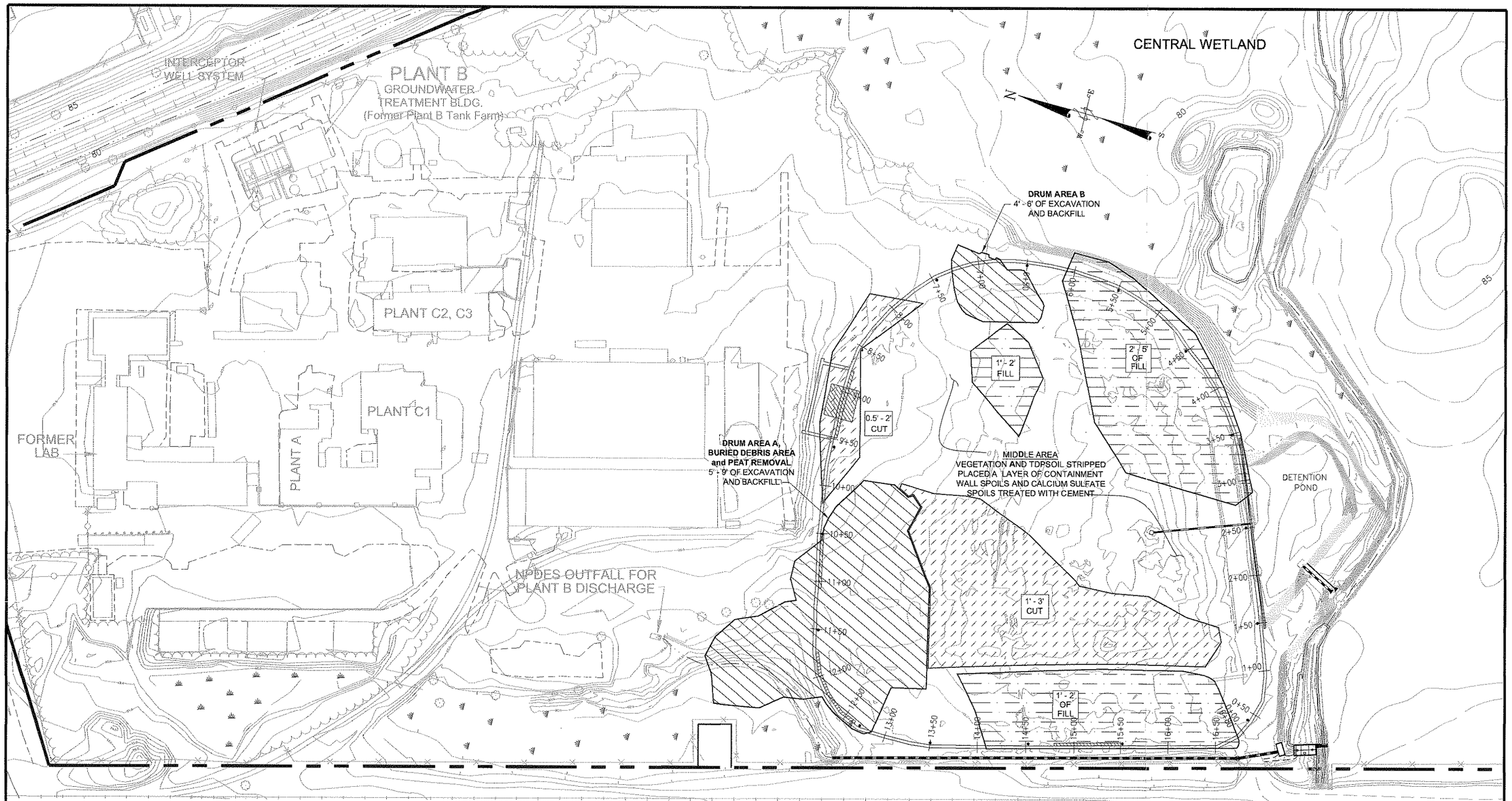
NOTES:

1. BASE PLAN PROVIDED BY DANA F. PERKINS, INC., 2001 AND 2003.

0 100 200
SCALE, FEET

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	SITE PLAN AND WORK COMPLETED THROUGH JULY 2004
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G1

97598-639 djm 09/03/04



LEGEND:

- EXISTING CONTOURS (FT., NGVD)
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- BOLLARD

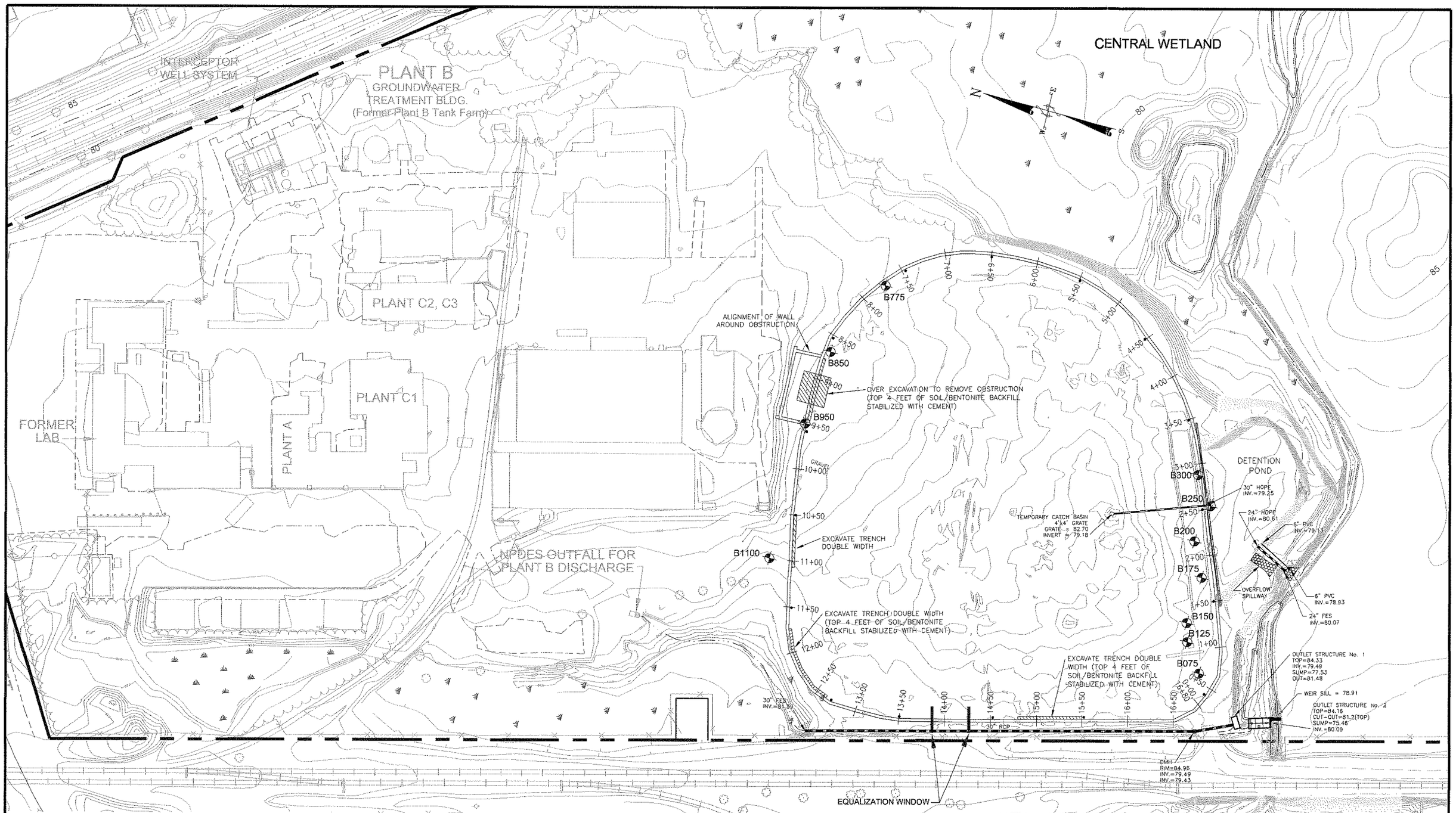
NOTES:

1. BASE PLAN PROVIDED BY DANA F. PERKINS, INC., 2001 AND 2003.

0 50 100
SCALE, FEET

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	CONTAINMENT AREA EXCAVATION AND BACKFILL LOCATIONS
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G2

97598-641 djm 09/07/04



LEGEND:

- EXISTING CONTOURS (FT., NGVD)
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- SOIL BORING
- BOLLARD

NOTES:

1. BASE PLAN PROVIDED BY DANA F. PERKINS, INC., 2001 AND 2003.
2. SELECTED BORING LOCATIONS FOR CONTAINMENT WALL CONSTRUCTION. OTHER BORINGS AT SITE NOT SHOWN.

0 50 100
SCALE, FEET

Part 2 Construction-Related RAM Status Report No. 8

Olin Corporation
51 Eames Street, Wilmington, MA

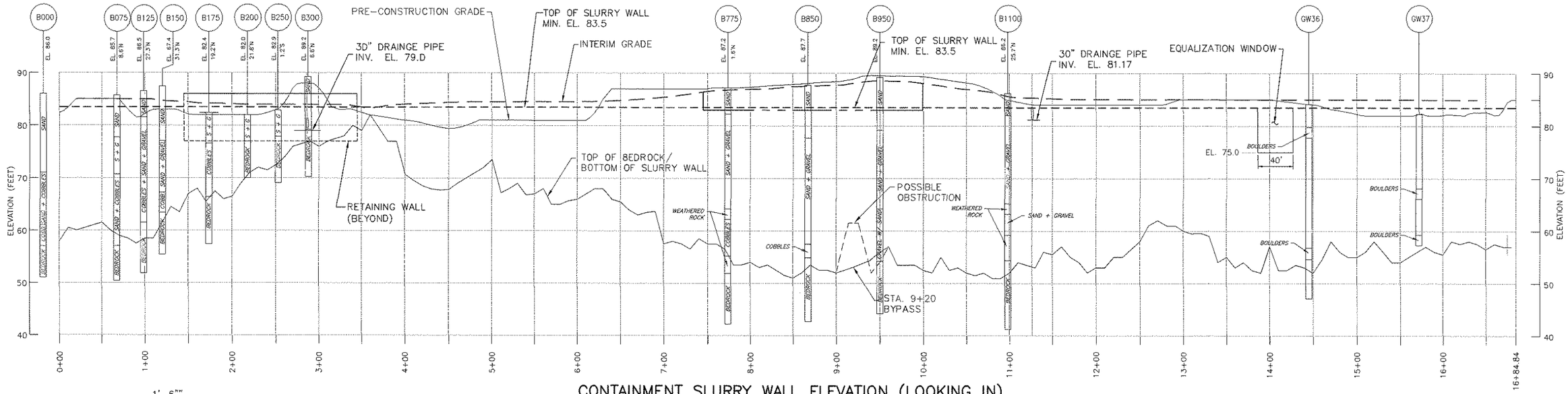
GEI Consultants

Project 97598

CONTAINMENT WALL, DRAINAGE STRUCTURES, AND PRE-CONSTRUCTION BORING LOCATIONS

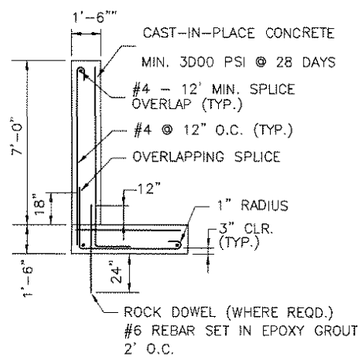
September 2004 Figure G3

97598-641 djm 09/07/04

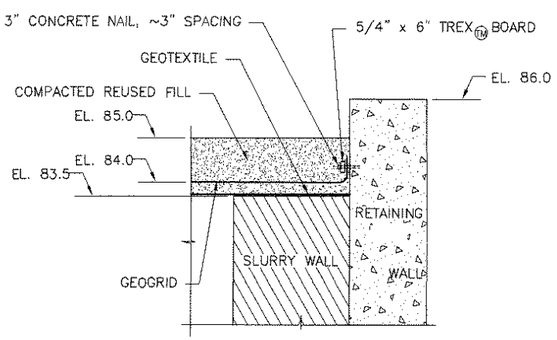


CONTAINMENT SLURRY WALL ELEVATION (LOOKING IN)

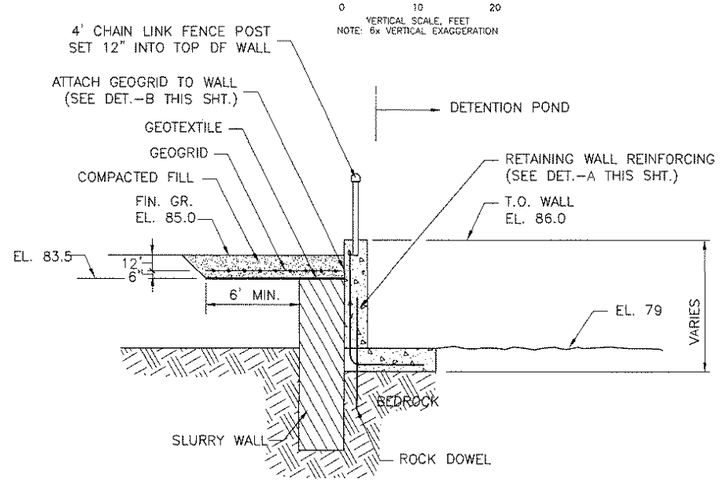
HORIZONTAL SCALE, FEET
0 60 120
0 10 20
VERTICAL SCALE, FEET
NOTE: 6x VERTICAL EXAGGERATION



DETAIL A
RETAINING WALL REINFORCING
NO SCALE



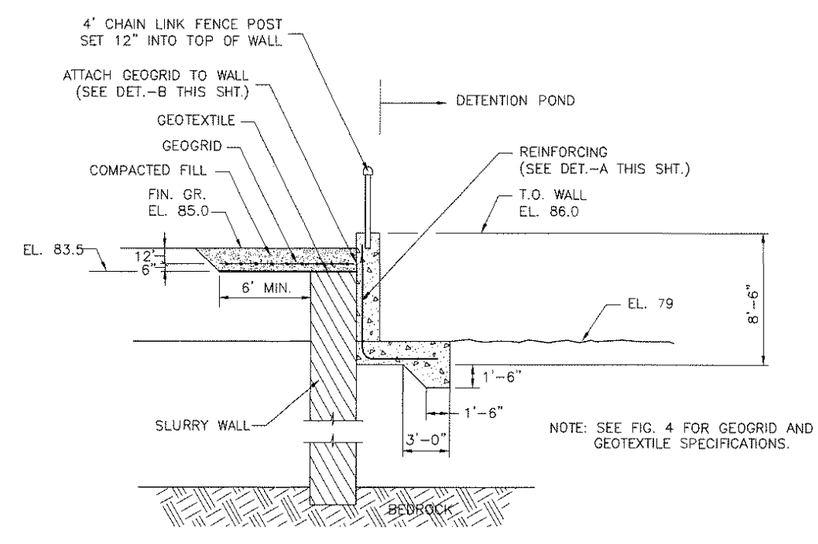
DETAIL B
GEOGRID CONNECTION TO RETAINING WALL
NO SCALE



NOTE: SEE FIG. 4 FOR GEOGRID AND GEOTEXTILE SPECIFICATIONS.

TYPICAL SLURRY WALL SECTION AT RETAINING WALL (ROCK FOUNDATION)

0 5 10
SCALE, FEET



NOTE: SEE FIG. 4 FOR GEOGRID AND GEOTEXTILE SPECIFICATIONS.

TYPICAL SLURRY WALL SECTION AT RETAINING WALL (SOIL FOUNDATION)

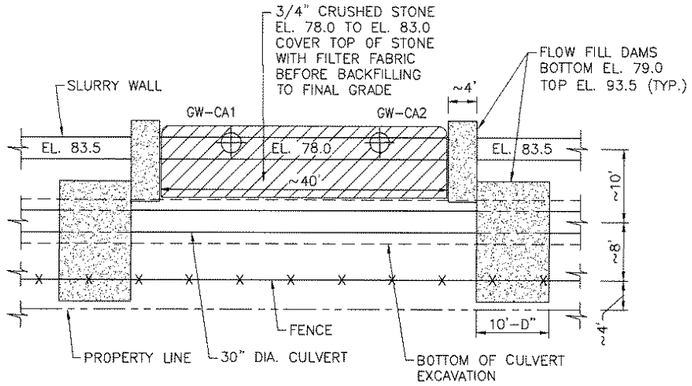
0 5 10
SCALE, FEET

NOTES:

1. TOP OF BEDROCK ELEVATIONS INTERPOLATED BASED ON BORINGS. ACTUAL TOP DF ROCK ELEVATIONS MAY VARY.
2. BORINGS GW37 AND GW36 DRILLED USING ROTARY WASH METHODS.
3. BORINGS B000 THROUGH B1100 DRILLED USING ROTOSONIC METHODS. SAMPLES FRDM THESE BORINGS ARE AVAILABLE FOR VIEWING AT THE SITE.

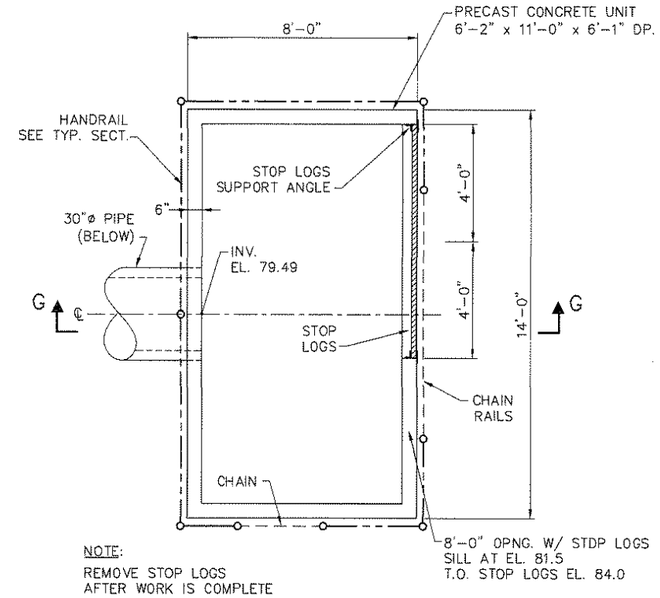
Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	CONTANMENT WALL SECTION AND DETAILS
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G4

97598-642 djm 09/03/04



EQUALIZATION WINDOW DETAIL – PLAN VIEW

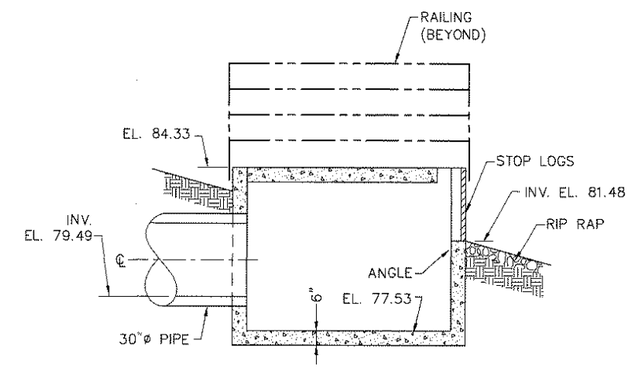
N.T.S.



NOTE:
REMOVE STOP LOGS
AFTER WORK IS COMPLETE

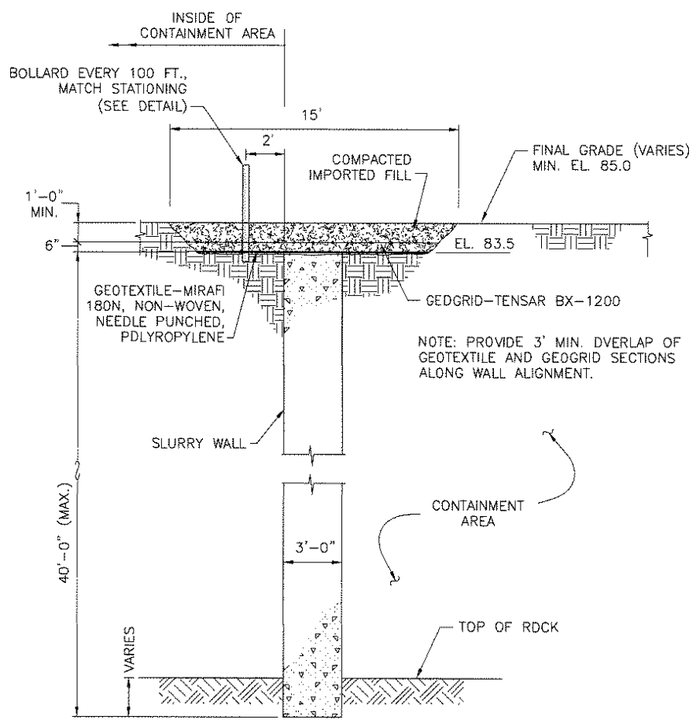
OUTLET PIPE STRUCTURE NO. 1 PLAN

0 2 4
3/8" = 1'-0"



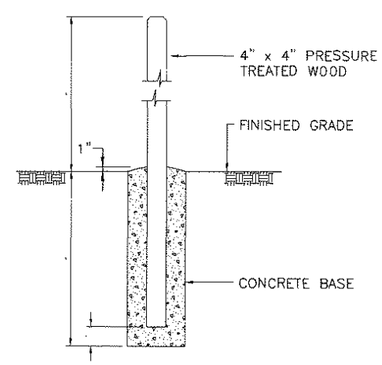
SECTION G–G

0 2 4
3/8" = 1'-0"



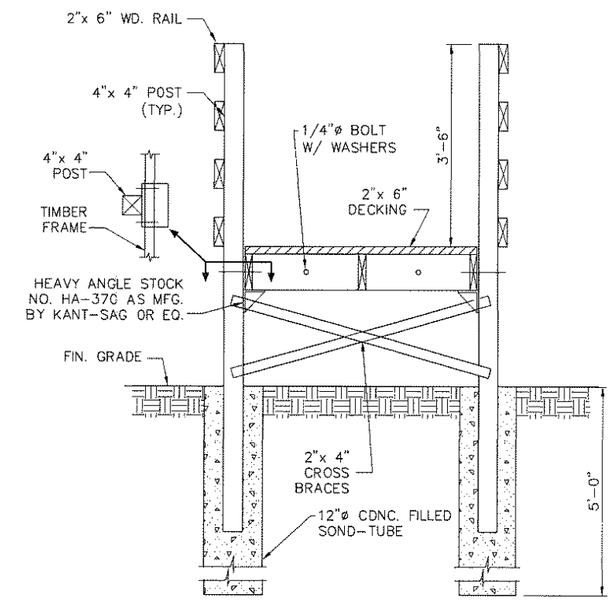
TYPICAL SLURRY WALL SECTION

0 4 8
1/4" = 1'-0"



BOLLARD DETAIL

N.T.S.

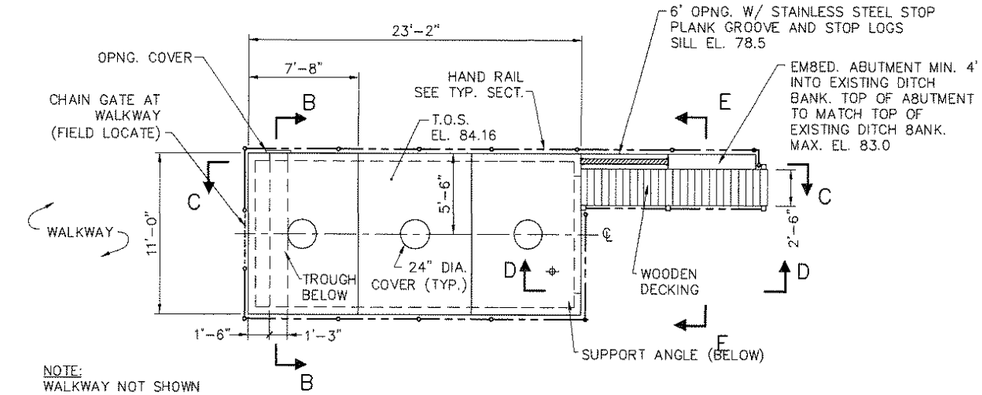


TYPICAL WALKWAY SECTION

0 1 2
3/4" = 1'-0"

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	PLANS, DETAILS, AND SECTIONS
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G5

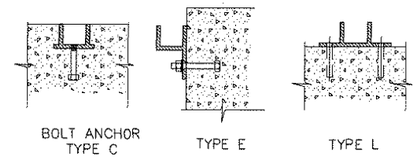
97598-643 djm 07/29/04



NOTE:
WALKWAY NOT SHOWN FOR CLARITY.

OUTLET STRUCTURE NO. 2 PLAN

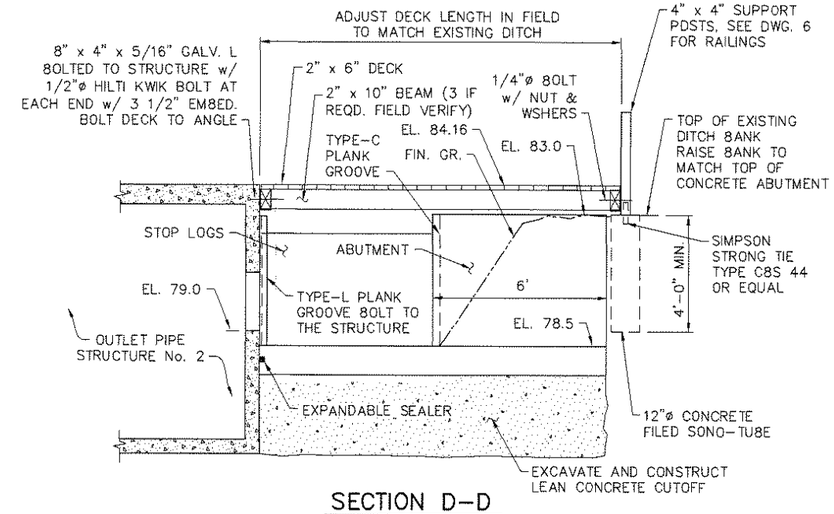
0 5 10
3/16" = 1'-0"



NOTE: USE NEENAH R-7500 SERIES OR EQUAL

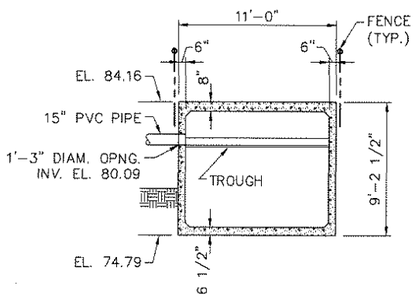
STAINLESS STEEL STOP PLANK GROOVES

NOT TO SCALE



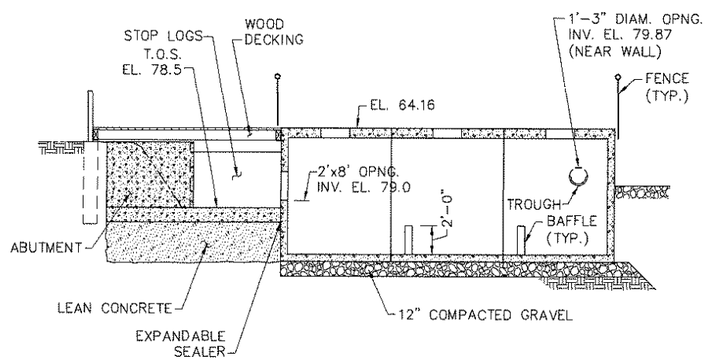
SECTION D-D

0 2 4
3/8" = 1'-0"



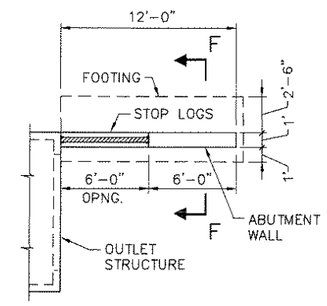
SECTION B-B

0 5 10
3/16" = 1'-0"



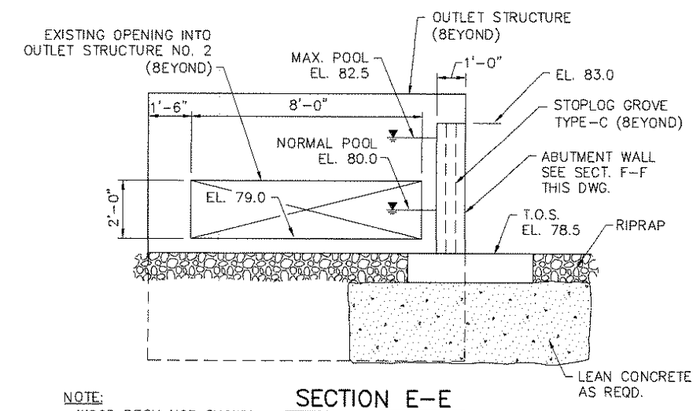
SECTION C-C

0 5 10
3/16" = 1'-0"



ABUTMENT PLAN

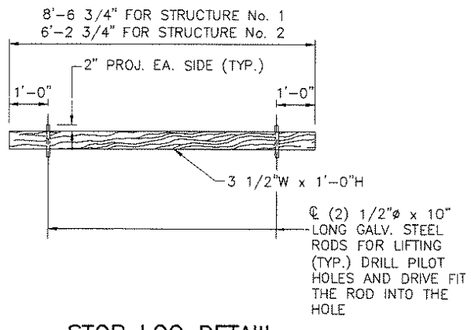
0 5 10
3/16" = 1'-0"



NOTE:
WOOD DECK NOT SHOWN FOR CLARITY.

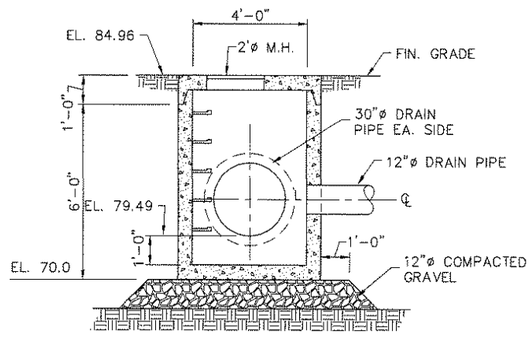
SECTION E-E

0 2 4
3/8" = 1'-0"



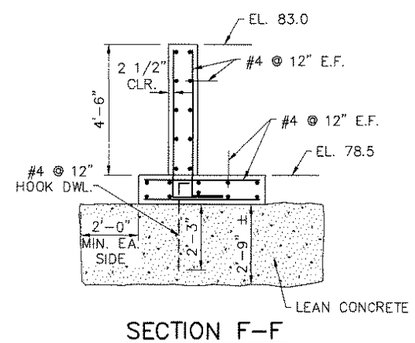
STOP LOG DETAIIL

N.T.S.



48" DIA. DRAIN MANHOLE

0 2 4
3/8" = 1'-0"



SECTION F-F

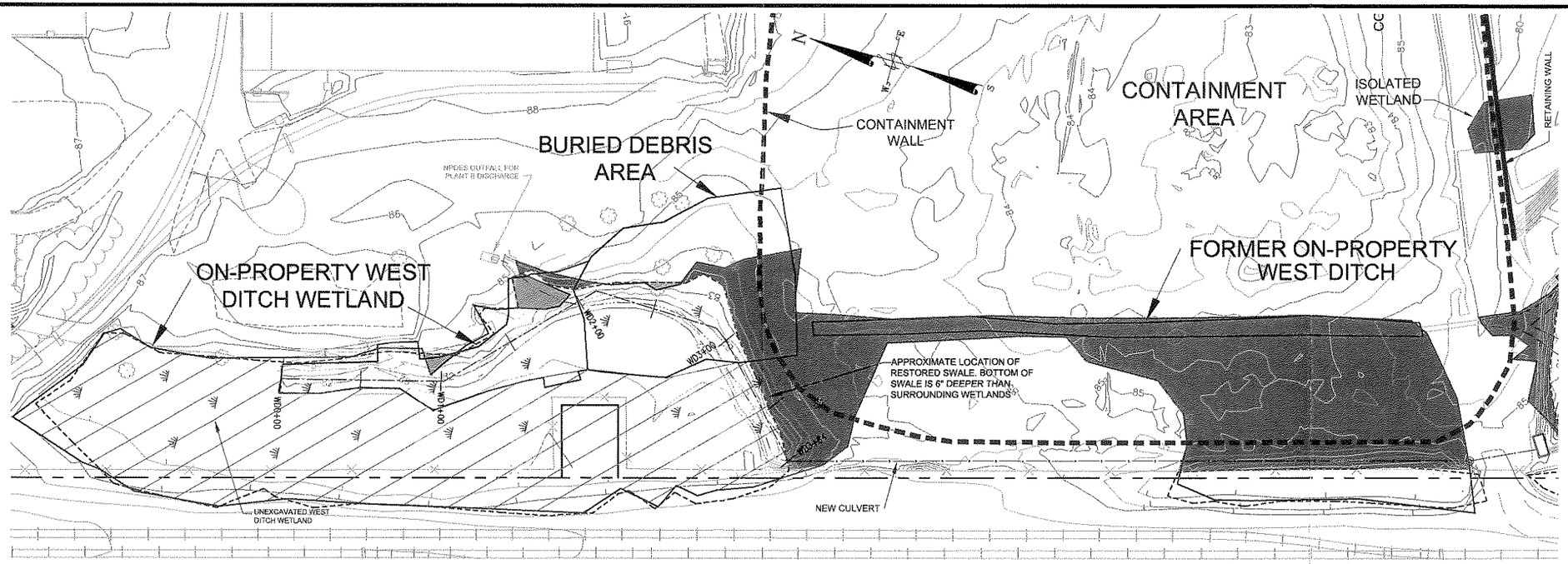
0 2 4
3/6" = 1'-0"

GENERAL NOTES:

1. STRUCTURAL CONCRETE SHALL HAVE A 4000 PSI MIN. COMPRESSIVE STRENGTH AT 28 DAYS. CONCRETE WORK SHALL BE IN ACCORDANCE WITH ACI 301, ACI 318 LATEST EDITION. ALL CONCRETE WORK SHALL BE AIR ENTRAINED AND SHALL BE PROPORTIONED TO BE WATERTIGHT. THE MAXIMUM COARSE AGGREGATE SIZE SHALL BE 3/4 INCH. REINFORCING SHALL BE ASTM A615 GRADE 60 KSI.
2. LEAN CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2000 PSI.
3. STANDARD HOOKS AND BENDS SHALL CONFORM TO ACI 318 SECTION 7.1 AND 7.2.
4. THE FIRST AND LAST BARS IN SLAB WALLS ARE TO START AND END AT A MAXIMUM OF ONE HALF OF ADJACENT BAR SPACING. ALL REINFORCING TO BE EQUALLY SPACED UNLESS OTHERWISE SHOWN ON THE DRAWINGS.

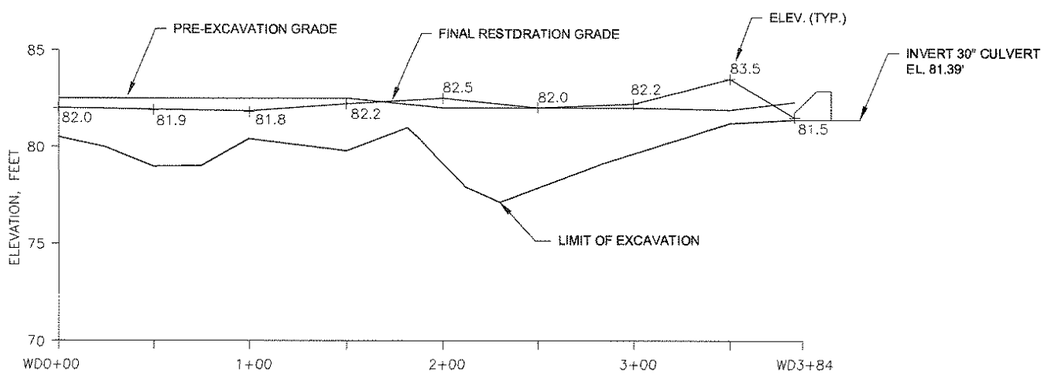
Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	PLANS, DETAILS, AND SECTIONS
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G6

97598-644 djm 07/29/04



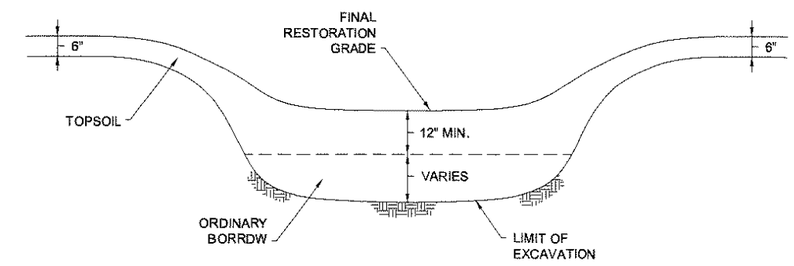
WEST DITCH WETLAND / BURIED DEBRIS AREA / WEST DITCH PLAN

0 40 80
SCALE, FEET



WEST DITCH WETLAND PROFILE

HORIZONTAL SCALE, FEET
0 40 80
0 4 8
VERTICAL SCALE, FEET
NOTE: 10x VERTICAL EXAGGERATION



TYPICAL SECTION

NOT TO SCALE

LEGEND:

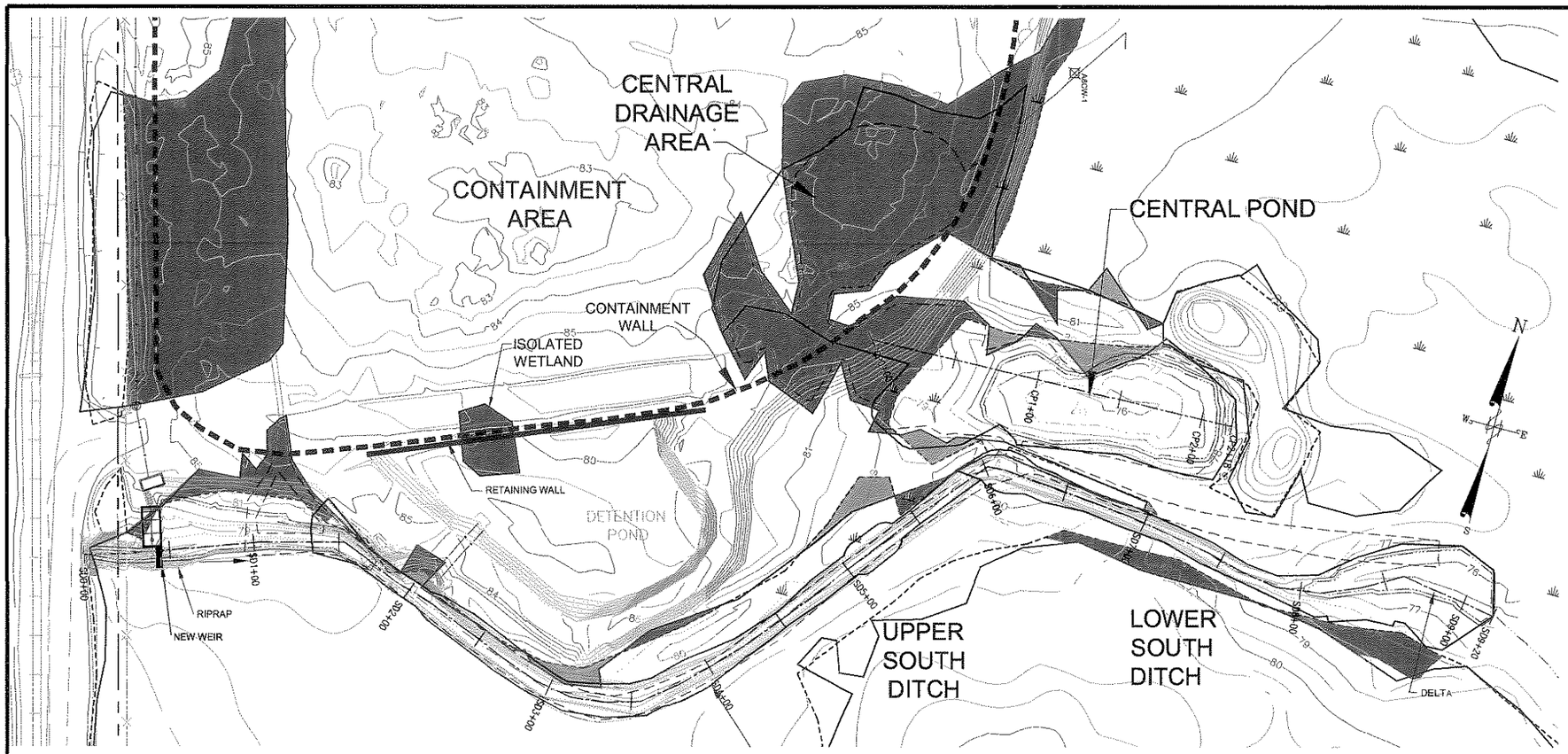
- NEW WETLAND AREA
- TEMPDRARY IMPACTED WETLANDS
- PERMANENTLY IMPACTED WETLANDS
- PRE-EXCAVATION WETLAND BOUNDARY
- RESTORED WETLAND BOUNDARY (2003)
- ACTUAL LIMITS OF SEDIMENT EXCAVATION
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- AS-BUILT CONTOURS (FT., NGVD)

GENERAL NOTES:

1. TOPSOIL OBTAINED FROM ROBERTD LDAM AND EQUIP. CORP. (N. BILLERICA, MA). A BLEND OF 65% LOAM AND 35% COMPOST.
2. ORDINARY BORROW OBTAINED FROM BENEVENTO SAND & GRAVEL CO. (WILMINGTON, MA.)
3. FINAL RESTORATION GRADE SPECIFIED BY WETLAND PRESERVATIDN, INC. (PLAISTOW, NH).

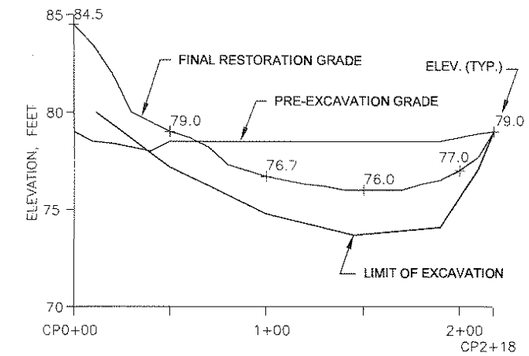
Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	WETLANDS RESTORATION
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G7

97598-645 djm 09/03/04



SOUTH DITCH / CENTRAL POND PLAN

SCALE, FEET: 0 40 80

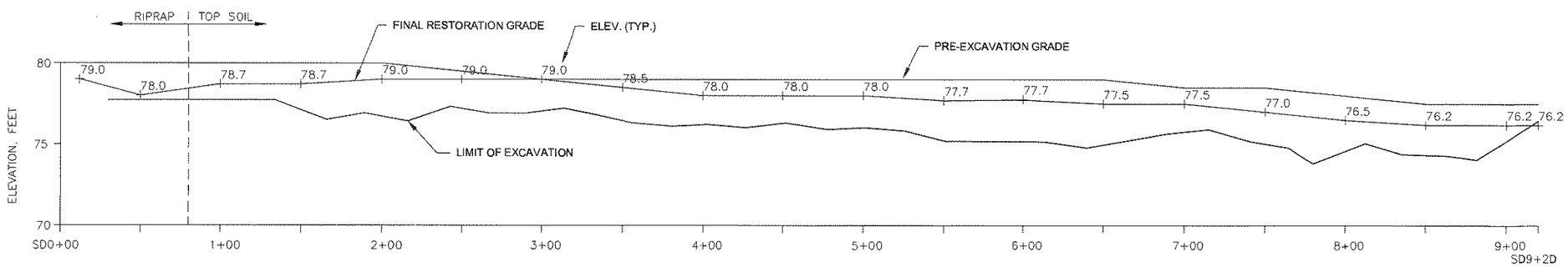


CENTRAL POND PROFILE

HORIZONTAL SCALE, FEET: 0 40 80

VERTICAL SCALE, FEET: 0 4 8

NOTE: 10x VERTICAL EXAGGERATION



SOUTH DITCH PROFILE

HORIZONTAL SCALE, FEET: 0 40 80

VERTICAL SCALE, FEET: 0 4 8

NOTE: 10x VERTICAL EXAGGERATION

LEGEND:

- NEW WETLAND AREA
- TEMPORARY IMPACTED WETLANDS
- PERMANENTLY IMPACTED WETLANDS
- PRE-EXCAVATION WETLAND BOUNDARY
- RESTORED WETLAND BOUNDARY (2003)
- ACTUAL LIMITS OF SEDIMENT EXCAVATION
- APPROXIMATE DITCH/POND WATERLINE
- STREAM
- AS-BUILT CONTOURS (FT., NGVD)

GENERAL NOTES:

1. TOPSOIL OBTAINED FROM ROBERTO LOAM AND EQUIP. CORP. (N. BILLERICA, MA). A BLEND OF 65% LOAM AND 35% COMPOST.
2. ORDINARY BORROW OBTAINED FROM BENEVENTO SAND & GRAVEL CO. (WILMINGTON, MA.)
3. FINAL RESTORATION GRADE SPECIFIED BY WETLAND PRESERVATION, INC. (PLAISTOW, NH).

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	WETLANDS RESTORATION
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G8

97598-645 djm 09/03/04

EQUIPMENT & MATERIAL STORAGE PAD

PLANT C2, C3

PLANT C1

ESTIMATED EDGE OF 2003 TEMPORARY CAP

ALIGNMENT OF WALL AROUND OBSTRUCTION

EXISTING GRAVEL ACCESS ROAD

GW-6D
GW-6S

GW-201S

GW-CA3D
GW-CA3S

GW-CA4S

EAST WAREHOUSE

WEST WAREHOUSE

OVER EXCAVATION TO REMOVE OBSTRUCTION (TOP 4 FEET OF SOIL/BENTONITE BACKFILL STABILIZED WITH CEMENT)

CONTAINMENT AREA

DETENTION POND

EDGE OF 2001 TEMPORARY CAP (REMAINS)

GW-34D
GW-34SR

TRENCH DOUBLE WIDTH

MP-1

GW-35S
GW-35D

NPDES OUTFALL FOR PLANT B DISCHARGE

TRENCH DOUBLE WIDTH (TOP 4 FEET OF SOIL/BENTONITE BACKFILL STABILIZED WITH CEMENT)

GW-30DR
PW-2

BR-1

TRENCH DOUBLE WIDTH (TOP 4 FEET OF SOIL/BENTONITE BACKFILL STABILIZED WITH CEMENT)

GW-CA1
GW-CA2

GW-202S
GW-202D

EQUALIZATION WINDOW

LEGEND:

- EXISTING CONTOURS (FT., NGVD)
- STREAM
- GW-CA1 GROUNDWATER MONITORING WELL
- BOLLARD
- APPROXIMATE ALIGNMENT OF SLURRY WALL
- EDGE OF TEMPORARY CAP INSTALLED 2001 (REMAINS)
- ESTIMATED EDGE OF TEMPORARY CAP INSTALLED 2003

0 40 80
SCALE, FEET

NOTES:

1. BASE PLAN AND EDGE OF 2001 TEMPORARY CAP PROVIDED BY DANA F. PERKINS, INC
2. 2003 CAP AREA BASED ON FIELD MEASUREMENTS RECORDED BY GEI ON 5/23/03

Part 2 Construction-Related RAM Status Report No. 8	GEI Consultants	CONTAINMENT AREA TEMPORARY CAP
Olin Corporation 51 Eames Street, Wilmington, MA	Project 97598	September 2004 Figure G9

97598-646 djm 09/03/04

Appendix H

Summary of Sediment and Hot Spot Removal Confirmatory Sampling Results for 2000 and 2001Investigation Activity Placement Rational

Table H-1
On-Property West Ditch Confirmatory Samples
Olin Corporation
51 Eames Street
Wilmington, MA

Parameter	Method	Units	S3-GW1 mg/kg	Soil UCLs mg/kg	Olin Site Specific Soil Mean (0-3 ft)	Olin Site Specific Soil Mean (0-15 ft)	Frequency of Detect	Minimum Detected	Maximum Detected	Mean of Detects	Mean of All (including half of non-detect value)	Standard Deviation of All
Semivolatile Organic Compounds	8270C	mg/kg										
bis(2-Ethylhexyl)phthalate			100	10,000	19	130	27 / 31	0.58	426	56	49	105
N-Nitrosodiphenylamine			1000 (RCS2)	10,000	3.9	48	14 / 31	0.21	19	2.4	2.5	4.4
Volatile Organic Compounds	8260B	mg/kg										
Methylene chloride			0.1	7,000	0.057	0.02	4 / 8	0.18	0.59	0.30	0.19	0.18
Pesticides	8081A	mg/kg					0 / 9					
Metals	6010B	mg/kg										
Aluminum			NS	10,000	10,653	5,925	9 / 9	2,300	7,400	3867	3867	1495
Arsenic			30	300	7.1	5.6	3 / 9	1.9	6.8	3.6	1.9	1.9
Chromium			5,000	10,000	513	436	31 / 31	6	810	179	179	220
Iron			NS	10,000	11,949	7,772	9 / 9	1,100	11,000	3511	3511	2935
Lead			600	6,000	24	17	8 / 9	1.6	5.4	2.8	2.6	1.5

General Notes:

1. Only results for analytes detected in at least one sample are reported here. For a complete list of analytes see the Olin Wilmington Active Database.
2. NS = No standard available.
3. NC = Not calculated.
4. Olin Site-Specific Soil Means for surface and subsurface soils are based on Focused Risk Assessment (Harding-ESE, 2000).
5. The location of the On-Property West Ditch is shown on Figure 2.
6. Results include final confirmatory data only (excludes field duplicate samples and samples superseded by subsequent soil excavation). For a summary of all confirmatory sample results, see summary tables in Appendix G in Status Report No. 2.
7. Method 1 Standards (e.g., S3-GW1), Reportable Concentrations (e.g., RCS2), and Upper Concentration Limits (UCLs), where identified, are cited from the Massachusetts Contingency Plan, June 2003.
8. mg/kg = milligrams per kilogram.

Table H-2
Buried Debris Area Confirmatory Samples
Olin Corporation
51 Eames Street
Wilmington, MA

Parameter	Method	Units	S3-GW1 mg/kg	Soil UCLs mg/kg	Olin Site Specific Soil Mean (0-3 ft)	Olin Site Specific Soil Mean (0-15 ft)	Frequency of Detect	Minimum Detected	Maximum Detected	Mean of Detects	Mean of All (including half of non-detect value)	Standard Deviation of All
Semivolatile Organic Compounds	8270C	mg/kg										
2,4-Dimethylphenol			0.7	10,000	NC	NC	1 / 33	1.8	1.8	1.8	2.7	5.5
bis(2-Ethylhexyl)phthalate			100	10,000	19	130	19 / 33	0.22	375	68	39	98
Di-n-butyl phthalate			500 (RCS2)	10,000	3.9	1.5	4 / 33	0.27	33	9.2	3.0	6.7
N-Nitrosodiphenylamine			1000 (RCS2)	10,000	3.9	48	1 / 33	4.7	4.7	4.7	2.7	5.5
Volatile Organic Compounds	8260B	mg/kg										
2,4,4-Trimethyl-1-pentene			1000 (RCS2)	10,000	0.0048	NC	1 / 27	6.7	6.7	6.7	0.4	1.3
2,4,4-Trimethyl-2-pentene			1000 (RCS2)	10,000	0.0045	NC	1 / 27	2.2	2.2	2.2	0.2	0.4
Ethylbenzene			80	10,000	NC	0.046	1 / 33	0.88	0.88	0.88	0.13	0.18
Fluorotrichloromethane			10,000 (RCS2)	10,000	NC	NC	1 / 33	0.17	0.17	0.17	0.11	0.11
m+p-Xylene			800	10,000	NC	0.0076	1 / 27	0.5	0.5	0.5	0.1	0.1
Methylene chloride			0.1	7,000	0.057	0.02	1 / 33	0.1	0.1	0.1	0.2	0.2
o-Xylene			800		NC	0.0076	1 / 33	0.15	0.15	0.15	0.11	0.11
p-Isopropyltoluene			NC	10,000	NC	NC	1 / 33	0.57	0.57	0.57	0.12	0.14
Toluene			90	10,000	0.057	0.076	2 / 33	0.21	0.25	0.23	0.11	0.12
Pesticides	SW846 8081A	mg/kg					0 / 27					
Metals	7471A	mg/kg										
Aluminum			NS	10,000	10653	5925	27 / 27	1100	12000	3570	3570	2168
Arsenic			30	300	7.1	5.6	4 / 27	2	7.1	4.5	1.7	1.7
Cadmium			80	800	0.5	1.8	3 / 27	0.35	0.65	0.47	0.26	0.21
Chromium			5,000	10,000	513	436	29 / 33	3.5	320	30	26	68
Iron			NS	10,000	11949	7772	27 / 27	160	12000	2650	2650	2270
Lead			600	6,000	24	17	20 / 27	1.7	50	5.1	4.4	9.3
Mercury	6010B	mg/kg	60	600	0.17	0.086	1 / 27	0.17	0.17	0.17	0.05	0.05

General Notes:

1. Only results for analytes detected in at least one sample are reported here. For a complete list of analytes see the Olin Wilmington Active Database.
2. NS = No standard available.
3. NC = Not calculated.
4. Olin Site-Specific Soil Means for surface and subsurface soils are based on Focused Risk Assessment (Harding-ESE, 2000).
5. The location of the Buried Debris Area is shown on Figure 2.
6. Results include final confirmatory data only (excludes field duplicate samples and samples superseded by subsequent soil excavation). For a summary of all confirmatory sample results, see summary tables in Appendix G of Status Report No. 2.
7. Method 1 Standards (e.g., S3-GW1), Reportable Concentrations (e.g., RCS2), and Upper Concentration Limits (UCLs), where identified, are cited from the Massachusetts Contingency Plan, June 2003.
8. mg/kg = milligrams per kilogram.

Table H-3
On-Property West Ditch Wetland Confirmatory Samples
Olin Corporation
51 Eames Street
Wilmington, MA

Parameter	Method	Units	S3-GW1 mg/kg	Soil UCLs mg/kg	Olin Site Specific Soil Mean (0-3 ft)	Olin Site Specific Soil Mean (0-15 ft)	Frequency of detect		Minimum Detected	Maximum Detected	Mean of Detects	Mean of All (including half of non-detect value)	Standard Deviation of all
Semivolatile Organic Compounds	8270C	mg/kg											
bis(2-Ethylhexyl)phthalate			100	10,000	19	130	20	23	1.1	871	80	71	185
Di-n-butyl phthalate			500 (RCS2)	10,000	3.7	1.5	5	23	0.45	263	65	18	54
N-Nitrosodiphenylamine			1000 (RCS2)	10,000	3.9	48	2	23	2.6	16	9.3	16	45
Phenol			60	10,000	NC	1.5	1	23	6.6	6.6	6.6	16	45
Volatile Organic Compounds	8260B	mg/kg											
2,4,4-Trimethyl-1-pentene			1000 (RCS2)	10,000	0.0048	NC	2	5	1.3	5.4	3.4	1.5	2.2
2,4,4-Trimethyl-2-pentene			1000 (RCS2)	10,000	0.0045	NC	2	5	0.59	2.3	1.4	0.78	0.86
Ethylbenzene			80	10,000	NC	0.046	1	6	0.54	0.54	0.54	0.27	0.19
m+p-Xylene			800	10,000	NC	0.0076	1	5	0.58	0.58	0.58	0.33	0.18
Methylene chloride			0.1	7,000	0.057	0.02	3	6	0.66	1.1	0.88	0.47	0.46
Toluene			90	10,000	0.057	0.076	1	6	0.051	0.051	0.05	0.20	0.15
Pesticides	8081A	mg/kg					0	5					
Metals	6010B	mg/kg											
Aluminum			NS	10,000	10,653	5,925	5	5	1,400	6,600	3260	3260	1979
Arsenic			30	300	7.1	5.6	1	5	3.9	3.9	3.9	2.7	1.1
Chromium			5,000	10,000	513	436	24	25	10	410	102	98	126
Iron			NS	10,000	11,949	7,772	5	5	630	7,800	4646	4646	2839
Lead			600	6,000	24	17	4	5	2.5	31	13	11	12

General Notes:

1. Only results for analytes detected in at least one sample are reported here. For a complete list of analytes see the Olin Wilmington Active Database.
2. NS = No standard available.
3. NC = Not calculated.
4. Olin Site-Specific Soil Means for surface and subsurface soils are based on Focused Risk Assessment (Harding-ESE, 2000).
5. The location of the West Ditch Wetland is shown on Figure 2.
6. Results include final confirmatory data only (excludes field duplicate samples and samples superseded by subsequent soil excavation). For a summary of all confirmatory sample results, see summary tables in Appendix G of Status Report No.2.
7. Method 1 Standards (e.g., S3-GW1), Reportable Concentrations (e.g., RCS2), and Upper Concentration Limits (UCLs), where identified, are cited from the Massachusetts Contingency Plan, June 2003.
8. mg/kg = Milligrams per kilogram.

Table H-6
Central Pond Oily Soil Excavation Confirmatory Samples
Olin Corporation
51 Eames Street
Wilmington, MA

Parameter	Method	Units	S-3/ GW-1	SOIL-UCL	Frequency of detect		Minimum Detected	Maximum Detected	Mean of detects	Mean of All (including half of non-detect value)
Extractable Petroleum Hydrocarbons	MAEPH	mg/Kg								
C11-C22 Aromatics (FID)			200	10000	8	11	5.2	206	43.49	32.12
C19-C36 Aliphatics (PID)			5000	20000	8	11	11	152	38.28	28.33
C9-C18 Aliphatics (FID)			5000	20000	2	11	9.5	15	12.25	3.80
EPH Concentration (Total)			NS	NS	9	11	5.2	373	75.41	62.03
Benzo(g,h,i)perylene			2500	10000	1	11	0.47	0.47	0.47	0.22
Benzo(k)fluoranthene			40	400	1	11	0.59	0.59	0.59	0.23
Fluoranthene			2000	10000	1	11	0.47	0.47	0.47	0.22
Metals	6010B	mg/Kg								
Arsenic, Total			30	300	8	8	1.53	7.99	4.93	4.93
Barium, Total			5000	10000	8	8	11.6	55.2	32.96	32.96
Cadmium, Total			80	800	2	8	0.293	0.299	0.30	0.17
Chromium, Total			5000	10000	8	8	10.3	451	108.53	108.53
Lead, Total			600	6000	8	8	3.25	62.5	20.70	20.70

General Notes:

1. Only results for analytes detected in at least one sample are reported here. For a complete list of analytes see the Olin Wilmington Active Database.
2. NS = No standard available.
3. Olin Site-Specific Soil Means for surface and subsurface soils are based on Focused Risk Assessment (Harding-ESE, 2000).
4. The location of the Central Pond Oily Soil Excavations are shown on Figure 2.
5. Results include final confirmatory data only (excludes field duplicate samples and samples superseded by subsequent soil excavation). For a summary of a confirmatory sample results, see summary table in Appendix C of Status Report No. 7.
6. Method 1 Standards (e.g., S3-GW1), Reportable Concentrations (e.g., RCS2), and Upper Concentration Limits (UCLs), where identified, are cited from the Massachusetts Contingency Plan, June 2003.
7. mg/kg = Milligrams per kilogram.

Table H-7
Hotspot Confirmatory Samples, 2000 and 2001
Olin Corperation
51 Eames Street
Wilmington, MA

Parameter	Method	Units	S3-GW1 mg/kg	Sample ID: / Date Sampled: / Soil UCLs mg/kg	1160-A8CW-1-B 11/9/00	1160-A8CW-1-E 11/9/00	1160-A8CW-1-N 11/9/00	1160-A8CW-1-S 11/9/00	1160-A8CW-1-W 11/9/00	1160-RS0-06-B 11/9/00	1160-RS0-06-E 11/9/00	1160-RS0-06-N 11/9/00	1160-RS0-06-S 11/9/00
Volatile Organics (VOCs)	6260B	mg/kg			NT	NT	NT	NT	NT	NT	NT	NT	NT
1,2,3-Trichlorobenzene			NS	NS									
1,2,4-Trichlorobenzene			100	10,000									
1,2,4-Trimethylbenzene			1000 (RCS2)	NS									
1,2-Dichlorobenzene			200	5,000									
1,4-Dichlorobenzene			2	2,000									
2,4,4-Trimethyl-1-pentene			1000 (RCS2)	NS									
2,4,4-Trimethyl-2-pentene			1000 (RCS2)	NS									
Ethylbenzene			80	10,000									
Methylene chloride			0.1	7,000									
p-Isopropyltoluene			NS	NS									
Semivolatile Organics (SVOCs)	6270C	mg/kg											
Anthracene			5,000	10,000	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	7.6 C	< 0.36
Benzo(a)anthracene			4	100	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	18 C	< 0.36
Benzo(a)pyrene			0.7	100	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	23 C	< 0.36
Benzo(b)fluoranthene			4	100	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	17 C	0.2 J
Benzo(g,h,i)perylene			2,500	10,000	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	9.5 C	< 0.36
Benzo(k)fluoranthene			40	400	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	21 C	< 0.36
bis(2-Ethylhexyl)phthalate			100	10,000	< 0.4 B	0.79	0.33 J	0.29 J	0.55	0.34 J	0.21 J	5.7 C J	0.72
Chrysene			40	400	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	16 C	< 0.36
Di-n-butyl phthalate			500 (RCS2)	NS	0.32 J	0.31 J	0.3 J	< 0.41	0.24 J	0.35 J	0.24 J	4.6 C J	0.2 J
Fluoranthene			2,000	10,000	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	37 C	0.24 J
Indeno(1,2,3-cd)pyrene			4	100	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	10 C	< 0.36
N-Nitrosodiphenylamine			1000 (RCS2)	NS	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	6.4 C J	< 0.36
Phenanthrene			700	10,000	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	33 C	< 0.36
Pyrene			1000	10,000	< 0.4	< 0.51	< 0.45	< 0.41	< 0.44	< 0.36	< 0.35	35 C	0.21 J
Pesticides	8081A	mg/kg											
4,4`-DDT			9	90	< 0.012	0.021	< 0.013	< 0.012	0.027	< 0.011	< 0.01	< 0.054 C	< 0.011
Metals	6010B	mg/kg											
Cadmium			80	800	0.41	< 0.4	< 0.3	< 0.3	< 0.3	< 0.2	< 0.2	0.29	< 0.2
Chromium			5,000	10,000	830	250	740	170	140	7.3	5.1	19	9.7
Lead			6000	6,000	1.6	7.3	12	8.8	7.5	3.5	1.8	19	13
Ammonia Nitrogen as N	LAC107061A	mg/kg	1000 (RCS2)	NS	NT	NT	NT	NT	NT	NT	NT	NT	NT
Solids, percent	EPA 160.3	%			82.3	64.3	72.3	80.5	73.7	90.9	93.5	69.7	91.2

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2. 'Method 1 Standards (e.g., S3-GW1), Reportable Concentrations (e.g., RCS2), and Upper Concentration Limits (UCLs), where identified, are cited from the Massachusetts Contingency Plan, June 2003.
3. mg/kg = milligrams per kilogram
4. "<" = Analyte not detected at a concentration above the specified laboratory reporting limit.
5. NS = No applicable Massachusetts Contingency Plan standard.
6. NT = Sample not tested for this analyte.
7. Hot spot locations shown on Figure 2.

Qualifying Notes:
B The reported result is attributed to laboratory contamination due to the presence of the chemical in the associated laboratory blank.
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F The result is estimated due to matrix spike recovery outside of control limits.
J The reported result is below the laboratory reporting limit and is therefore

Table H-7
Hotspot Confirmatory Samples, 2000 and 2001
Olin Corporation
51 Eames Street
Wilmington, MA

Parameter	Method	Units	S3-GW1 mg/kg	Soil UCLs mg/kg	1160-RS0-06-W 11/9/00	1160-LAKE POLY 1-B 11/17/00 Excavated in 2004	1160-LAKE POLY 1-E 11/17/00 Excavated in 2004	1160-LAKE POLY 1-N 11/17/00 Excavated in 2004	1160-LAKE POLY 1-S 11/17/00 Excavated in 2004	1160-LAKE POLY 1-W 11/17/00 Excavated in 2004	1160-LAKEPOLY1-01 5/8/01 Excavated in 2004	1160-LAKEPOLY1-02 5/8/01 Excavated in 2004
Volatile Organics (VOCs)	8260B	mg/kg			NT							
1,2,3-Trichlorobenzene			NS	NS		< 0.13	< 0.15	< 0.14	1.7	< 1	< 0.14	< 1
1,2,4-Trichlorobenzene			100	10,000		< 0.13	< 0.15	< 0.14	3	< 1	< 0.14	< 1
1,2,4-Trimethylbenzene			1000 (RCS2)	NS		< 0.13	< 0.15	< 0.14	< 0.45	< 1	< 0.14	0.68 J
1,2-Dichlorobenzene			200	5,000		< 0.13	< 0.15	< 0.14	7.1	< 1	< 0.14	< 1
1,4-Dichlorobenzene			2	2,000		< 0.13	< 0.15	< 0.14	9	< 1	< 0.14	< 1
2,4,4-Trimethyl-1-pentene			1000 (RCS2)	NS		< 0.13	< 0.15	0.81	41	33	0.92	97
2,4,4-Trimethyl-2-pentene			1000 (RCS2)	NS		< 0.13	< 0.15	0.15	72	24	1.4	45
Ethylbenzene			80	10,000		< 0.13	< 0.15	< 0.14	0.5	< 1	< 0.14	< 1
Methylene chloride			0.1	7,000		< 0.27 B	< 0.29 B	0.3 B	0.93 B	< 2 B	< 0.28	< 2.1
p-Isopropyltoluene			NS	NS		< 0.13	< 0.15	< 0.14	< 0.45	< 1	< 0.14	4.4
Semivolatile Organics (SVOCs)	8270C	mg/kg										
Anthracene			5,000	10,000	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Benzo(a)anthracene			4	100	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Benzo(a)pyrene			0.7	100	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Benzo(b)fluoranthene			4	100	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Benzo(g,h,i)perylene			2,500	10,000	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Benzo(k)fluoranthene			40	400	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
bis(2-Ethylhexyl)phthalate			100	10,000	< 0.35 B	1.2	0.57	390 C	890 C	875 C	< 0.42	600 J
Chrysene			40	400	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Di-n-butyl phthalate			500 (RCS2)	NS	0.28 J	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Fluoranthene			2,000	10,000	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Indeno(1,2,3-cd)pyrene			4	100	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
N-Nitrosodiphenylamine			1000 (RCS2)	NS	< 0.35	< 0.37	< 0.39	37 C	62 C	205 C	< 0.42	2800
Phenanthrene			700	10,000	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Pyrene			1000	10,000	< 0.35	< 0.37	< 0.39	< 20	< 61	< 53	< 0.42	< 670
Pesticides	8081A	mg/kg										
4,4'-DDT			9	90	< 0.01	< 0.01	< 0.012	< 0.057	< 0.085	< 0.079	NT	NT
Metals	6010B	mg/kg										
Cadmium			80	800	< 0.2	< 0.3	< 0.2	< 0.3	0.62	0.63	< 0.63	< 1
Chromium			5,000	10,000	6.4	3400	6.4	21	11000 F	5300	11	1500
Lead			6000	6,000	2.1	11	2.6	1.4	27	33	4	21
Ammonia Nitrogen as N	LAC107061A	mg/kg	1000 (RCS2)	NS	NT	NT	NT	NT	NT	NT	61	2775
Solids, percent	EPA 160.3	%			93.9	88.9	83.6	82.9	54.6	61.2	81.4	56.2

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