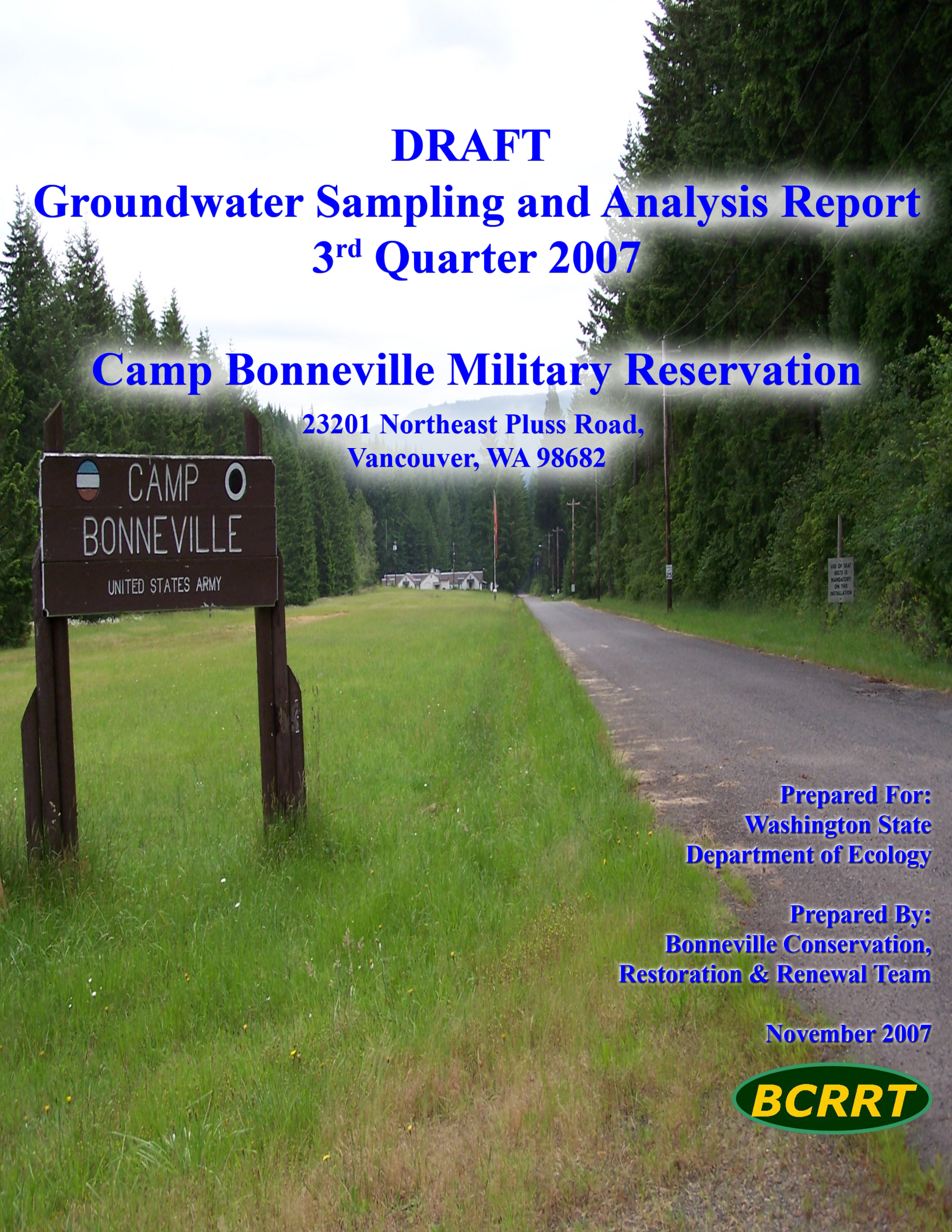
DRAFT
Groundwater Sampling and Analysis Report
3rd Quarter 2007

Camp Bonneville Military Reservation

23201 Northeast Pluss Road,
Vancouver, WA 98682



Prepared For:
Washington State
Department of Ecology

Prepared By:
Bonneville Conservation,
Restoration & Renewal Team

November 2007

BCRRT

Baker

Engineering & Energy

Baker Environmental, Inc.
A Unit of Michael Baker Corporation

5261 Fountain Drive
Suite A
Crown Point, IN 46307

219-736-0263
FAX 219-755-0233

November 27, 2007

Mr. Mike Gage
Bonneville Conservation Restoration and Renewal Team, LLC (BCRRT)
Camp Bonneville
23201 NE Pluss Road
Vancouver, WA 98682

SUBJECT: Draft Groundwater Sampling and Analysis Report – 3rd Quarter, 2007 for the Camp Bonneville Facility located in Vancouver Washington

Dear Mr. Gage:

This letter and its attachments constitute the Draft Groundwater Sampling and Analysis Report – 3rd Quarter, 2007 for submittal to the Washington Department of Ecology. Attached to this letter are:

1) Figures 1 and 2,
2) Landfill 4/Demolition Area 1 Groundwater Data,
3) Draft Groundwater Sampling and Analysis Report – 3rd Quarter, 2007 by PBS Engineering and Environmental (PBS), and
4) Electronic copies of the submittal on CD.

Following your review, please forward two copies of the entire submittal to the following:

Mr. Ben Amoah-Forson, Ph.D., P.E.
Washington State Department of Ecology
Toxics Cleanup Program
PO Box 47600
300 Desmond Drive
Olympia, Washington 98504

Recent Groundwater Sampling Results at Boundary Area/Sentinel Wells

Upon review of historic groundwater data at Landfill 4/Demolition Area 1, the following appears to be occurring at the site:

- Perchlorate concentrations in wells located in close proximity to the landfill excavation (LF4-MW-2A&B) are experiencing significant fluctuations both seasonally and over time. The 3rd quarter LF4-MW-2A&B perchlorate sample results reversed their 2007 decreasing pattern and have returned to historic concentrations. There appears to be a correlation between elevated perchlorate concentrations and lower water levels in the 3rd quarter historically that is followed by decreasing concentration/increasing groundwater elevations (see Attachment 2).

This seasonal variation maybe attributable to dilution of impacted aquifer(s) during increased precipitation.

- Perchlorate concentrations in wells with perchlorate detections (LF4-MW-3 A&B, LF4-MW-4 A, and LF4-MW-5A) are experiencing less severe fluctuations seasonally and over time.

- Perchlorate concentrations (or non-detections) in the remaining wells (LF4-M2-1A&B, and LF4-MW-17 and 18) have had little change throughout the monitoring period.

- The remaining volatile organic compound (VOC) detections have had little variation throughout the monitoring period with the exception of decrease at well LF4-MW-2B.

Groundwater detections for VOCs are summarized in the attached tables and figures and monitoring well locations are shown on Attachment 1 - Figures 1 and 2; and Attachment 2 - Landfill 4/Demolition Area 1 Groundwater Data. Completed details for the latest sampling event are included in the Attachment 3 – Draft Groundwater Sampling and Analysis Report – 3rd Quarter.

Sampling Schedule

The typical quarterly groundwater sampling schedule consists of approximately:

- 1 to 11/2 week(s) for field sample collection and shipment to the laboratory,

- 4 to 5 weeks for laboratory sample analysis, generation of a final report, and electronic data deliverable (EDD),

- 1 to 2 weeks for summary of field activities, laboratory data summaries, data QA/QC, and report generation (upon receipt of final laboratory report/EDD),

- 1 week for Baker review of quarterly report and trend comparisons,

- 1 week for BCRRT review of entire quarterly report package, reproduction, and submittal to WDOE.

Additional Evaluation

Additional evaluations of the groundwater will be included in subsequent quarterly reports and ultimately in the Remedial Investigation/Feasibility Study (RI/FS) for RAU 2C and RAU 3 for groundwater. As a result of the 3rd quarter LF4-MW-2A&B perchlorate pattern reversal Baker is currently evaluating the existing historic data/reports, data trends, and potential additional data requirements to address the LF4/DA1 groundwater. This additional evaluation is in accordance with Item C of the July 11, 2007 technical memorandum submitted to DOE titled "Evaluation and Decision Points for Groundwater Related Activities at Landfill 4/Demolition Area 1(LF4/DA1)".

If you have any questions, please contact me at (219) 736-0263.

Very truly yours,

MICHAEL BAKER JR., INC.

James D. Peyton, PG
Senior Geologist

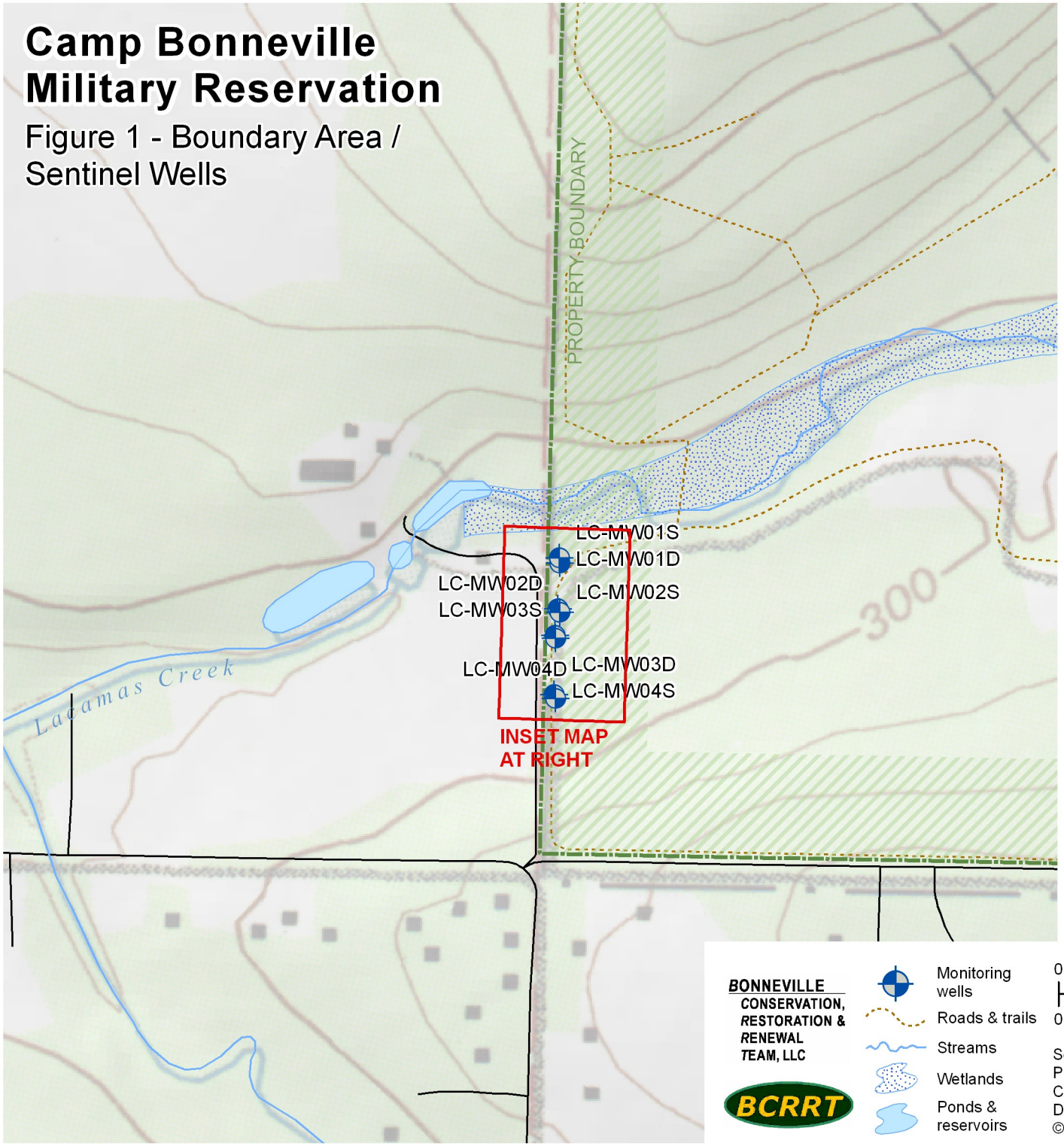
Earl H. Rothfuss, PE
Interim Project Manager

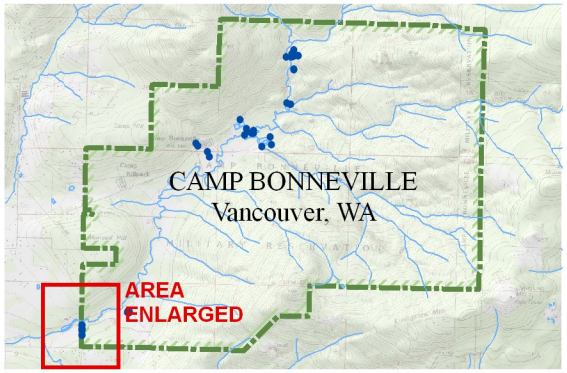
JDP/amt
Attachments

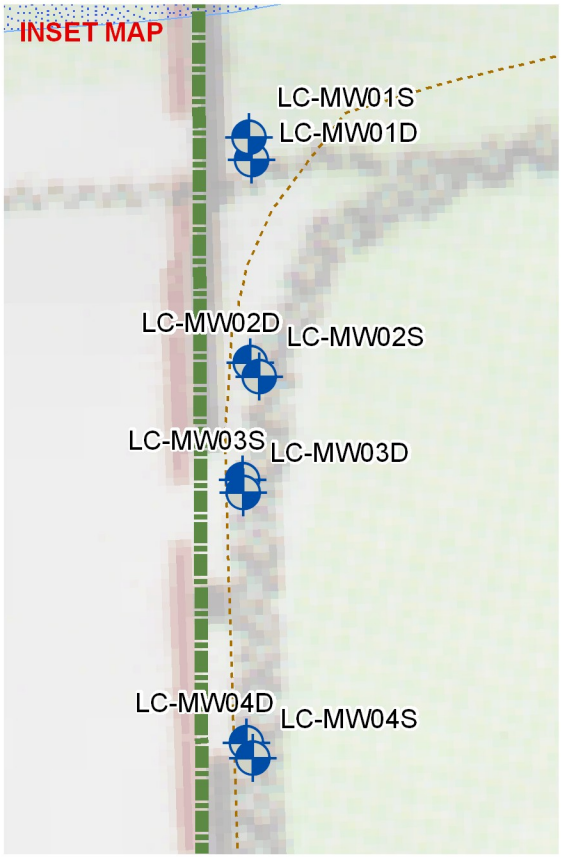
ATTACHMENT 1
FIGURES

Camp Bonneville Military Reservation

Figure 1 - Boundary Area / Sentinel Wells







BONNEVILLE CONSERVATION, RESTORATION & RENEWAL TEAM, LLC

BCRRT

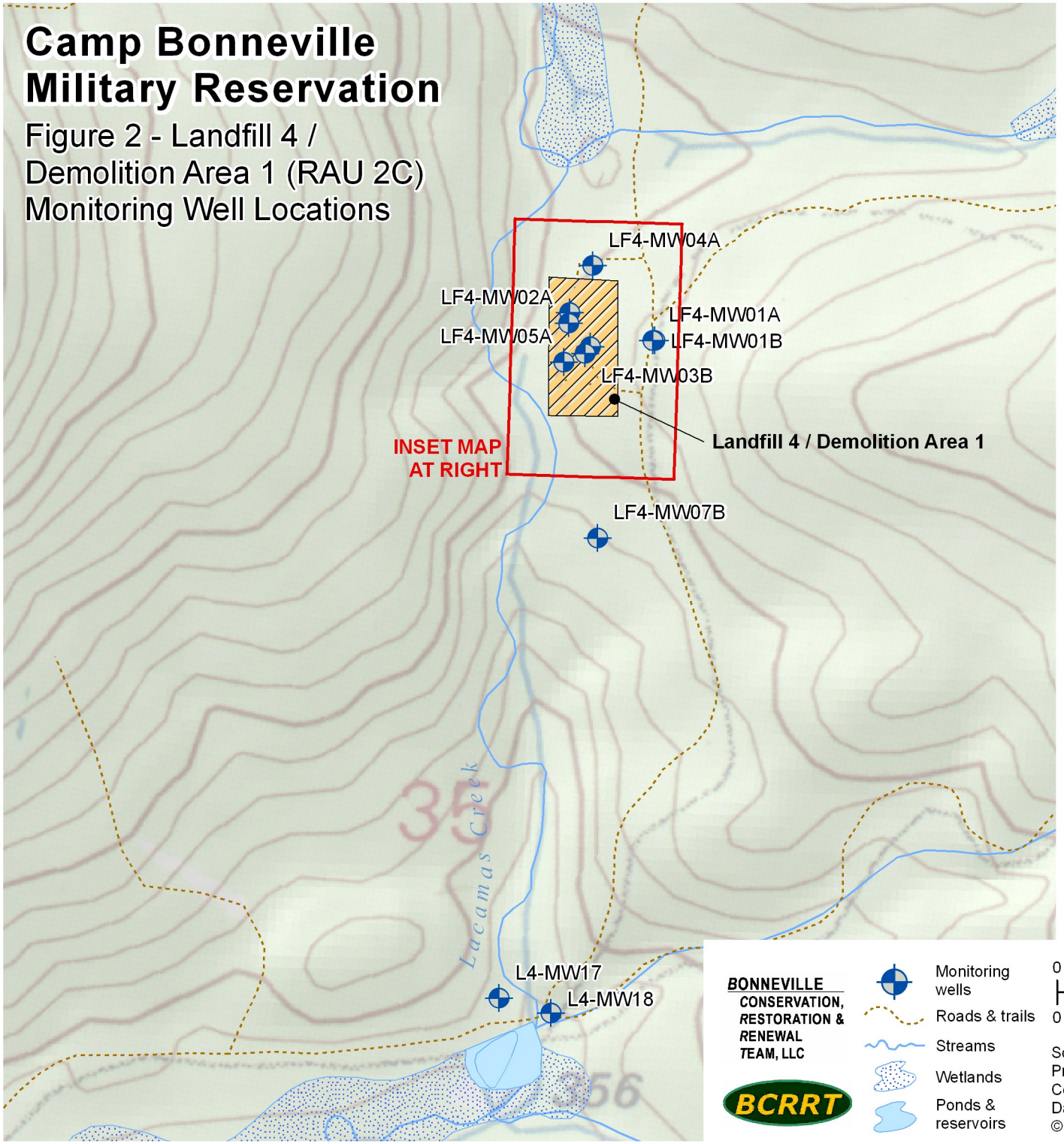
Monitoring wells
Roads & trails
Streams
Wetlands
Ponds & reservoirs

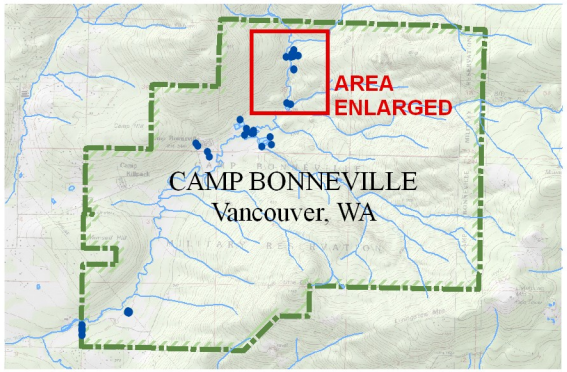
0 200 400 600 800 1,000 ft
0 100 200 m

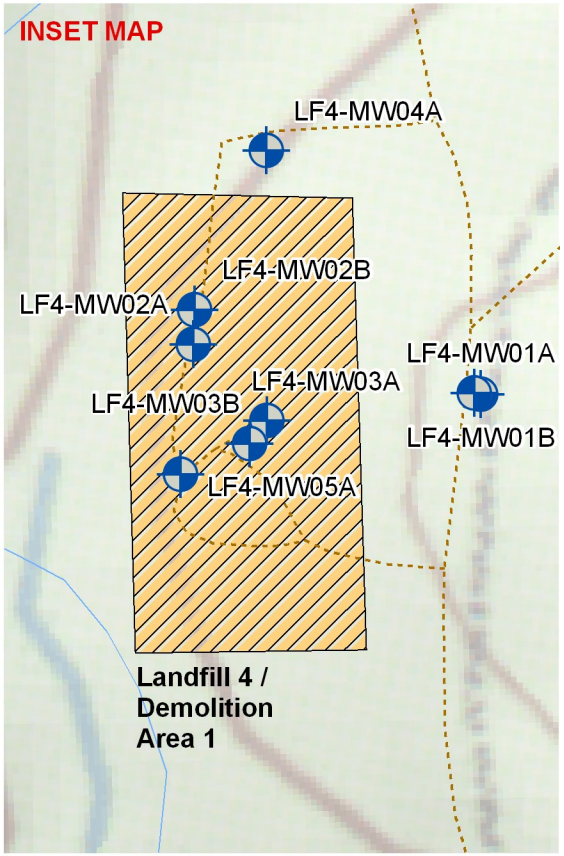
Scale - 1:5,000
Projection - Lambert Conformal Conic
Coordinate System - State Plane Washington South FIPS 4602
Data - Parsons & U.S. Army Corps of Engineers

Camp Bonneville Military Reservation

Figure 2 - Landfill 4 / Demolition Area 1 (RAU 2C) Monitoring Well Locations







BONNEVILLE CONSERVATION, RESTORATION & RENEWAL TEAM, LLC

BCRRT

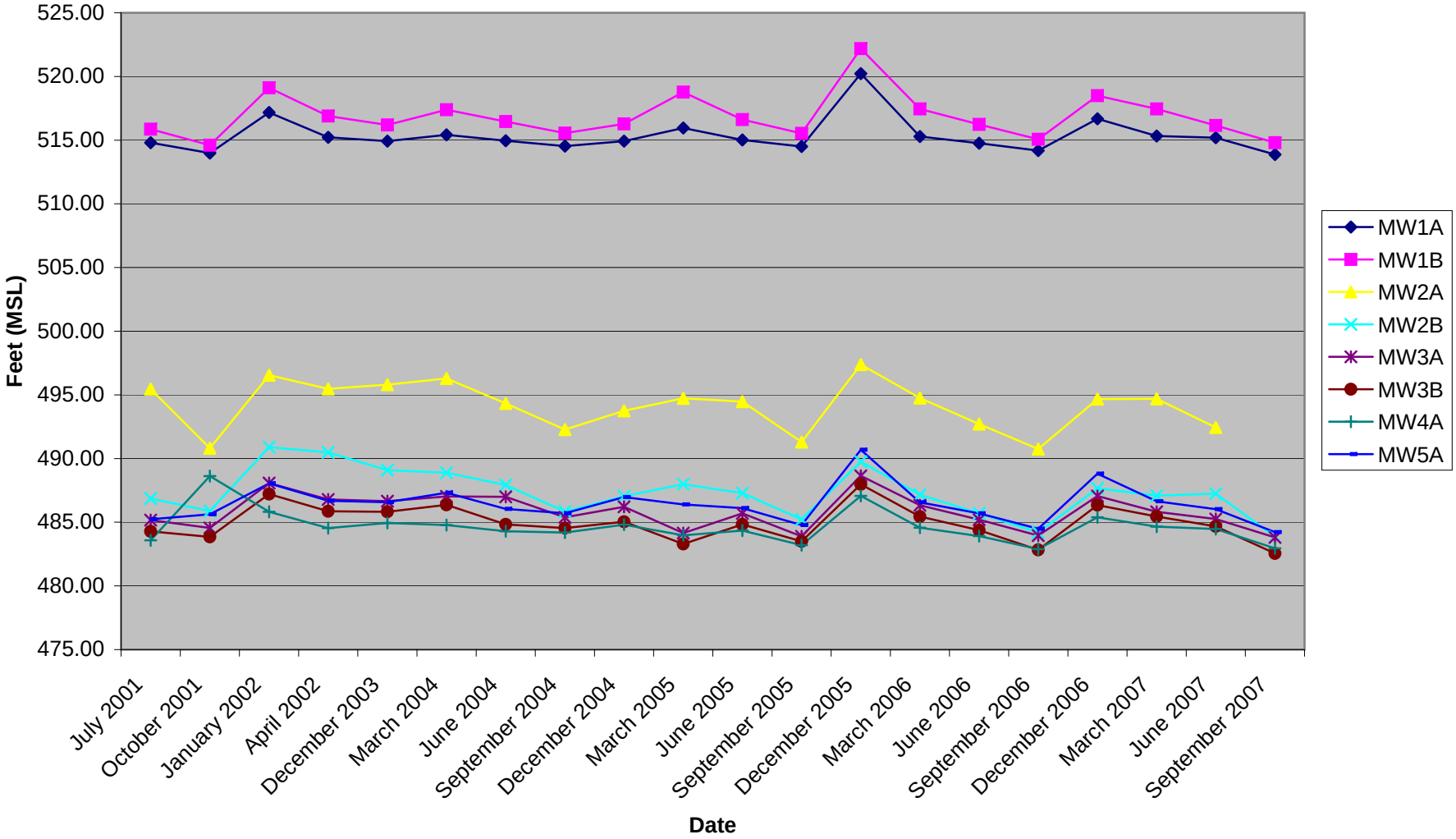
Monitoring wells
Roads & trails
Streams
Wetlands
Ponds & reservoirs

0 200 400 600 800 1,000 ft
0 100 200 m

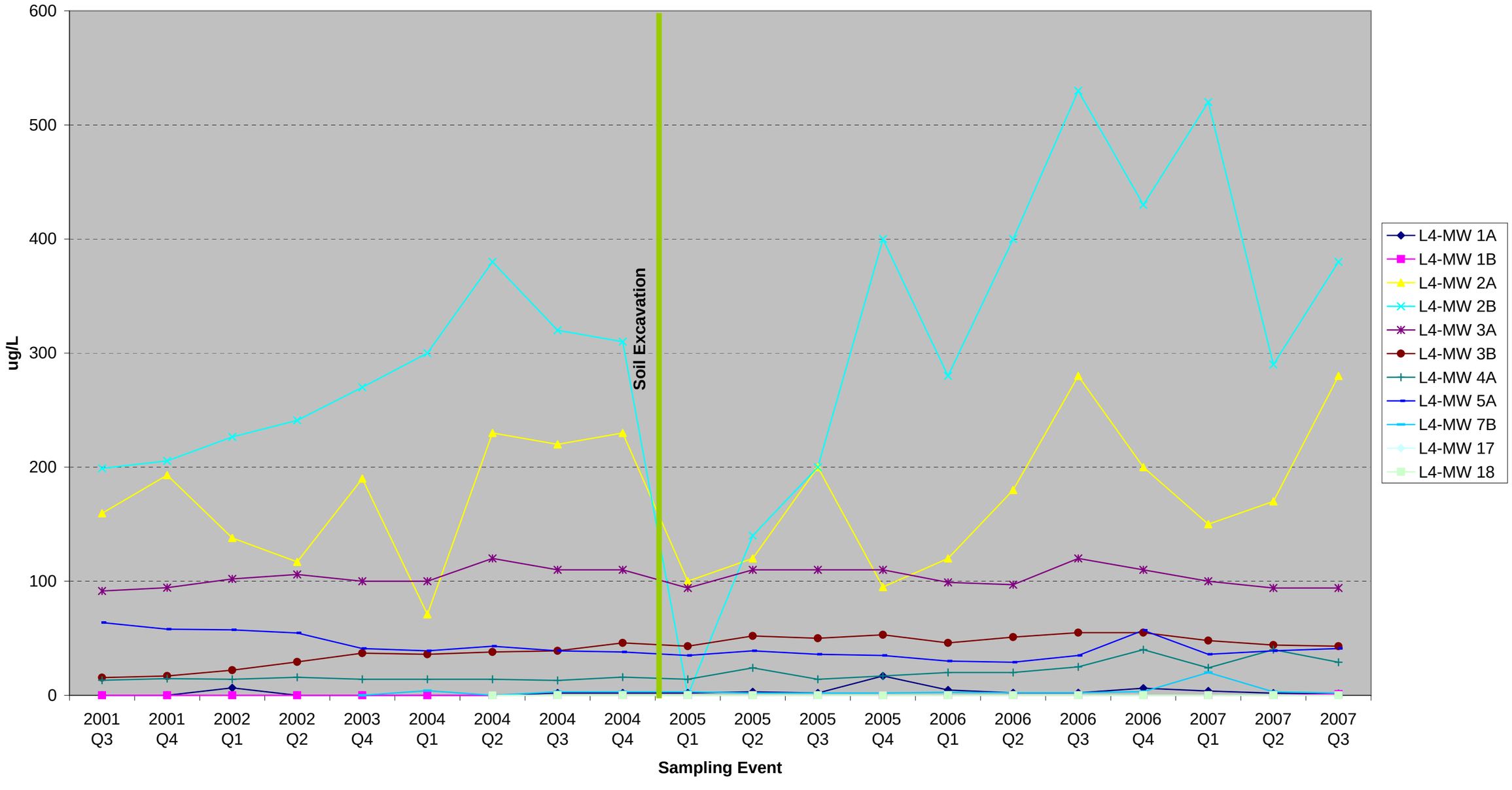
Scale - 1:5,000
Projection - Lambert Conformal Conic
Coordinate System - State Plane Washington South FIPS 4602
Data - Parsons & U.S. Army Corps of Engineers

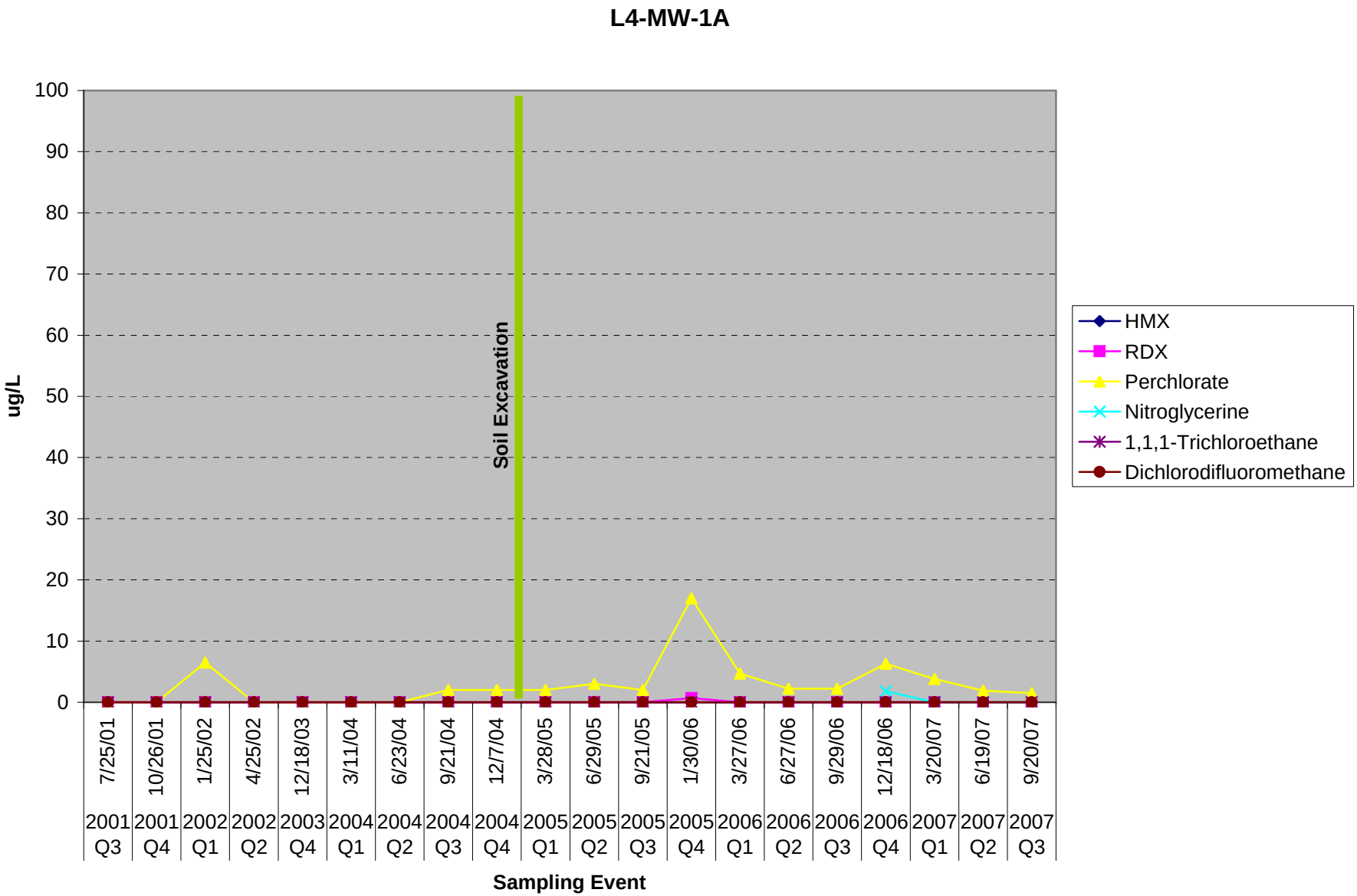
ATTACHMENT 2
LANDFILL 4 GROUNDWATER DATA

Landfill 4 Monitoring Wells
Groundwater Elevations
July 2001 through September 2007



Landfill 4 Perchlorate Results

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ug/L
100
90
80
70
60
50
40
30
20
10
0
Soil Excavation
HMX
RDX
Perchlorate
Nitroglycerine
1,1,1-Trichloroethane
Dichlorodifluoromethane
7/25/01
10/26/01
1/25/02
4/25/02
12/18/03
3/11/04
6/23/04
9/21/04
12/7/04
3/28/05
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9/21/05
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12/18/06
3/20/07
6/19/07
9/20/07
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2001 Q4
2002 Q1
2002 Q2
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2004 Q3
2004 Q4
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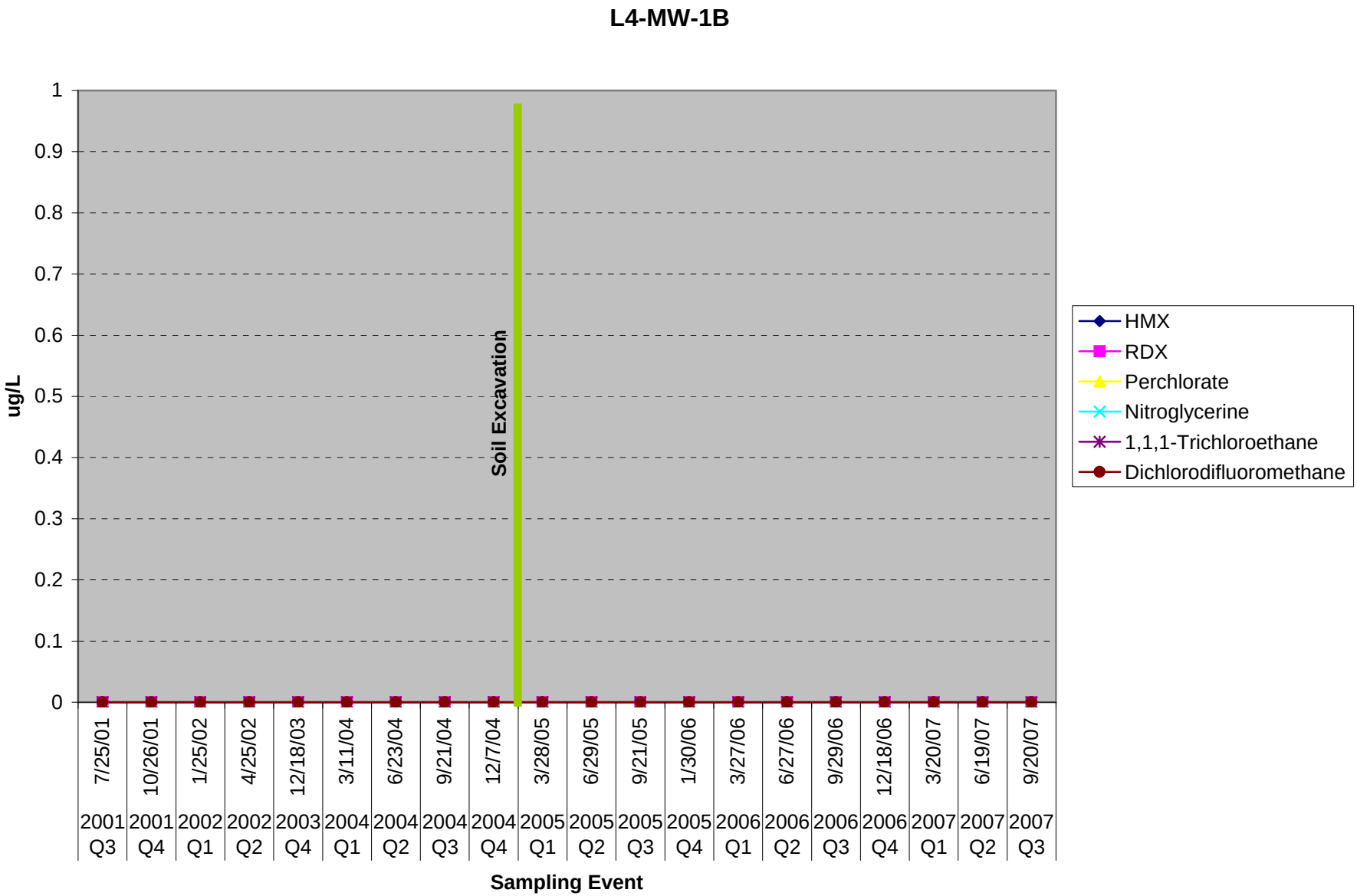
2006 Q4
2007 Q1
2007 Q2
2007 Q3
Sampling Event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0.7
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0.5
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0.2
0.1
0
Soil Excavation
HMX
RDX
Perchlorate
Nitroglycerine
1,1,1-Trichloroethane
Dichlorodifluoromethane
7/25/01
10/26/01
1/25/02
4/25/02
12/18/03
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6/19/07
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2001 Q3
2001 Q4
2002 Q1
2002 Q2
2003 Q4
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2004 Q2
2004 Q3
2004 Q4
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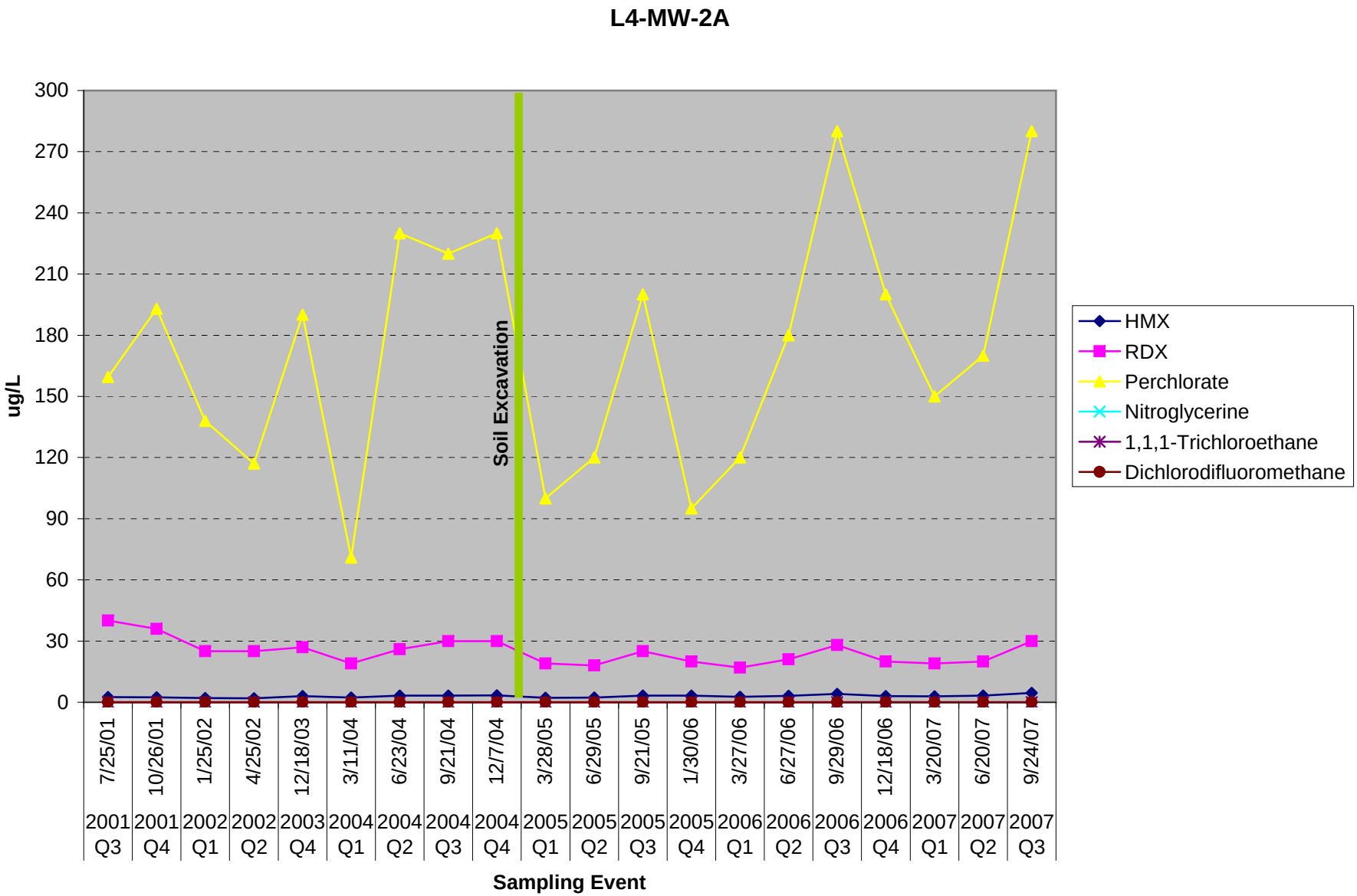
2007 Q1
2007 Q2
2007 Q3
Sampling Event


L4-MW-2A
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270
240
210
180
150
120
90
60
30
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Soil Excavation
HMX
RDX
Perchlorate
Nitroglycerine
1,1,1-Trichloroethane
Dichlorodifluoromethane
7/25/01
10/26/01
1/25/02
4/25/02
12/18/03
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1/30/06
3/27/06
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12/18/06
3/20/07
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9/24/07
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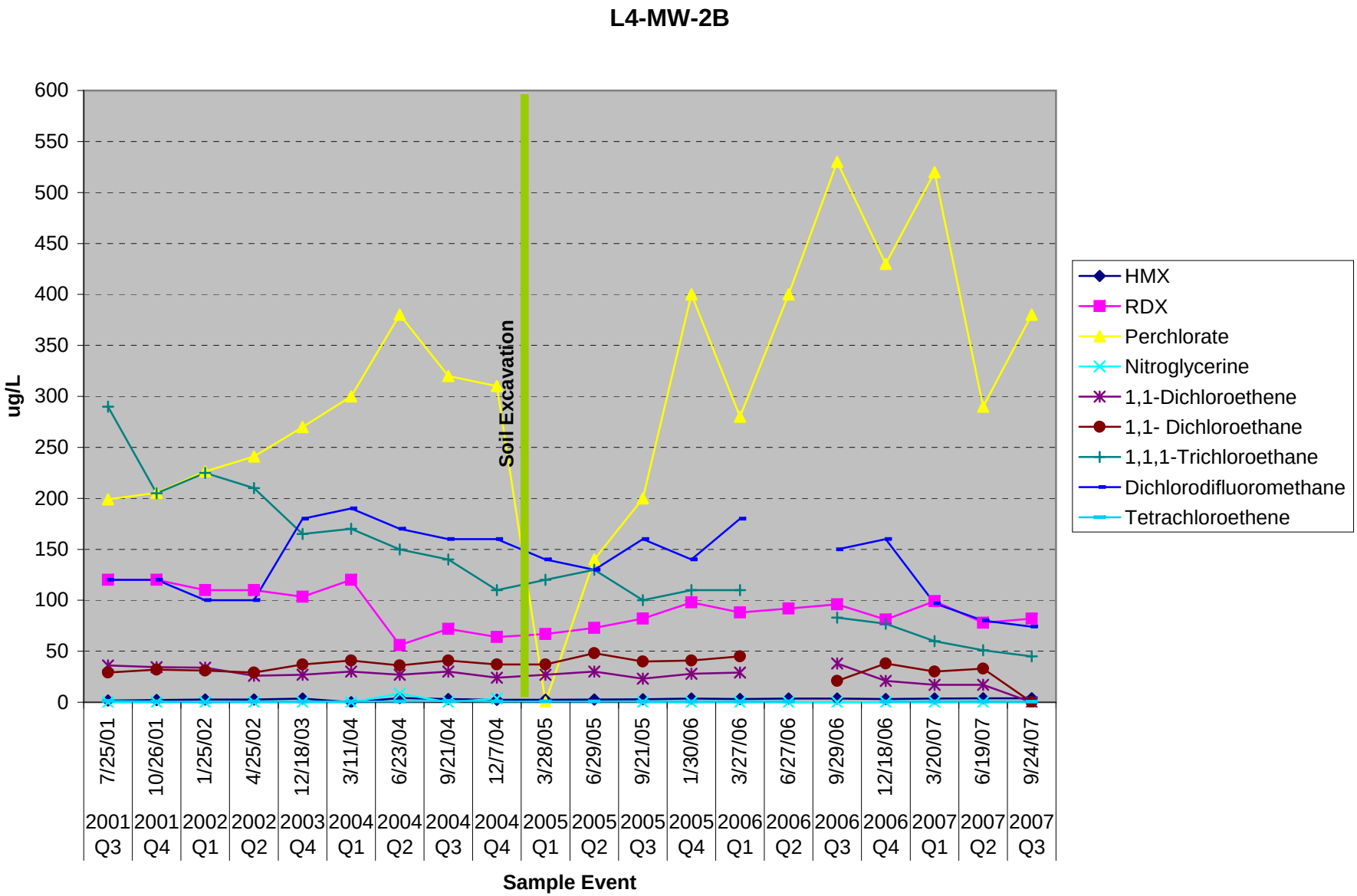
Sampling Event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ug/L
Soil Excavation
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RDX
Perchlorate
Nitroglycerine
1,1-Dichloroethene
1,1- Dichloroethane
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Dichlorodifluoromethane
Tetrachloroethene
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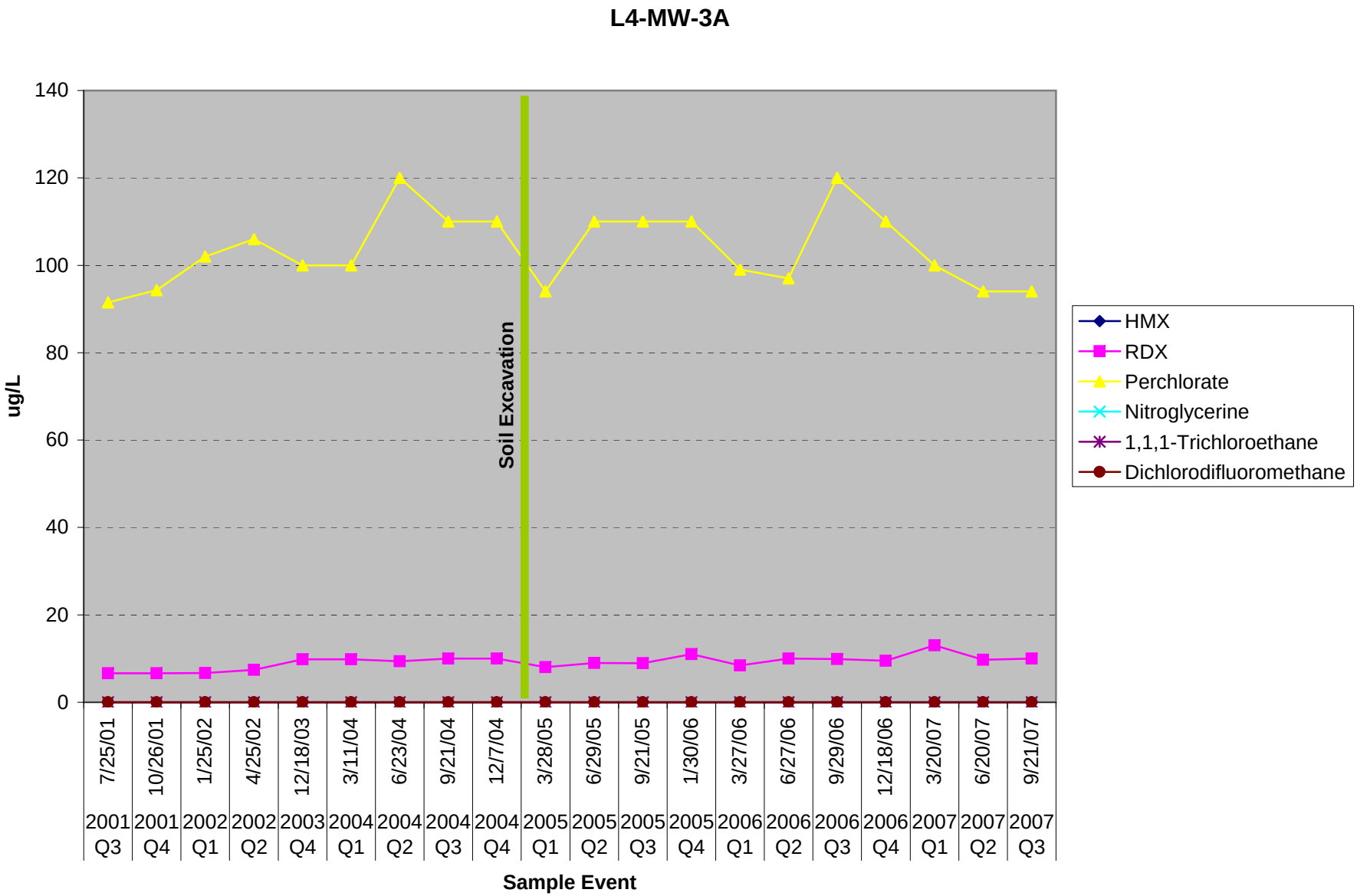
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ug/L
Soil Excavation
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Dichlorodifluoromethane
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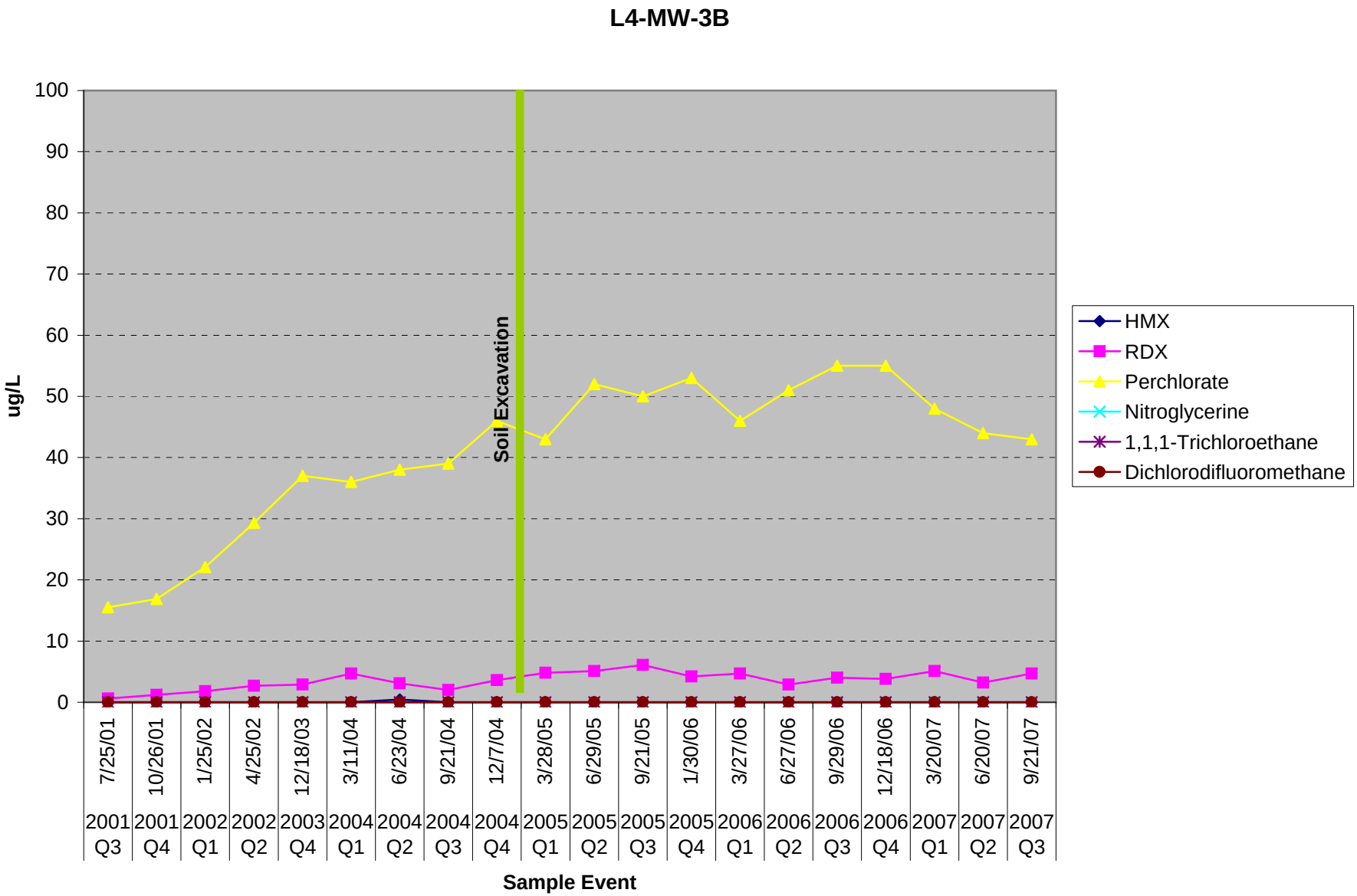
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Soil Excavation
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RDX
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Nitroglycerine
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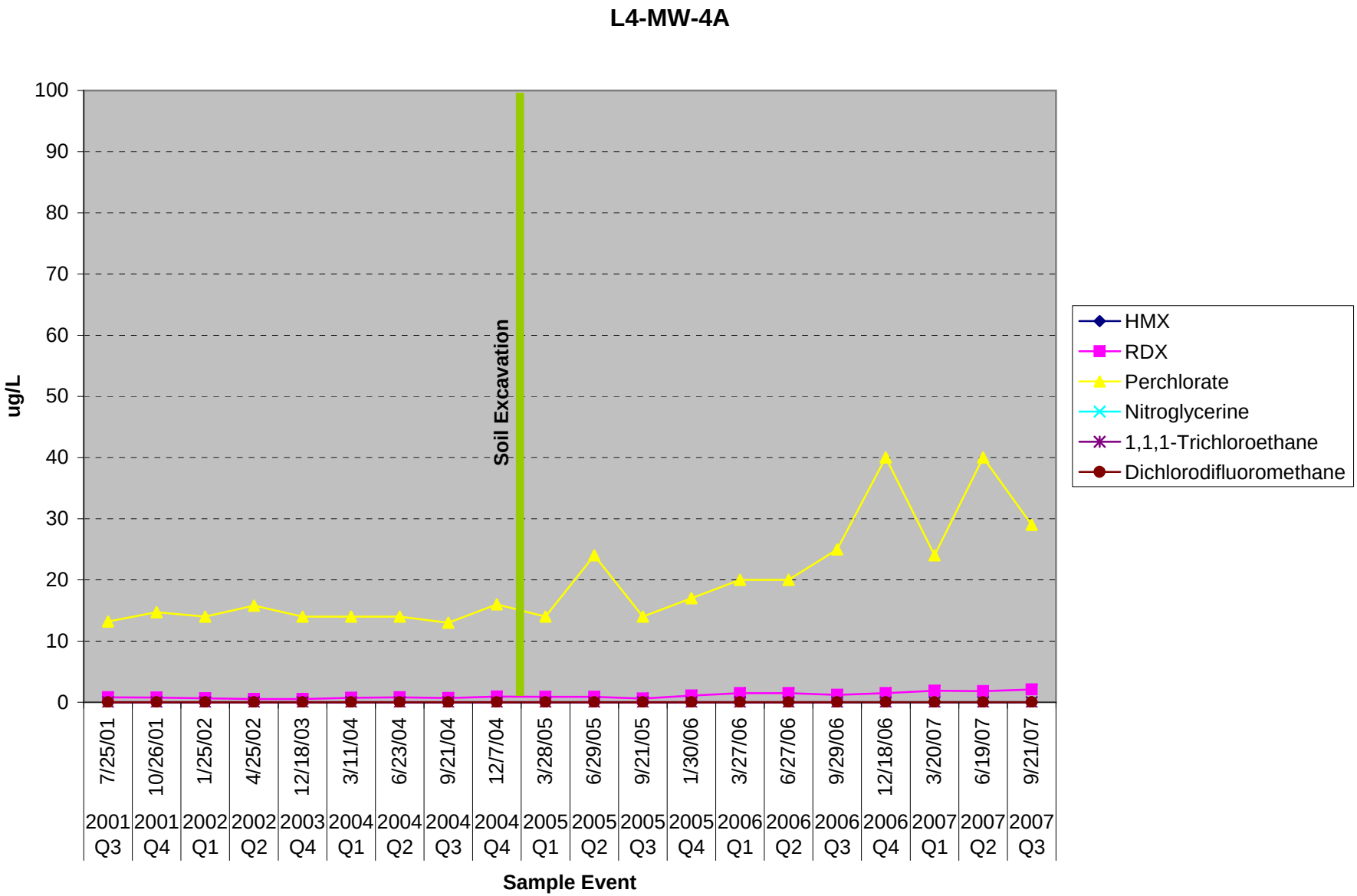
2007 Q3
Sample Event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ug/L
Soil Excavation
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2004 Q3
2004 Q4
2005 Q1
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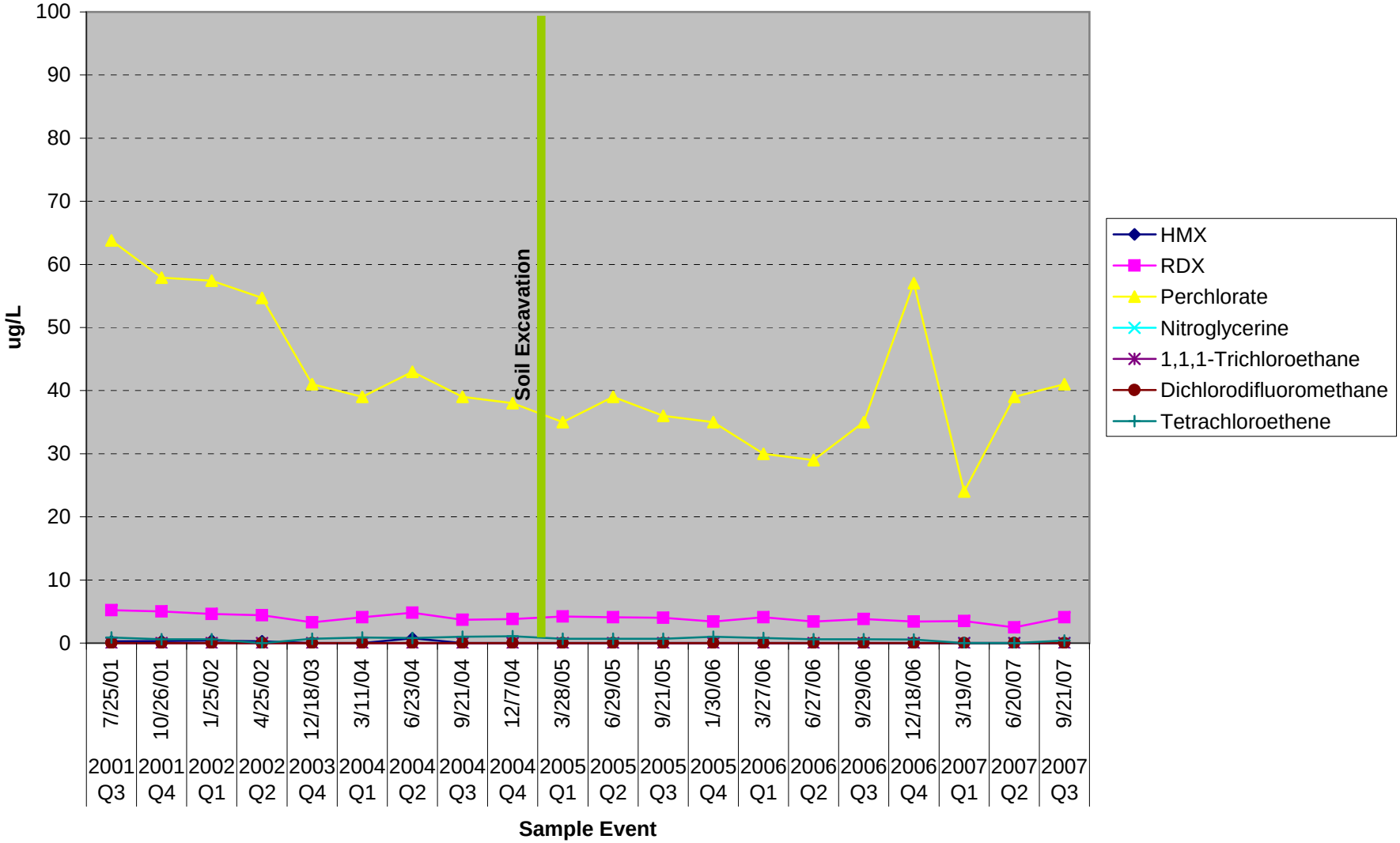
2006 Q3
2006 Q4
2007 Q1
2007 Q2
2007 Q3
Sample Event

L4-MW-5A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ug/L
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Nitroglycerine
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Dichlorodifluoromethane
Tetrachloroethene
7/25/01
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6/29/05
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6/27/06
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12/18/06
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9/21/07
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2001 Q4
2002 Q1
2002 Q2
2003 Q4
2004 Q1
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2004 Q3
2004 Q4
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2006 Q4
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2007 Q2
2007 Q3
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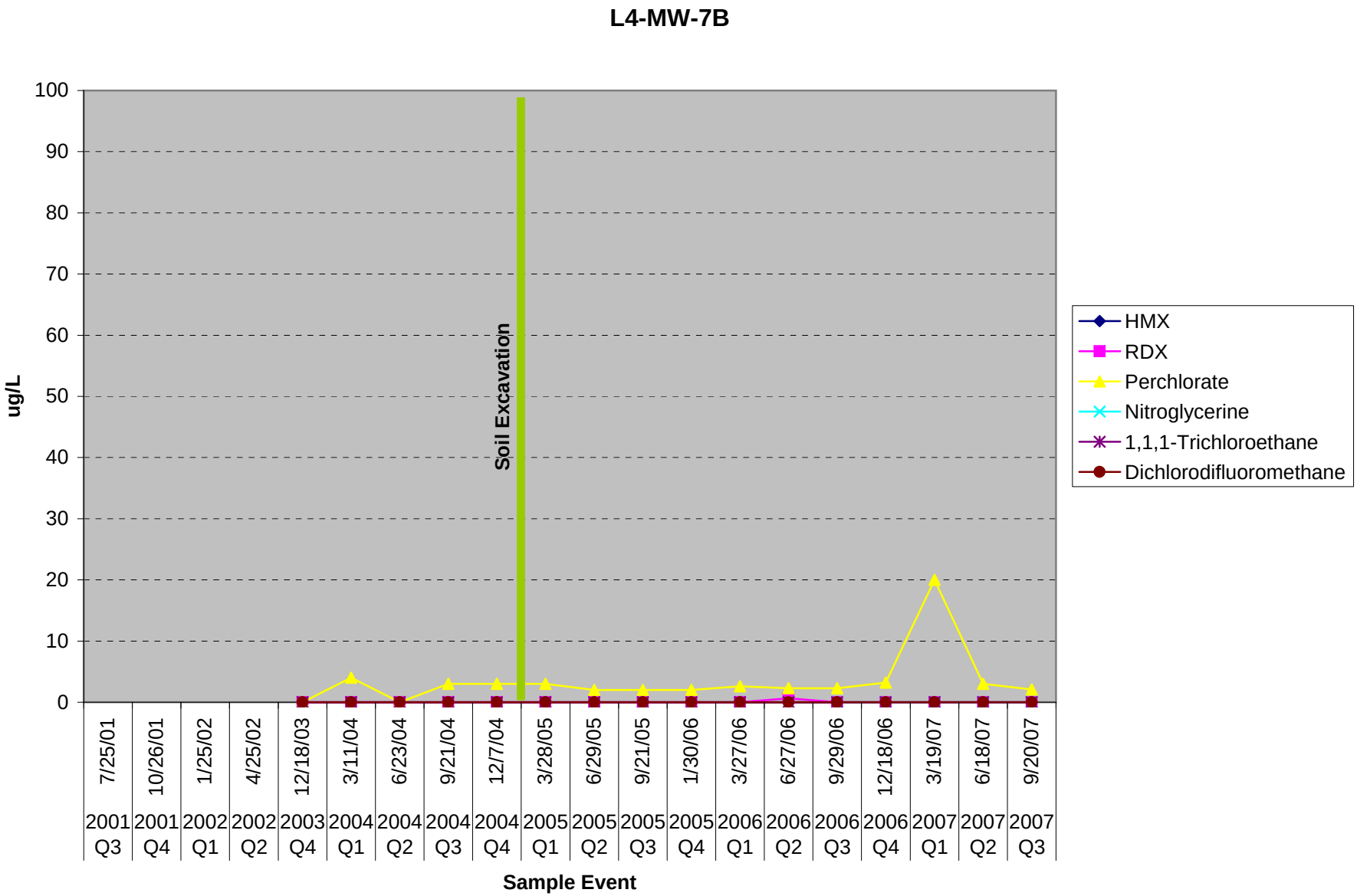
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Dichlorodifluoromethane
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2004 Q1
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2004 Q3
2004 Q4
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2005 Q4
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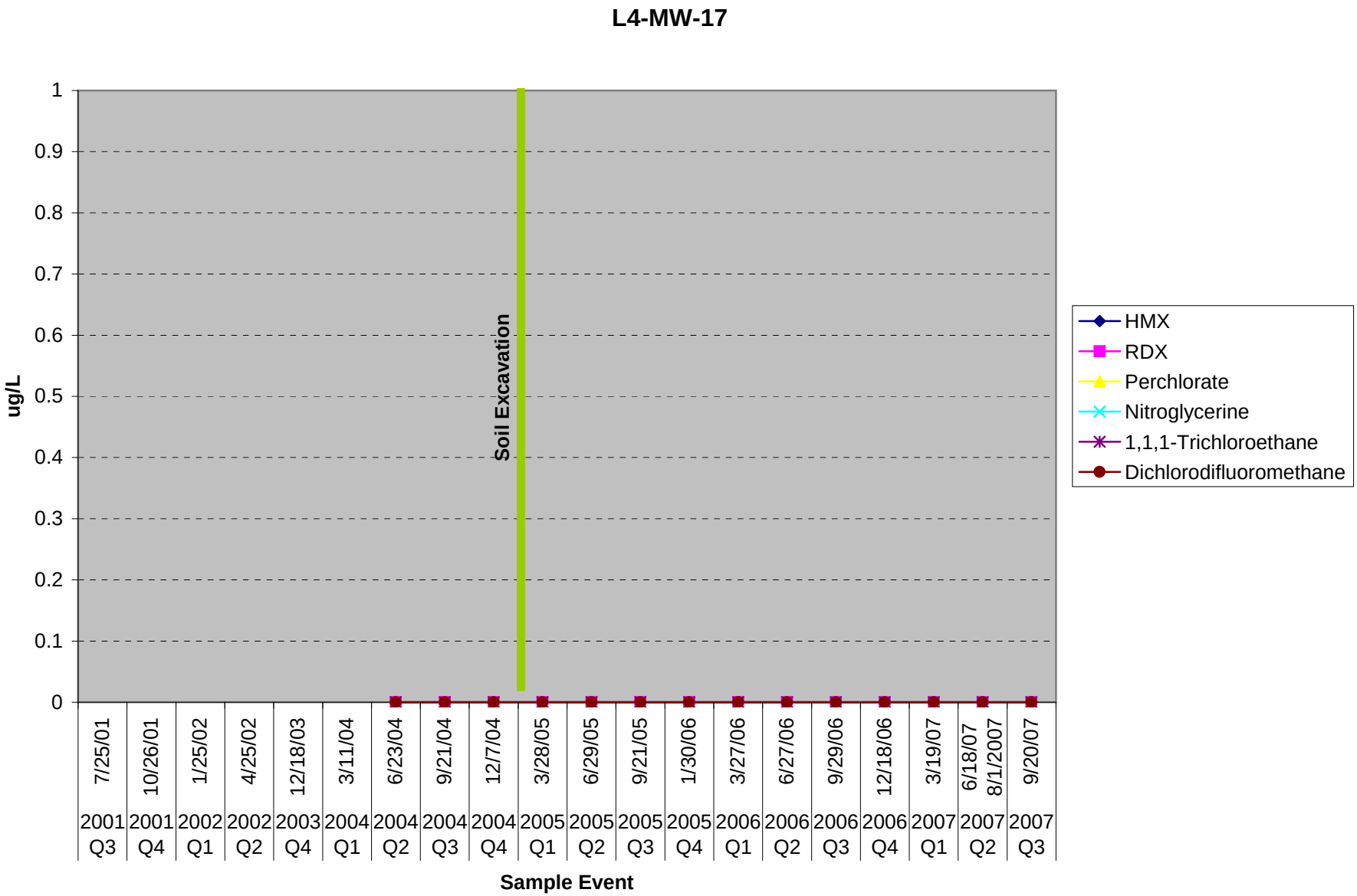
2006 Q2
2006 Q3
2006 Q4
2007 Q1
2007 Q2
2007 Q3
Sample Event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Soil Excavation
7/25/01
10/26/01
1/25/02
4/25/02
12/18/03
3/11/04
6/23/04
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12/7/04
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6/29/05
9/21/05
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2001 Q4
2002 Q1
2002 Q2
2003 Q4
2004 Q1
2004 Q2
2004 Q3
2004 Q4
2005 Q1
2005 Q2
2005 Q3
2005 Q4
2006 Q1
2006 Q2
2006 Q3
2006 Q4
2007 Q1
2007 Q2
2007 Q3
Sample Event
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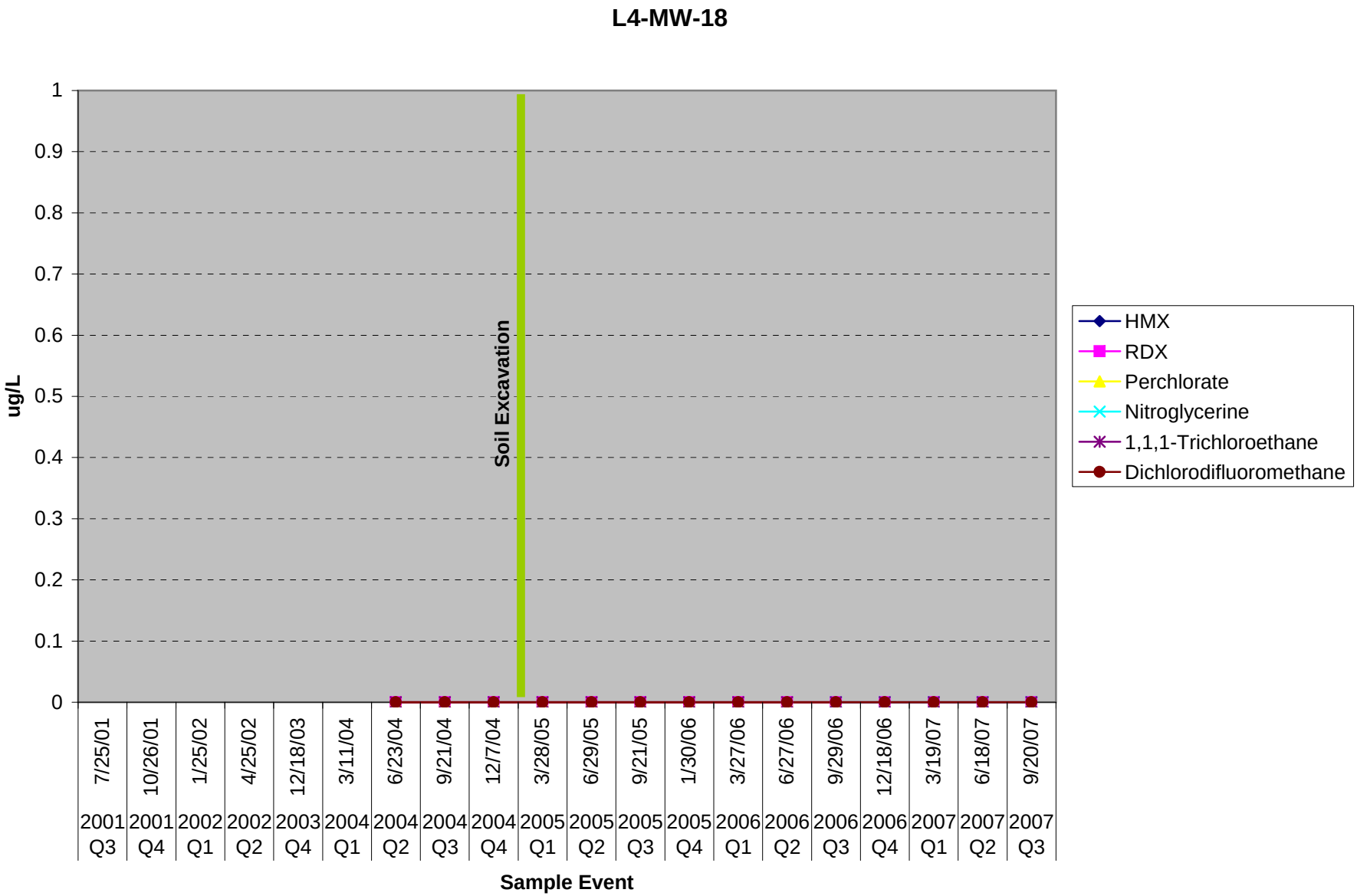
RDX
Perchlorate
Nitroglycerine
1,1,1-Trichloroethane
Dichlorodifluoromethane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Soil Excavation
7/25/01
10/26/01
1/25/02
4/25/02
12/18/03
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2004 Q1
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2004 Q4
2005 Q1
2005 Q2
2005 Q3
2005 Q4
2006 Q1
2006 Q2
2006 Q3
2006 Q4
2007 Q1
2007 Q2
2007 Q3
Sample Event
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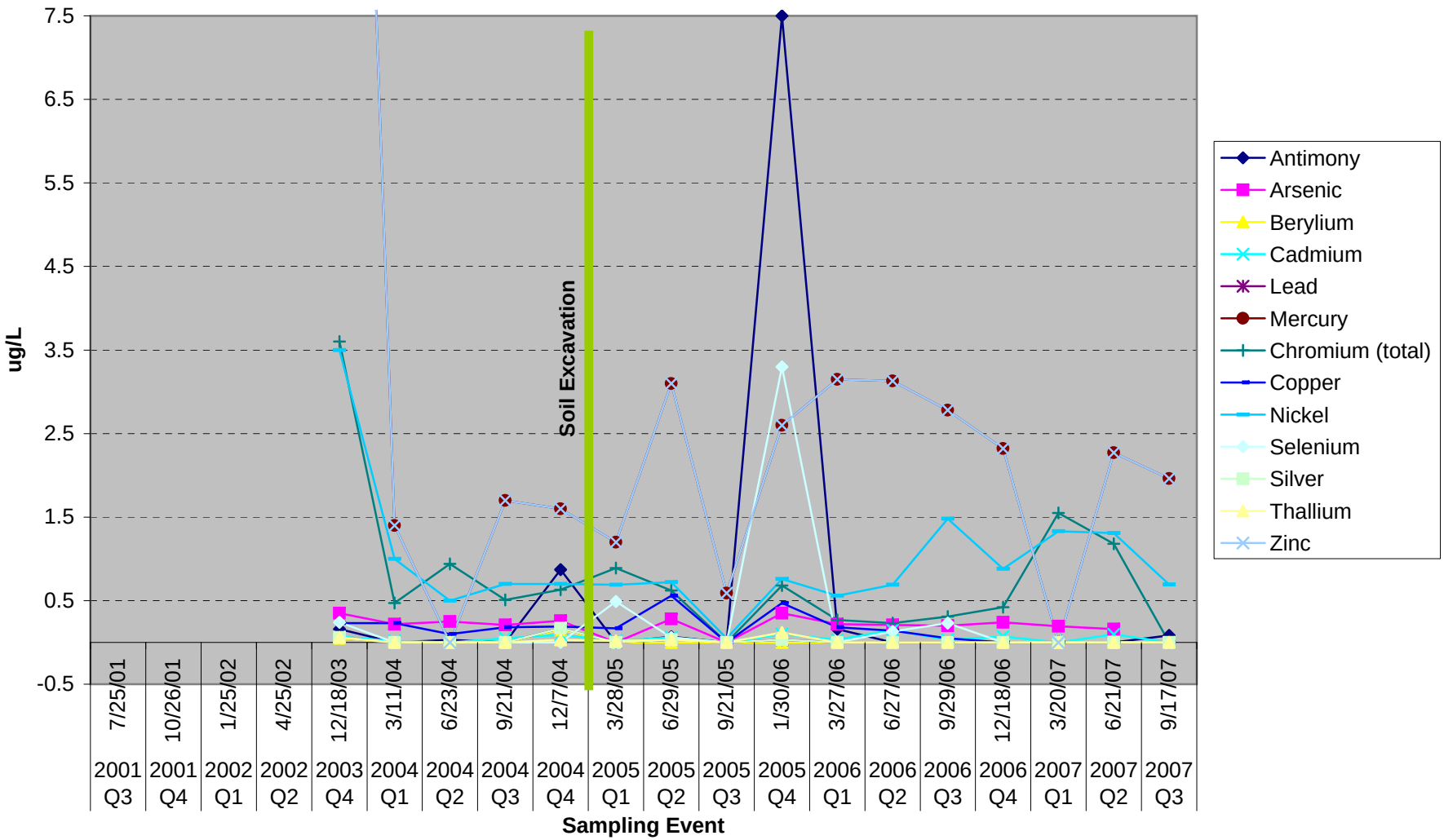
RDX
Perchlorate
Nitroglycerine
1,1,1-Trichloroethane
Dichlorodifluoromethane

LC-MW-01SW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0.5
-0.5
ug/L
Soil Excavation
7/25/01
10/26/01
1/25/02
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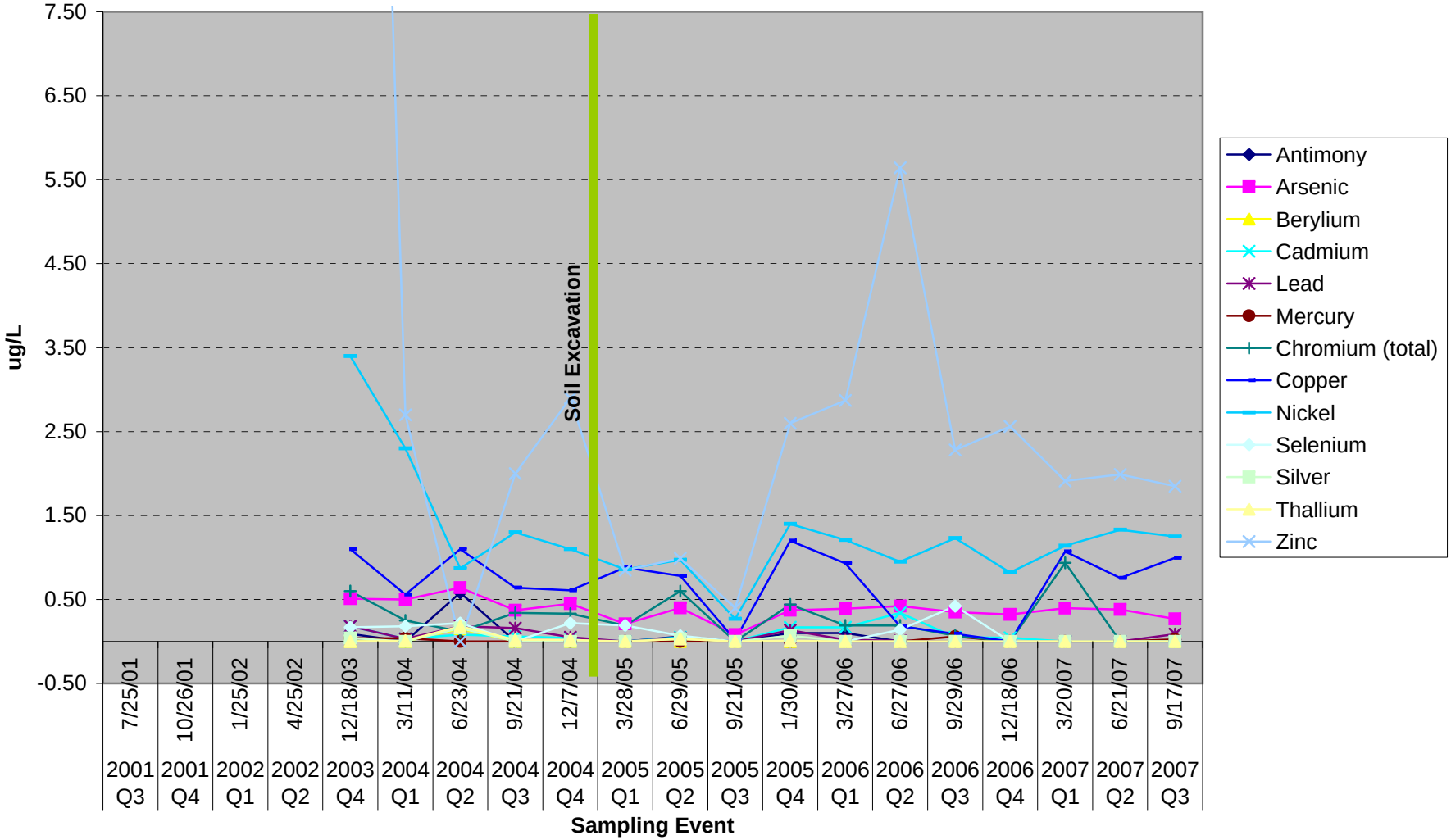
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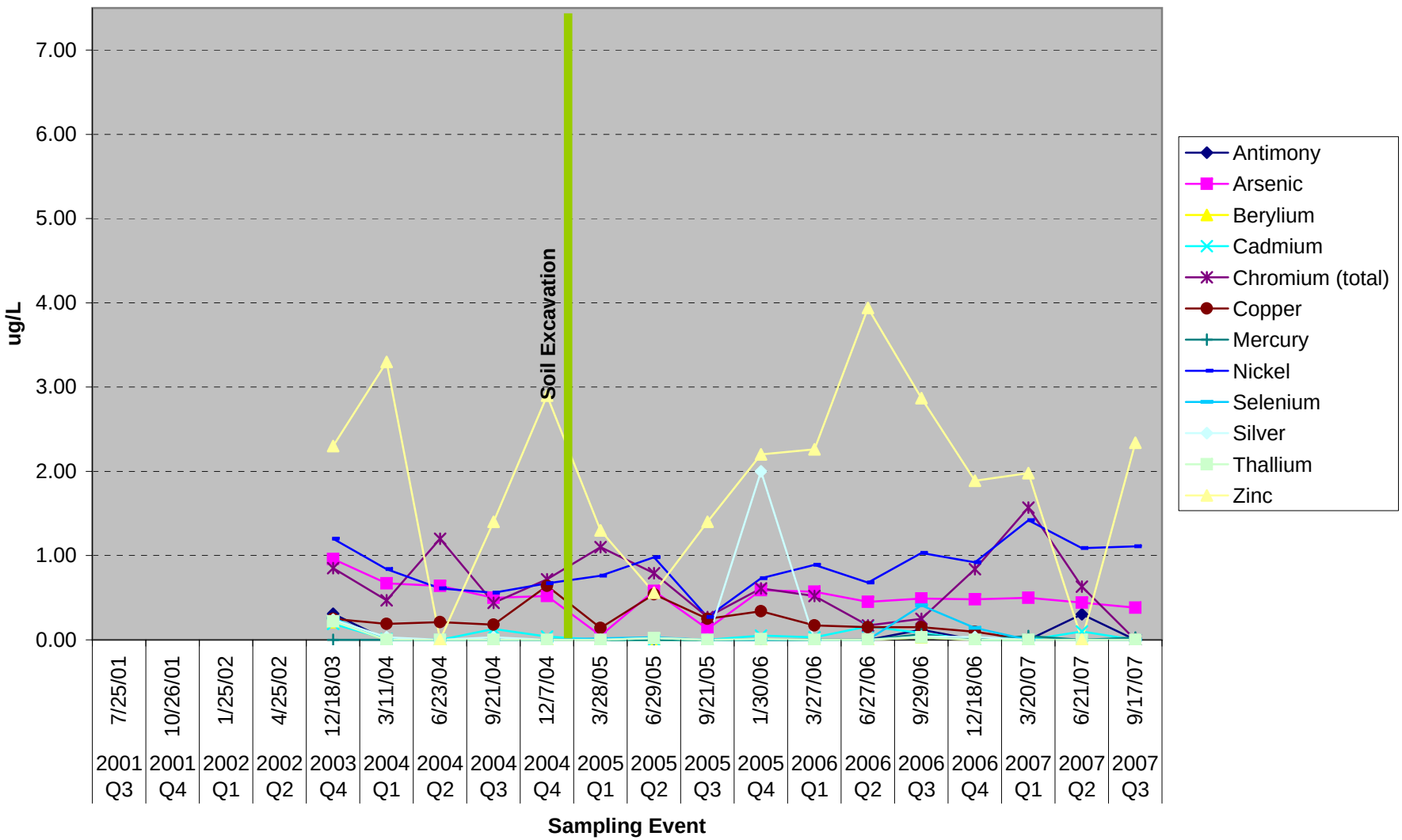
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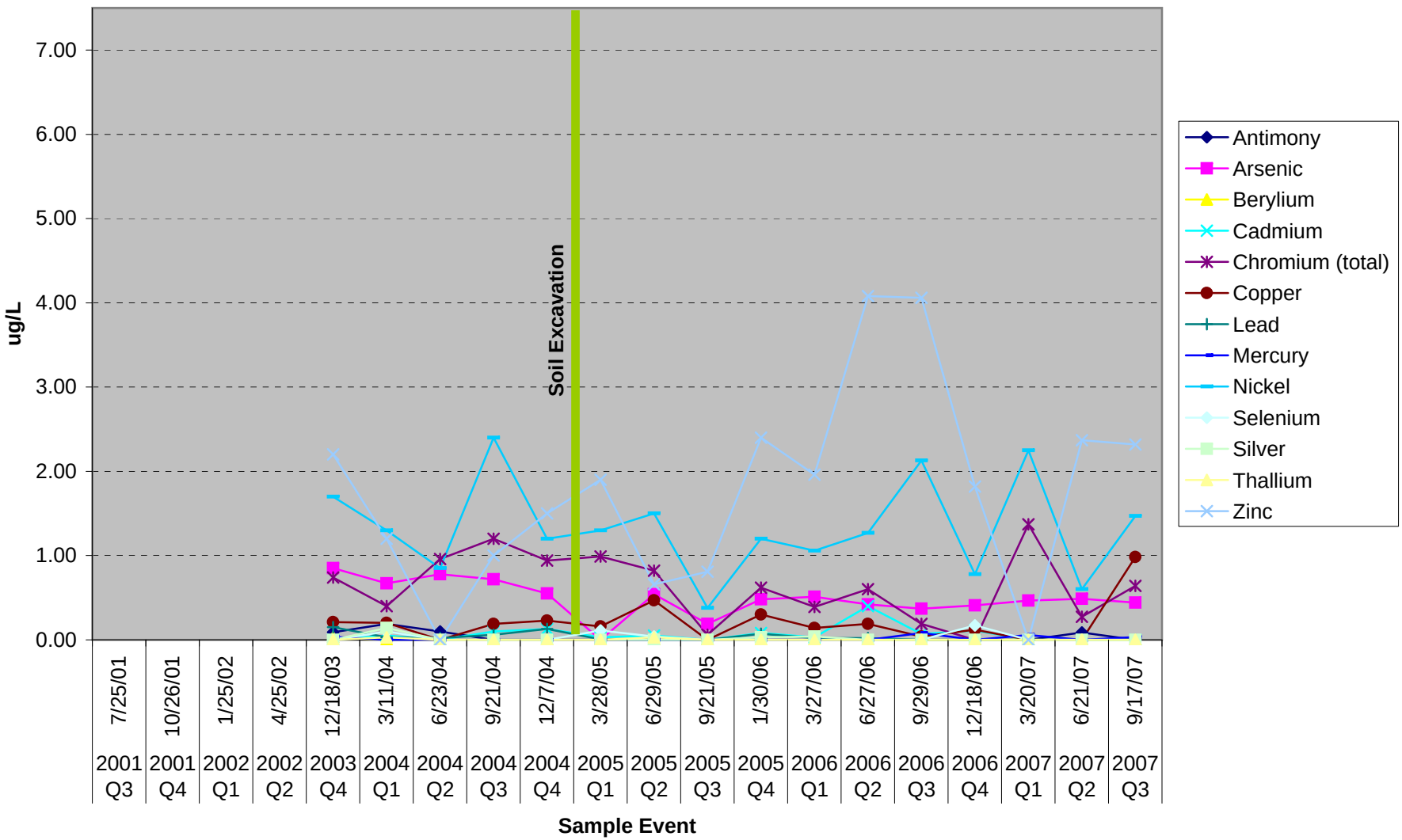
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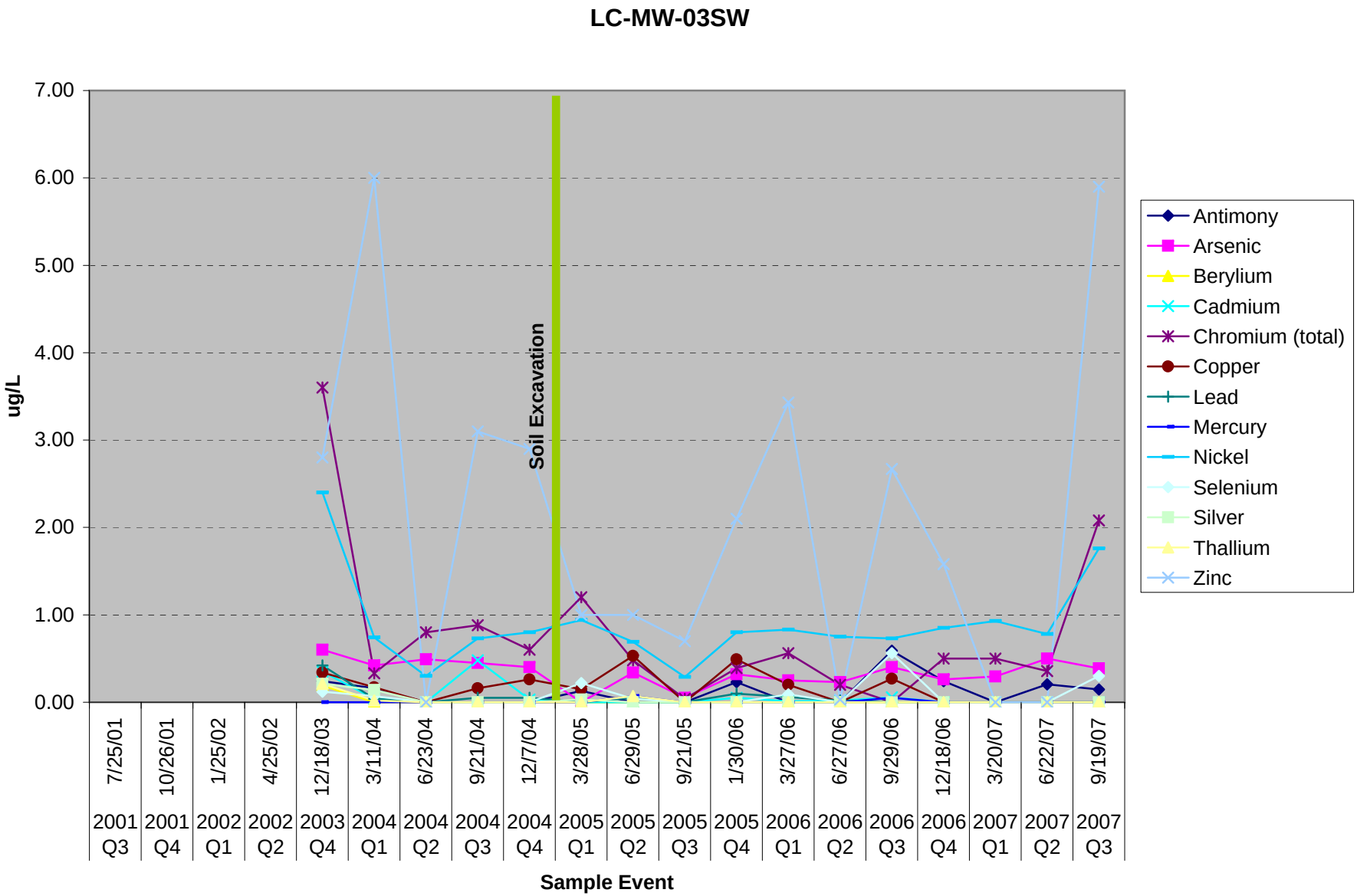
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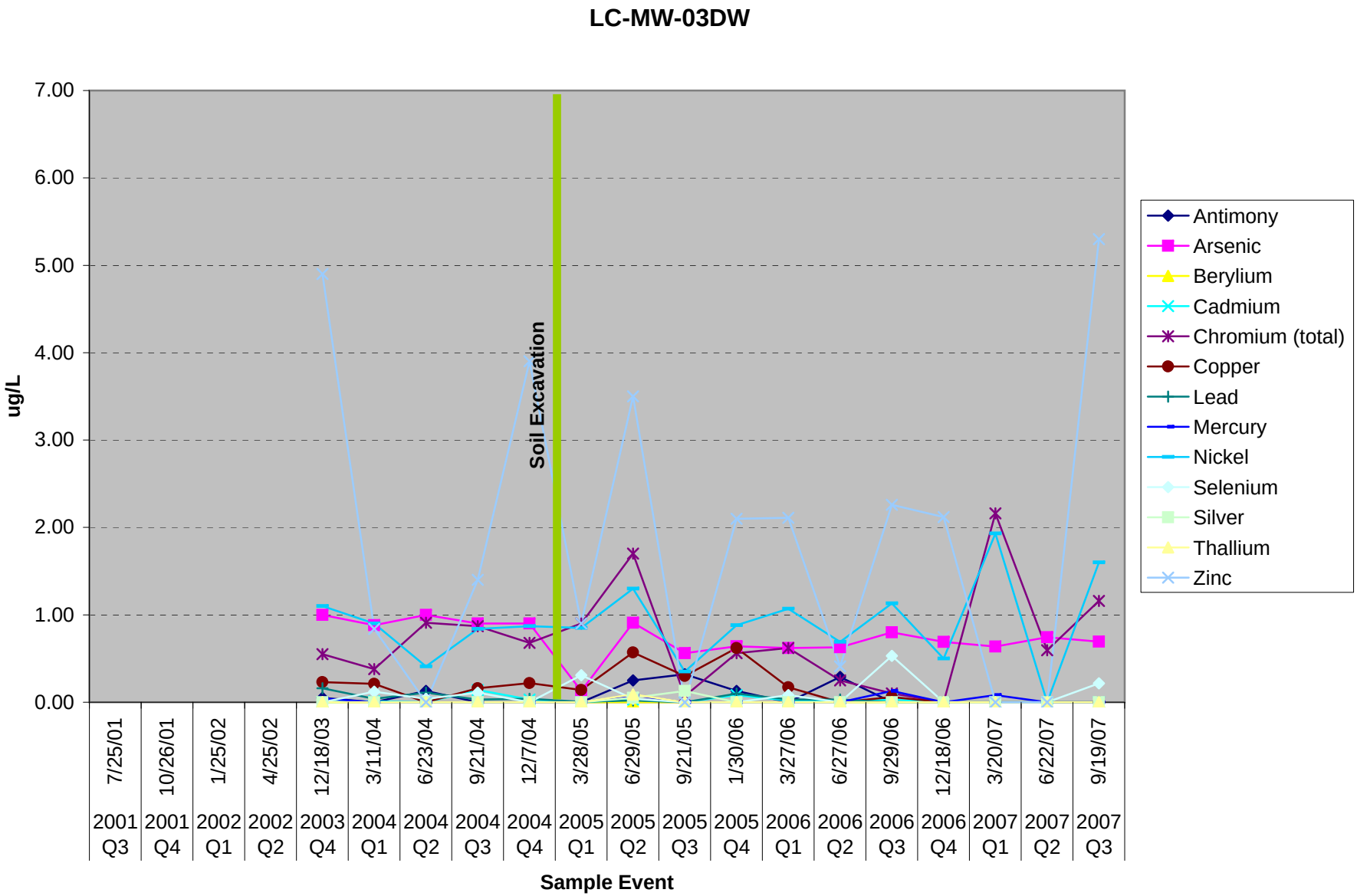
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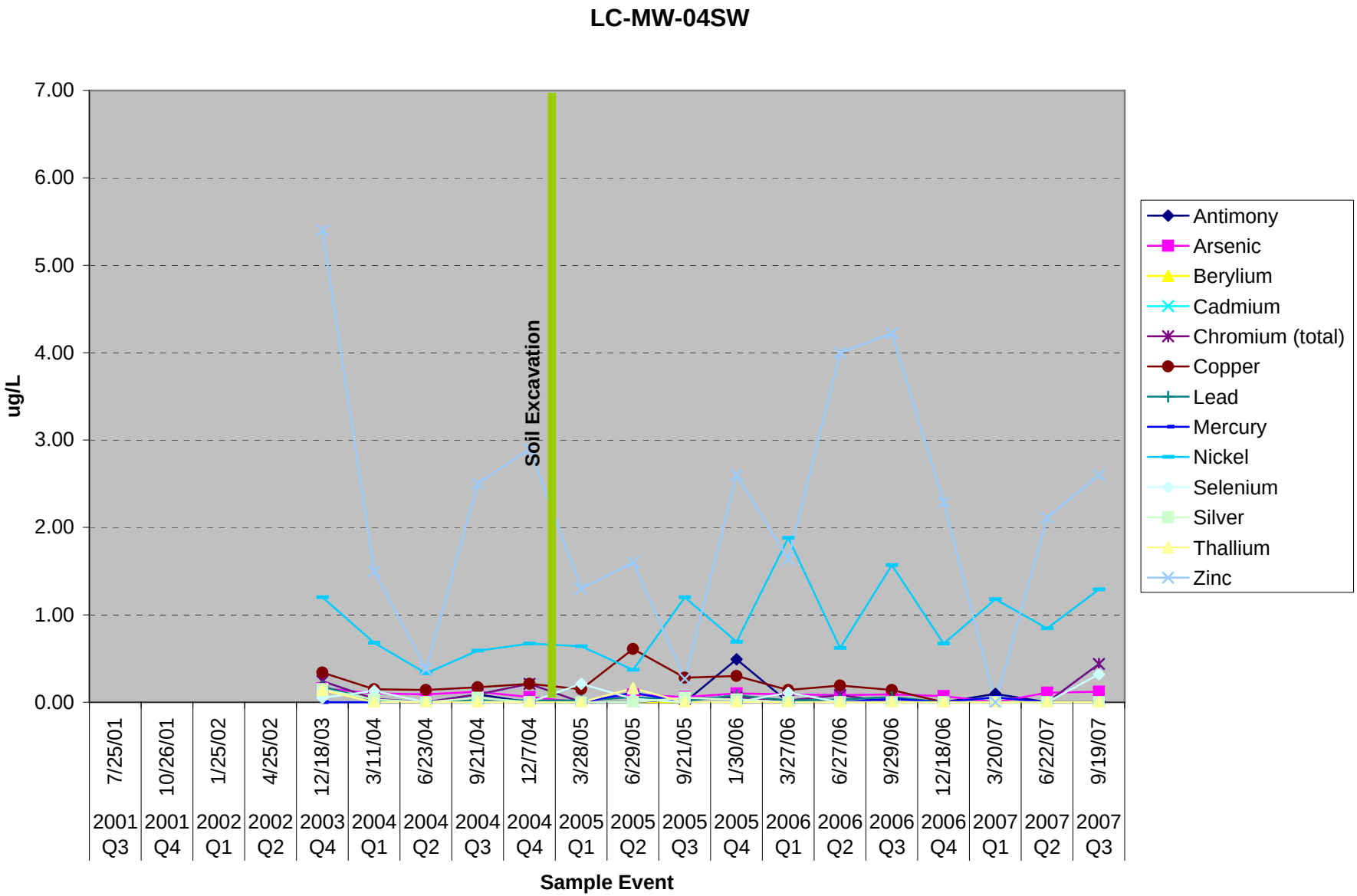
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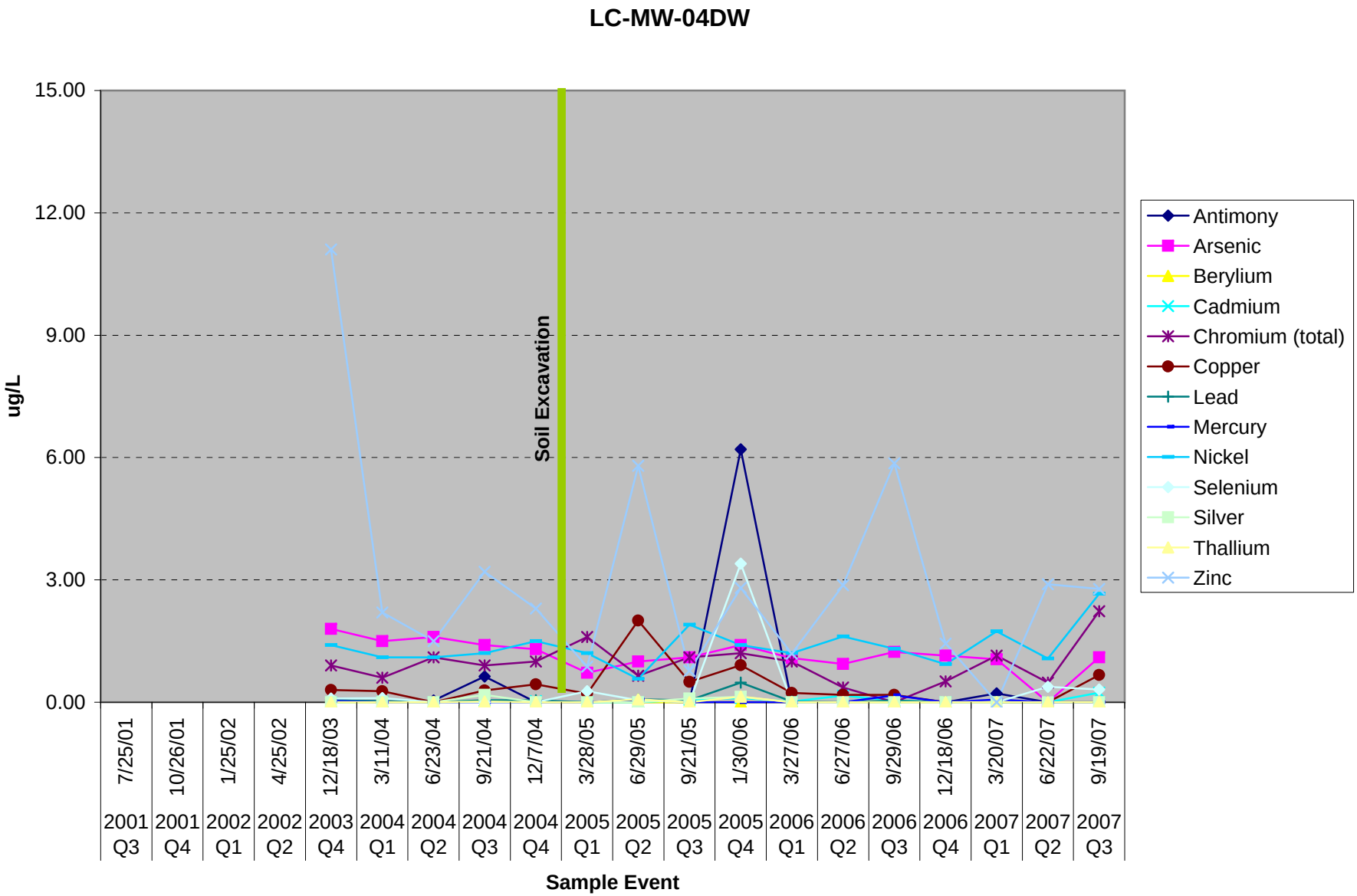
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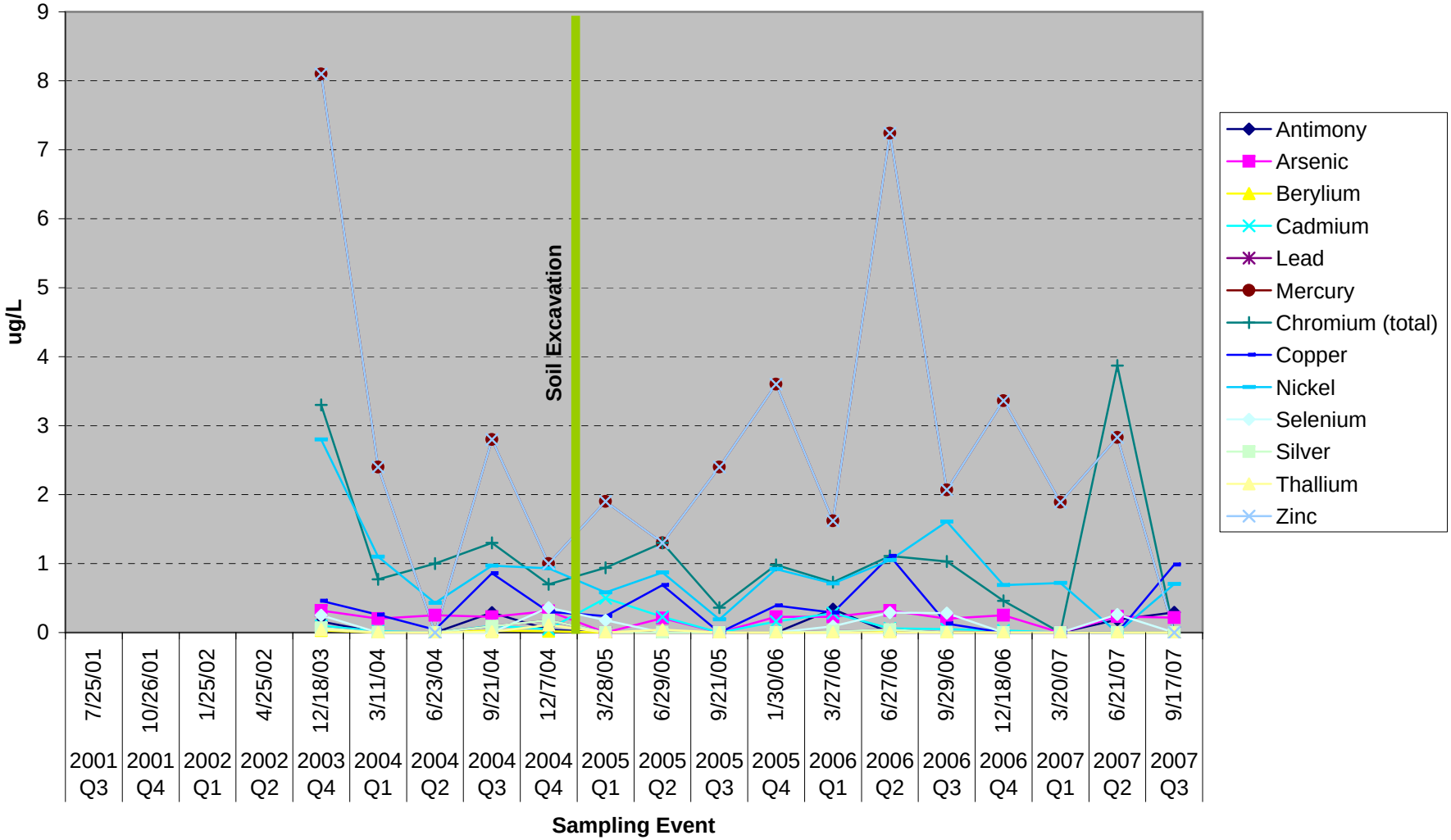
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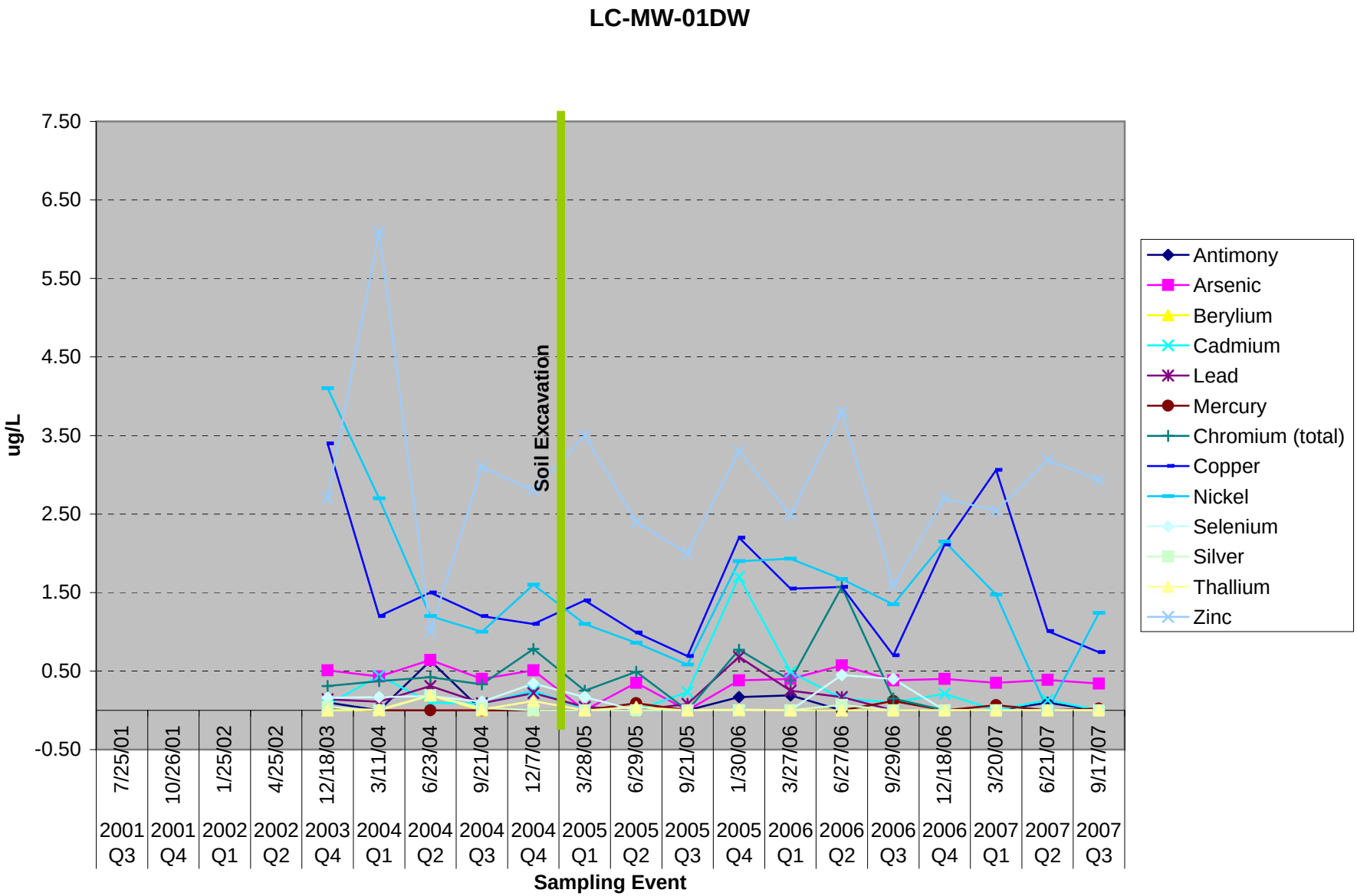
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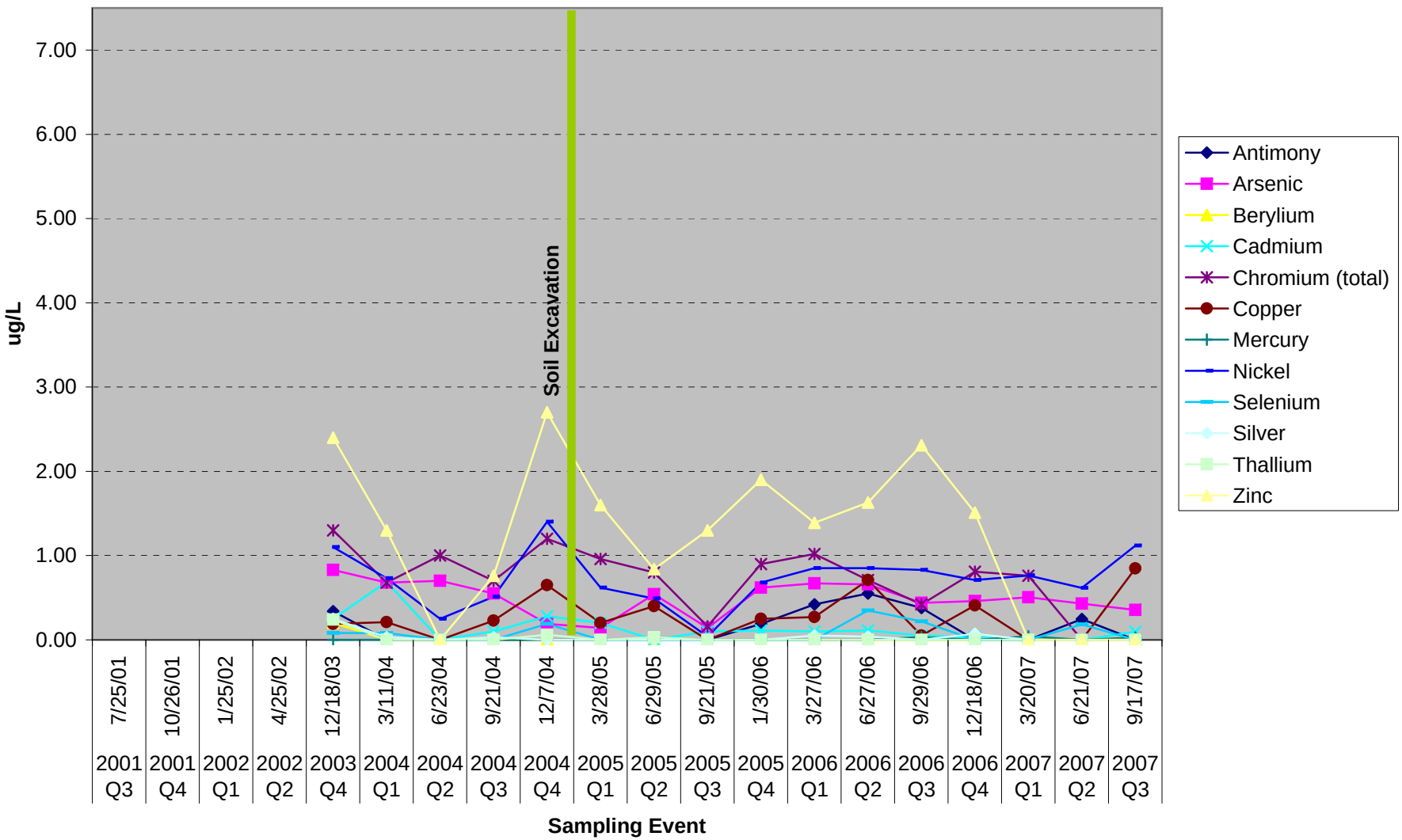
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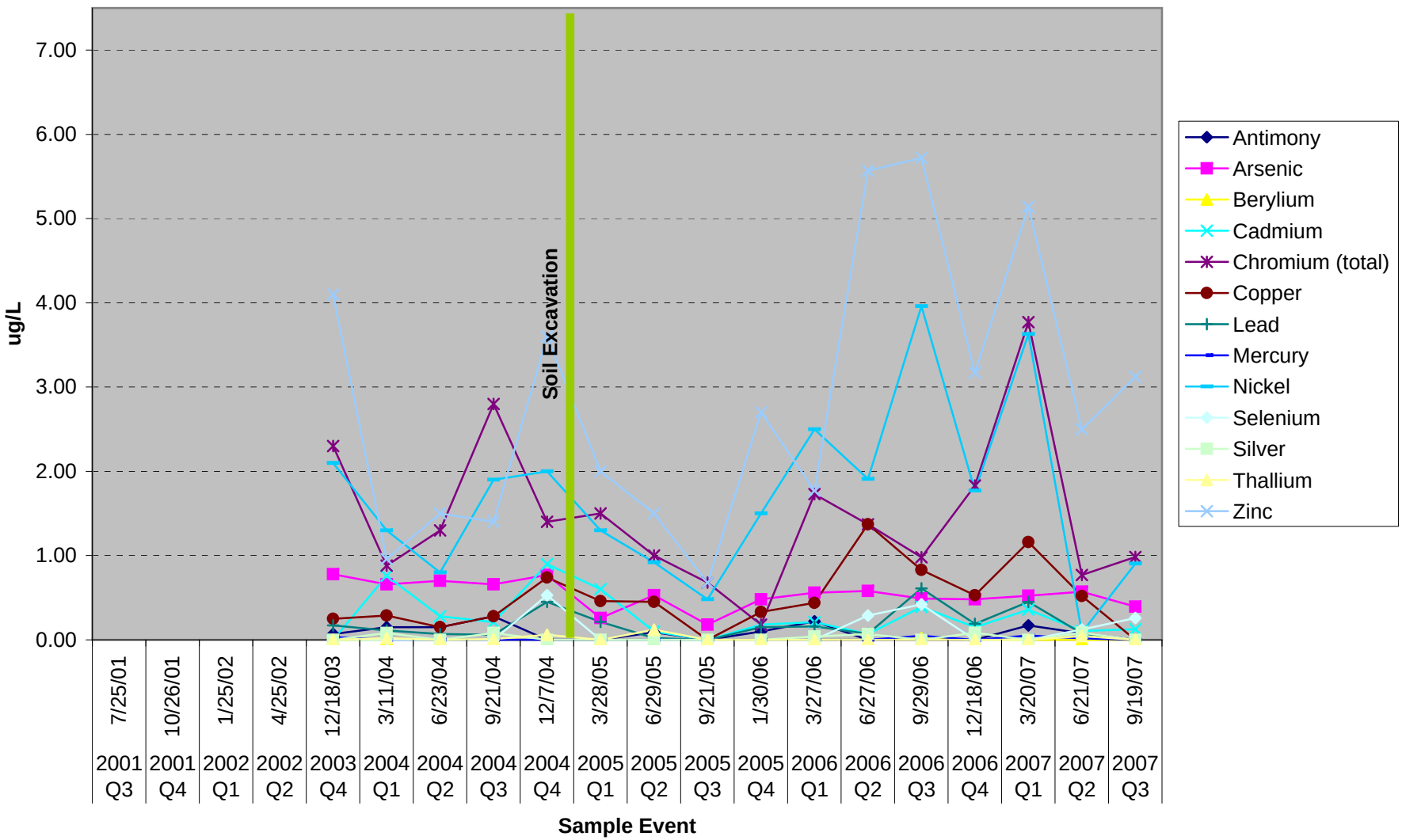
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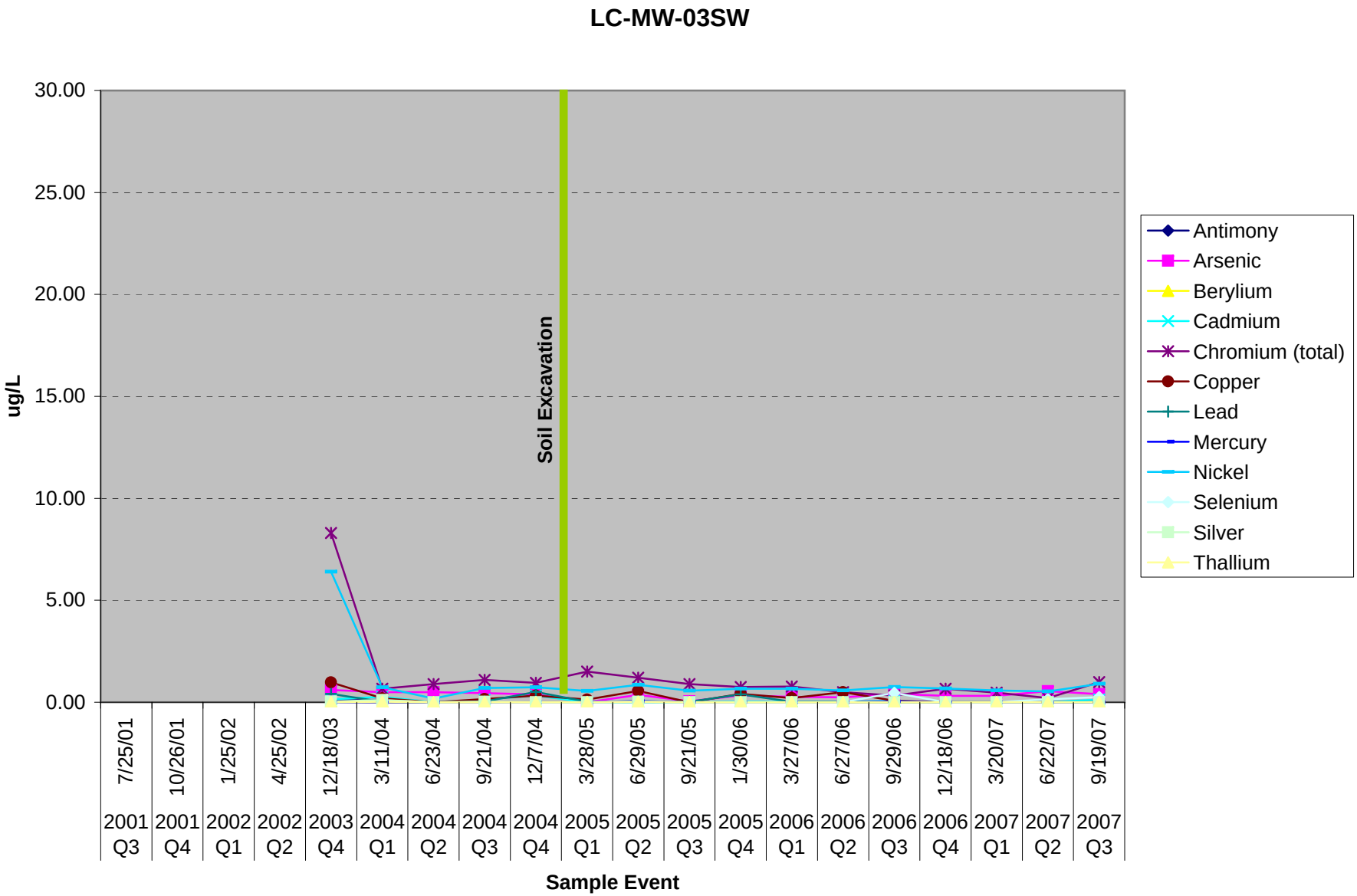
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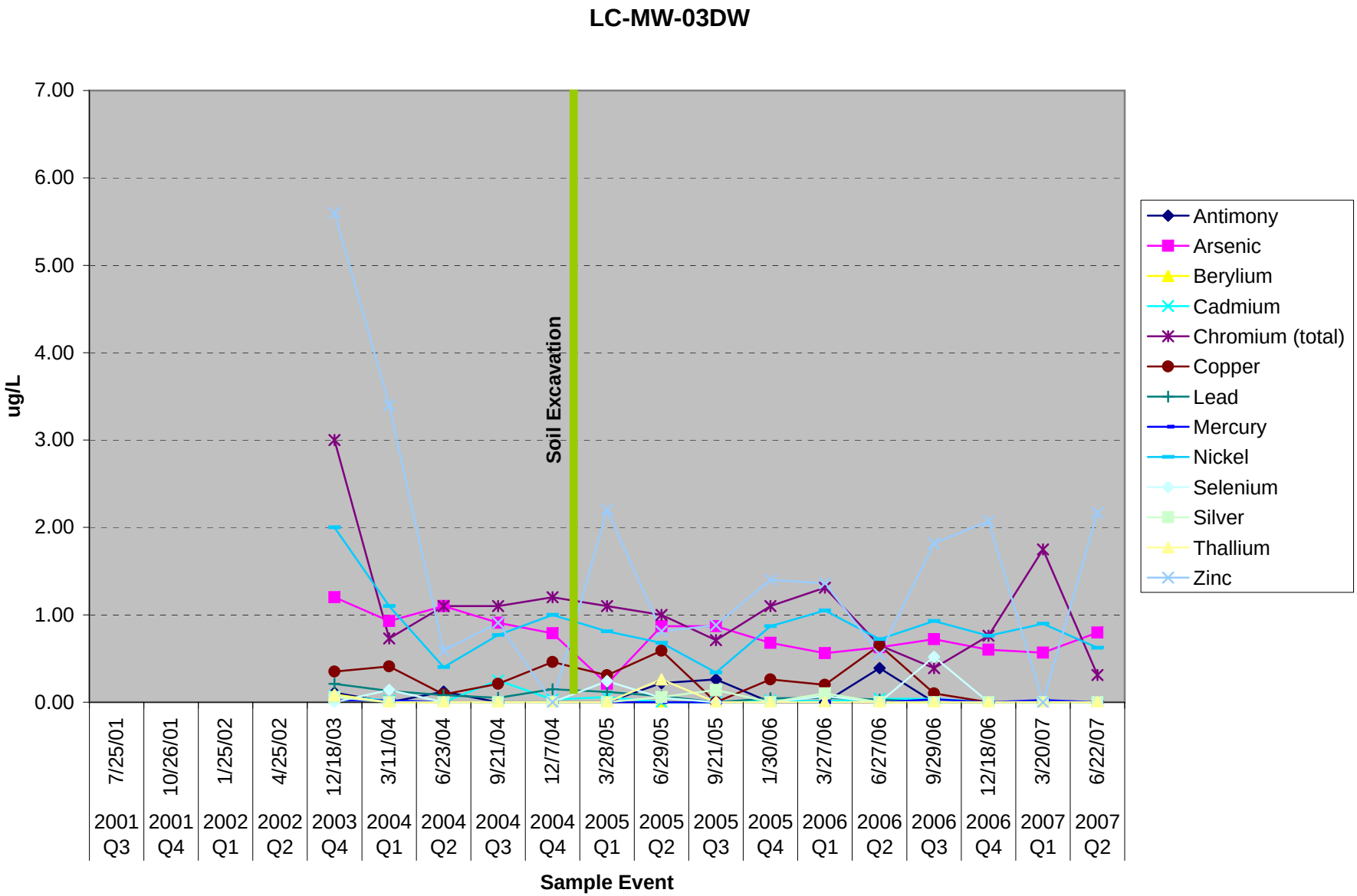
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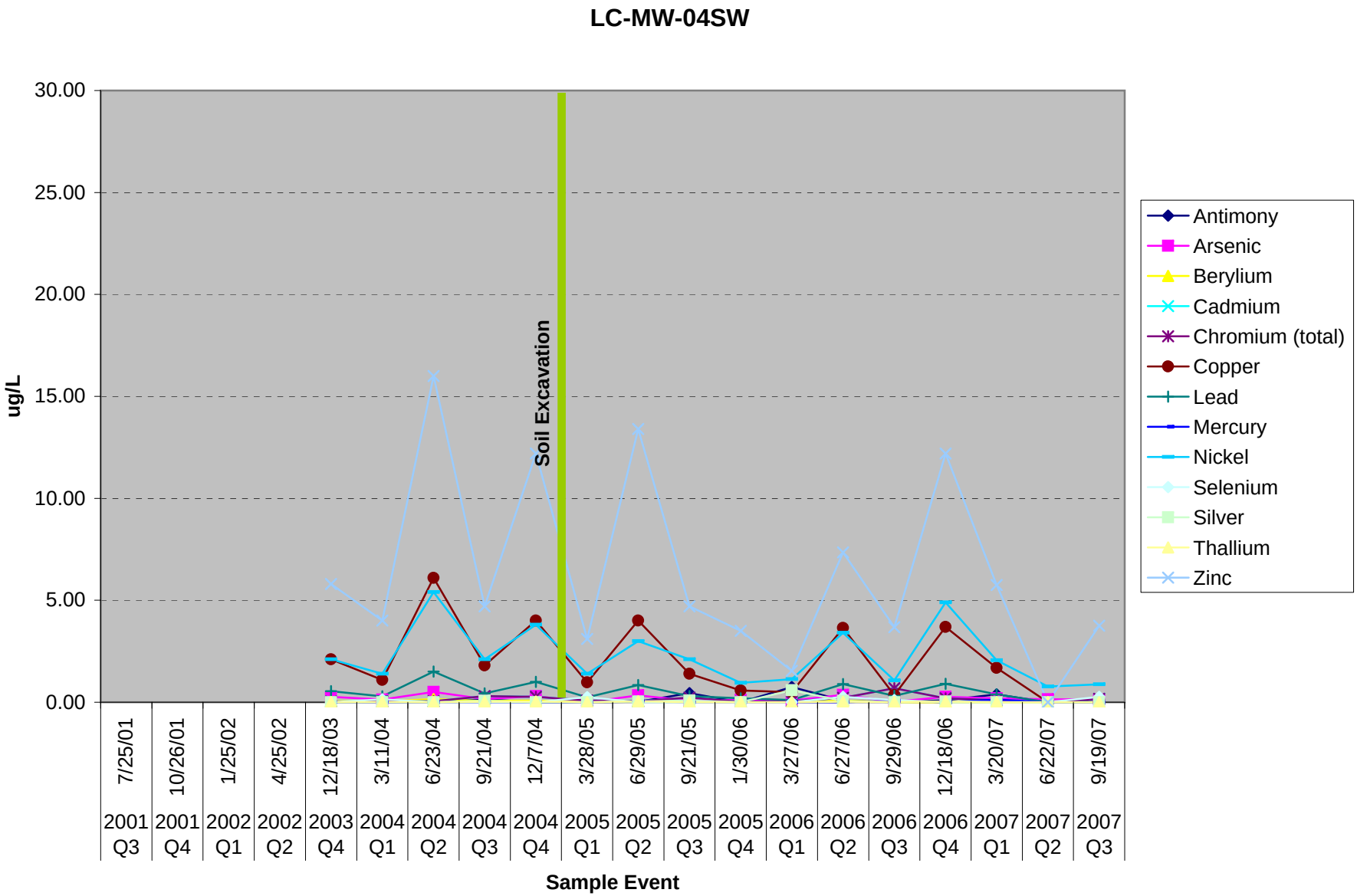
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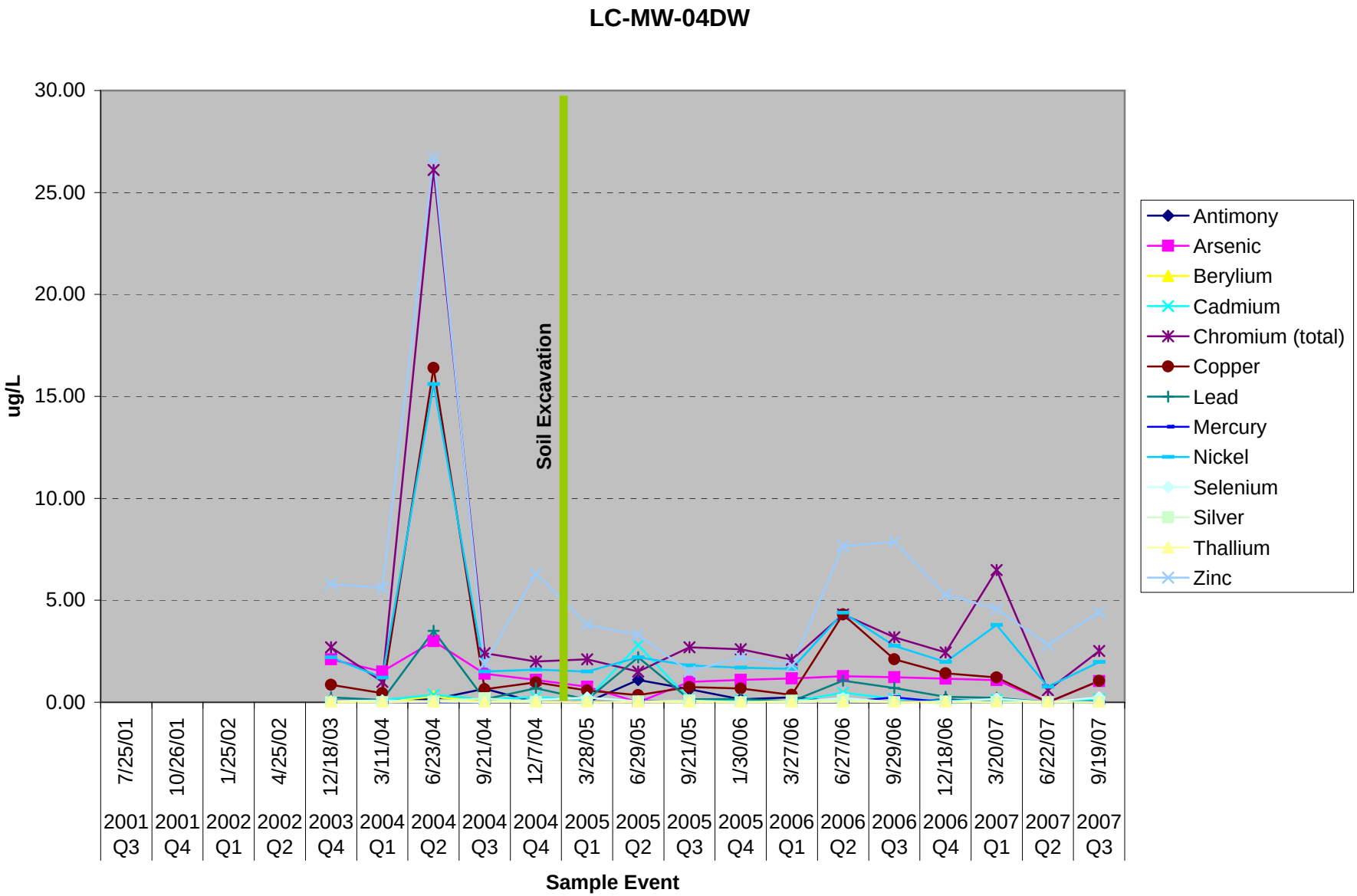
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ATTACHMENT 3
PBS GROUNDWATER REPORT

PBS | Engineering + Environmental

DRAFT
GROUNDWATER SAMPLING AND ANALYSIS REPORT

3rd QUARTER 2007

CAMP BONNEVILLE
VANCOUVER, WASHINGTON

Prepared for:

Washington State Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

DRAFT – November 20, 2007

PBS Project No.: 70489

4412 SW Corbett Avenue, Portland, OR 97239
503.248.1939 Main
503.248.0223 Fax
888.248.1939 Toll-Free
www.pbsenv.com

DRAFT
GROUNDWATER SAMPLING AND ANALYSIS REPORT

3rd QUARTER 2007

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VANCOUVER, WASHINGTON

Prepared for:

Washington State Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

DRAFT– November 20, 2007

Prepared by:

PBS Engineering + Environmental
Portland, Oregon

APPROVALS & CONCURRENCES:

Andrew Harvey PBS Project Manager	Signature	Date
Dulcy Berri PBS QA/QC Officer	Signature	Date
Kara Godineaux, Laucks Laboratory Analytical Chemistry Task Manager	Signature	Date
Jim Peyton Michael Baker Jr. Project Manager	Signature	Date
	Signature	Date

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LIST OF ACRONYMS AND ABBREVIATIONS

Army	U.S. Army
bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
COC	Chain-of-Custody
COPC	Chemical of Potential Concern
CWM	Clear Wide Mouth
DI	Deionized Water
DNR	State of Washington Department of Natural Resources
DOC	Dissolved Organic Carbon
DQO	Data Quality Objectives
EDF	Electronic Data Format
EO	Exploded Ordnance
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
FBI	Federal Bureau of Investigation
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HE	High Explosive
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IC	Ion chromatography
ICP	Inductively coupled plasma
IDW	Investigative Derived Waste
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
LQMP	Laboratory Quality Management Plan
µg/L	micrograms per liter (approximately equal ppb)
mg/L	milligrams per liter (approximately equal ppm)
MDL	Method Detection Limit
MRL	Method Reporting Limit
MS/MSD	Matrix Spike / Matrix Spike Duplicate
MTCA	Washington Model Toxics Control Act (Chapter 173-340 WAC)
NG	nitroglycerine
OE	ordnance and explosives
PA	picric acid
PCBs	polychlorinated biphenyls
PETN	pentaerythitol tetranitrate
ppb	parts per billion
ppm	parts per million
PQL	practical quantitation limit for laboratory test instrument
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAU	Remedial Action Unit
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine (Cyclonite)
RI	Remedial Investigation
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan

SDS	Sample Data Sheets
SI	Site Investigation
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TBD	To Be Determined
TIC	Tentatively Identified Compound
TNT	2,4,6-trinitrotoluene
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSD	Treatment, Storage, and Disposal
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
US	United States
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WDOE	State of Washington Department of Ecology

1.0 INTRODUCTION

This report documents the results of groundwater sampling and analysis at two locations of monitoring well installations at Camp Bonneville. The sampling and analysis was conducted for the 3rd Quarter of 2007. This work was performed by PBS Engineering + Environmental (PBS), Portland, Oregon, under contract to Michael Baker, Jr., Inc. (Baker). The work was performed at the Camp Bonneville Military Reservation (Camp Bonneville) northeast of Vancouver, Washington (Figure 1). Camp Bonneville is a former United States government military facility that was selected for closure under the Base Realignment and Closure (BRAC) authorization.

As part of the early transfer process for Camp Bonneville Military Reservation (CBMR), the U.S. Department of the Army (Army) and Clark County, Washington (Clark County, "County"), along with the Bonneville Conservation, Restoration, and Renewal Trust, LLC (BCRRT), negotiated an Environmental Services Cooperative Agreement (ESCA). The groundwater monitoring program is a component of the remedial action services performed in support of the Conservation, Restoration and Renewal Program (CRRP) associated with the facility. The CRRP includes those activities necessary to obtain Notice(s) of Completion, Site Closeout(s), and CERCLA Warranty(ies) for reconveyance of the CBMR from the BCRRT to Clark County. These additional remedial actions address requirements contained in agreements between the BCRRT and the Washington State Department of Ecology (WDOE).

The groundwater monitoring work was performed in general accordance with the Sampling and Analysis Plan (SAP) revised on September 5, 2007, the Health and Safety Plan (HASP) revised on August 24, 2007, and the Quality Assurance Project Plan (QAPP) dated November 3, 2006. Laboratory analytical services were provided by Laucks Testing Laboratories, Seattle, Washington, under contract to PBS.

1.1 Project Objectives

The overall objectives of site investigations at Camp Bonneville, which have been previously conducted as part of the U.S. Army BRAC process, have been to identify contaminated areas and determine the next appropriate steps toward restoration of those sites. This quarterly monitoring report describes the results of ongoing environmental monitoring of groundwater parameters at two areas at Camp Bonneville. Monitoring wells have been installed in these areas to monitor shallow and deeper groundwater to maximum depths of approximately 75 feet below the ground surface.

The sites that were monitored include one old landfill/demolition area (Landfill 4/Demo Area 1) and the Camp Bonneville base boundary at Lacamas Creek. Two other demolition areas (Demolition Areas 2 and 3) were previously monitored, but were deleted from the monitoring program per agreement with WDOE in 2006. Investigation activities included groundwater sampling at the old landfill and demolition area and the area where Lacamas Creek exits the southwest side of the base. These investigations were conducted in general accordance with the SAP, with adjustments made in the field to accommodate site conditions. The analytical results obtained from groundwater samples collected at the various monitoring wells locations were compared with screening levels established for the site to determine if the groundwater potentially poses an unacceptable environmental risk. Cleanup levels established by WDOE under the Model Toxics Control Act (MTCA) have been used as screening criteria to evaluate the levels of contaminants detected at Camp Bonneville.

1.2 Scope of Work

PBS conducted a round of groundwater sampling at 19 existing monitoring wells for the 3rd Quarter 2007 sampling event (September 2007). Sampling for this quarter was performed from September 17 to 24, 2007. The wells were purged and sampled utilizing low-flow, minimal drawdown procedures described in this report and based on procedures described in detail in the SAP which referenced the USACE standard operating procedure, "Low-Flow Groundwater Purging and Sampling."

Previous sampling events through the 2nd Quarter of 2006 sampled a total of 27 wells in the areas listed below, with their associated Remedial Action Unit (RAU) designations. The Lacamas Creek area contains four sets of paired shallow and deep wells (eight total wells) in a north-south alignment along the base boundary (Figure 3). Demolition Area 3 contains four shallow wells and one deep well located around the perimeter of a pond within a former blast pit. Demolition Area 2 has three wells located near the access road, a creek and a pond. Landfill 4/Demo Area 1 has five shallow and three deep wells around the perimeter of the landfill, one deep well along North Fork Lacamas Creek downstream of the landfill, and two wells along the creek at the base of the drainage ravine (Figure 4).

- Landfill 4 / Open Burning/Demolition Area 1 (RAU 2C)
- Open Burning / Open Demolition Area 2 (RAU 2B)
- Open Burning / Open Demolition Area 3 (RAB 2B)
- Base Boundary at Lacamas Creek (Site-wide Groundwater)

Starting in the 3rd Quarter 2006 sampling event (September 2006), the monitoring wells at Demolition Area 2 and Demolition Area 3 were deleted from the sampling program. The WDOE authorized deletion of these monitoring wells on the basis of the previous quarters of sampling results showing no detections exceeding the MTCA cleanup levels for the contaminants of concern. The monitoring wells at Landfill 4/Demo Area 1 and the Base Boundary at Lacamas Creek, a total of 19 wells, were sampled in the 4th Quarter 2006.

1.3 Report Organization

This report is organized into eight sections, with four appendices containing supporting information. A brief description of each section follows.

- **Section 1 – Introduction.** An introduction to the project, a description of the work scope and a review of the report organization is provided.
- **Section 2 – Site Background.** A description of the facility and a summary of its history are provided. The groundwater investigation reports are referenced. The groundwater sampling locations discussed in this report are presented, along with the chemicals of potential concern in groundwater.
- **Section 3 – Groundwater Sampling.** Descriptions of the field investigation, sampling techniques, and sample handling methods are provided.
- **Section 4 – Analytical Methods.** The field and laboratory analytical testing methods are presented.
- **Section 5 – Data Management and Review.** The data quality control procedures and Washington MTCA cleanup program information are presented.
- **Section 6 – Groundwater Monitoring Results.** A description of sample collection activities performed at each site, along with a summary of the results from these

activities, is provided. Contaminants detected at each site are identified and compared with screening levels.

- **Section 7 - Recent Trends in Groundwater Quality.** Presents an analysis of the change in certain analytical results.
- **Section 8 – Data Quality Objectives.** Chemical data quality and laboratory narratives of test procedures are discussed.
- **Section 9 – References.** A list of documents used in preparation of this report is provided.
- **Appendix A – Field Parameters and Laboratory Analysis Data Tables.** Summary tables of field and laboratory analysis data, including MTCA Cleanup Levels.
- **Appendix B – Laucks Testing Laboratories, Analytical Reports.** Copies of the laboratory reports are provided on CD disk, organized by laboratory data package.
- **Appendix C – Monitoring Well Boring Logs.** Copies of the boring logs for the groundwater monitoring wells are included.
- **Appendix D – Previous Quarterly Groundwater Monitoring Report Tables.** Previous groundwater monitoring report tables by PBS are included on the enclosed CD disk.

2.0 SITE BACKGROUND

2.1 Site History

Camp Bonneville comprises approximately 3,820 acres and is located in southwestern Washington, approximately 10 miles northeast of Vancouver, Washington. The Department of the Army used Camp Bonneville for live fire of small arms, assault weapons, artillery, and field and air defense artillery between 1910 and 1995. Since 1947, Camp Bonneville has also provided training for a variety of military and nonmilitary units, including National Guard, Army Reserves, and U.S. Air Force and federal, state, and local law enforcement agencies. Camp Bonneville includes approximately 820 acres of land leased from the State of Washington Department of Natural Resources (DNR). The Federal Bureau of Investigation (FBI) used one firing range on the site for training until late 2006. The Camp Bonneville site location is shown in Figure 1. The general areas of groundwater investigation are shown in Figure 2.

In July of 1995, Camp Bonneville was selected for closure under the 1995 Base Realignment and Closure (BRAC) process. The Camp Bonneville Draft Reuse Plan (Otak, September 1998; updated 2003) called for the majority of Camp Bonneville to be transferred to Clark County for the public benefit – education, law enforcement, and parks, with no financial gain to Clark County. The 840 acres currently leased from the Washington DNR would either be returned to the State, the lease renewed, or the property purchased and transferred to Clark County. Transfer of the site to The Trust for Public Lands and subsequently to Clark County, began in 2006. The facility was transferred from the Army to Clark County and from the County to the Bonneville Conservation Restoration and Renewal Team (BCRRT) on October 3, 2006. BCRRT and Clark County entered into a Prospective Purchaser Consent Decree with the Washington Department of Ecology (WDOE) that requires investigating and remediating the site. Clark County intends to use the site as a Regional Park and Wildlife Refuge.

Through the years, several ordnance and explosive (OE) items have been found within Camp Bonneville's boundaries. Recent OE characterization, sampling and removal efforts performed at Camp Bonneville confirmed the presence of OE at the site. Some of these OE items were determined to be unexploded ordnance (UXO).

2.2 Previous Investigations

During previous investigations (Shannon & Wilson, 1999), shallow monitoring wells were installed at Camp Bonneville at four sites: Landfill 2, Landfill 3, the Pesticide Mixing/Storage Building, and the Former Sewage Pond. Additional shallow and deep wells were installed at Landfill 4, Demolition Area 2, Demolition Area 3, and the Base Boundary at Lacamas Creek. The groundwater monitoring wells are located in areas of documented disposal of unexploded ordnance (UXO). However, the areas of the wells were cleared of UXO prior to well installation. Groundwater sampling activities were conducted only in the immediate area of the wells and did not occur in areas that have not been previously checked and cleared of UXO.

Groundwater sampling and analysis was previously conducted by consultants other than PBS on a quarterly schedule basis in 2001 and 2002 at the following sites within Camp Bonneville:

- Landfill 4/Open Burning / Demolition Area 1
- Open Burning/Open Demolition Area 2
- Open Burning/Open Demolition Area 3
- Base Boundary at Lacamas Creek

Quarterly sampling from shallow and deep monitoring wells at Landfill 4 was conducted in July and October 2001 and January and April 2002. Previous chemical analysis of groundwater samples has included explosives, perchlorate, metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and fuel residues (gasoline and diesel range petroleum hydrocarbons).

Groundwater sampling was conducted by PBS, under contract to the U.S. Army BRAC Division, for the 4th Quarter 2003, 1st Quarter 2004, 2nd Quarter 2004, 3rd Quarter 2004, 4th Quarter 2004, 1st Quarter 2005, 2nd Quarter 2005, 3rd Quarter 2005, 4th Quarter 2005, 1st Quarter 2006, 2nd Quarter 2006, and 3rd Quarter 2006. A total of 25 monitoring wells were sampled during the 4th Quarter 2003 and 1st Quarter 2004 events at Landfill 4/Demolition Area 1, Demolition Area 2, Demolition Area 3, and the Base Boundary at Lacamas Creek. Two additional monitoring wells near Landfill 4/Demolition Area 1 were installed in May 2004, and added to the sampling set for subsequent quarterly monitoring events (starting in the 2nd Quarter 2004). Laboratory analyses included TPH-Gx (gasoline), TPH-Dx (diesel), VOCs, SVOCs, explosive compounds (including HMX, RDX, NG, and PETN), picric acid, perchlorate, priority pollutant metals (total and dissolved), TOC, DOC, TSS, alkalinity and inorganic ions.

In May 2004, PBS supervised installation of two additional groundwater monitoring wells along North Fork Lacamas Creek below Landfill 4 (PBS, 2004b). The monitoring well completed in bedrock (well number L4-MW17) was located at the west side of North Fork Lacamas Creek, at a point where the creek exits the ravine below Landfill 4. The monitoring well completed in alluvium (well number L4-MW18) was located at the east side of North Fork Lacamas Creek near the bottom of the ravine and above the junction of an east-trending tributary stream to Lacamas Creek.

PBS' final Groundwater Sampling and Analysis Reports, completed under the Army BRAC contract and listed in the References section of this report, present the results of

each of the quarterly sampling events from the 4th Quarter 2003 through the 3rd Quarter 2006 sampling and analysis events. The last sampling event performed under the Army BRAC contract was for the 3rd Quarter 2006. PBS began groundwater sampling and analysis under contract to Michael Baker Jr., Inc. starting with the 4th Quarter 2006. The results of the 4th Quarter 2006 sampling and analyses were presented in PBS' draft report, *Groundwater Sampling and Analysis Report, 4th Quarter 2006, Camp Bonneville, Vancouver, Washington*, dated March 28, 2007 (PBS, 2007b). The results of the 1st Quarter 2007 sampling and analyses were presented in PBS' draft report, *Groundwater Sampling and Analysis Report, 1st Quarter 2007, Camp Bonneville, Vancouver, Washington*, dated June 1, 2007 (PBS, 2007c). The results of the 2nd Quarter 2007 sampling and analyses were presented in PBS' draft report, *Groundwater Sampling and Analysis Report, 2nd Quarter 2007, Camp Bonneville, Vancouver, Washington*, dated August 16, 2007 (PBS, 2007d).

2.3 Monitoring Well Numbering

Different numbers have been assigned over time to monitoring wells at the Base Boundary at Lacamas Creek, Demolition Area 2 and Demolition Area 3. Well numbers used by PBS in monitoring reports for the 4th Quarter 2003, the 1st Quarter 2004, and the 2nd Quarter 2004 were based on proposed well locations and well identifiers, as presented in the PBS-Army BRAC Contract documents. The actual well numbers were assigned by the U.S. Army Center for Health Promotion and Preventative Medicine (CHPPM) when the wells were installed. The CHPPM well identifiers are the numbers on the well caps. Remedial Investigation (RI) reports previous to PBS' reports have used the well numbers assigned by CHPPM. Washington State Department of Ecology well tag numbers are consistent across both numbering systems.

Table 8 (Appendix A) shows the monitoring well numbers used by PBS (per the PBS-Army BRAC Contract document), Washington State Department of Ecology well tag numbers, well locations, total depth, screened interval and CHPPM well identification numbers used in former RI reports for Camp Bonneville.

The laboratory analysis results (Tables 4, 5, and 6 in Appendix A) included in this monitoring report for the 3rd Quarter 2007 are referenced to the monitoring well numbers assigned by CHPPM. The well numbers used in the PBS quarterly reports are cross-referenced to the CHPPM numbers and the WDOE well tag numbers in Table 8 (Appendix A).

2.4 Groundwater Monitoring Locations

For the 3rd Quarter 2007, PBS conducted groundwater sampling and analysis for monitoring wells at the Landfill 4 area and the Base Boundary at Lacamas Creek. The locations of monitoring wells at these sites are shown on Figure 3 (Base Boundary at Lacamas Creek) and Figure 4 (Landfill 4/Demo Area 1). The monitoring wells at the sites are listed below (S = shallow well; D = deep well) according to the CHPPM numbers :

- Base Boundary at Lacamas Creek
  - Paired wells: LC-MW01S and LC-MW01D
  - Paired wells: LC-MW02S and LC-MW02D
  - Paired wells: LC-MW03S and LC-MW03D
  - Paired wells: LC-MW04S and LC-MW04D

- Landfill 4/Demo Area 1

- Paired wells: L4-MW01A (shallow) and L4-MW01B (deep)
- Paired wells: L4-MW02A (shallow) and L4-MW02B (deep)
- Paired wells: L4-MW03A (shallow) and L4-MW03B (deep)
- L4-MW04A (shallow)
- L4-MW05A (shallow)
- L4-MW07B (deep)
- L4-MW17 (in bedrock)
- L4-MW18 (in alluvium)

2.5 Chemicals of Potential Concern

Previous site studies have determined that the up-gradient areas of Camp Bonneville may contain exploded ordnance (EO) and unexploded ordnance (UXO). The historical uses of the up-gradient areas include firing ranges, a landfill, open burning locations, open detonation locations and general maintenance facilities. Chemicals of potential concern in groundwater include artillery propellants, high explosives residue, missile/rocket propellants, petroleum hydrocarbons, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs) and metals.

A summary of chemicals of potential concern (COPC) is presented in Table 1. Specific analytes and laboratory analysis methods are presented in Table 2. Sample container types, preservation techniques and holding times for the chemical analyses are presented in Table 3.

TABLE 1. CHEMICALS OF POTENTIAL CONCERN

Sampling Areas	***Munition Compound Classes***	***High Explosives and Organic Compounds***	***Artillery Propellants***	***Other***
Landfill 4 Demolition Areas Base Boundary	• Artillery Propellants • HE • Missile/ Rocket Propellants	• TNT • RDX • PETN • PA • HMX • NG	• Black Powder (nitrate) • Plasticizers • Stabilizers • AP	• Priority Pollutant Metals • TPH • SVOCs • VOCs

Notes:
AP = ammonium perchlorate
Black powder is a mixture of potassium or sodium nitrate, charcoal and sulfur.
Plasticizers = dibutylphthalate; diethylphthalate
Stabilizers = diphenylamine; N-nitrosodiphenylamine
HE = high explosives; 2,4 DNT, 2,6 DNT
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
NG = nitroglycerine
PA = picric acid
PETN = pentaerythritol tetranitrate
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine (Cyclonite)
TNT = 2,4,6-trinitrotoluene
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds

TABLE 2. ANALYTES AND ANALYTICAL METHODS

PARAMETER	***METHOD***
Total Priority Pollutant Metals	SW-846 6020/7000 series
Total Priority Pollutant Metals (field filtered)	SW-846 6020/7000 series
VOCs plus TICs	SW-846 8260B
SVOCs plus TICs	SW-846 8270C
TPH Gasoline Range (TPH-gasoline)	NWTPH-Gx
TPH Diesel Range (TPH-diesel)	NWTPH-Dx
Total Suspended Solids	EPA Method 160.2
Carbonate and Bicarbonate	SM 2320
Inorganic Ions (Sulfate, Nitrite + Nitrate, Chloride)	EPA Method 300.0
Total Organic Carbon	EPA Method 415.1
Dissolved Organic Carbon (field filtered)	EPA Method 415.1
ORDNANCE COMPOUNDS	
Explosive Residues (HMX, RDX)	8330 modified
PETN/Picric Acid/Nitroglycerine	8330 modified
Ammonium Perchlorate	EPA Method 314

Notes:
NWTPH = Northwest Total Petroleum Hydrocarbon
PETN = Pentaerythritol tetranitrate
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbon
TICs = Tentatively identified compounds

TABLE 3. SAMPLE ANALYTICAL METHODS, CONTAINERS, PRESERVATION, AND HOLDING TIMES

MEASUREMENT	***EPA METHOD***	***MINIMUM SAMPLE VOLUME***	***CONTAINER***	***PRESERVATIVE cool to 4°C, plus***	***HOLDING TIME***
Mercury (total & dissolved)	7470A cold vapor AA	100 mls	Included with 1 L. HDPE container	HNO_3 to pH <2 Filtered for dissolved	28 days
Metals (total and dissolved)	6020/7000	200 mls	1 L. HDPE	HNO_3 to pH <2 Filtered for dissolved	6 months
Total Suspended Solids	160.2	500 mls	20 ml HDPE	No additional	14 days
VOCs plus TICs	8260B	(2) 40 mls	40 ml VOA vial	HCl pH<2	14 days
SVOCs plus TICs	8270B	1,000 mls	1L. AG	No additional	7 days to extraction 40 days to analysis
TPH Gasoline Range	NWTPH-Gx	(2) 40 mls	40 ml VOA vial	HCl pH<2	14 days
TPH Diesel Range	NWTPH-Dx	1,000 mls	1 L. AG	HCl pH<2	14 days
Total Organic Carbon	415.1	25 mls	1 L. AG	H_3PO_4 pH<2	28 days
Dissolved Organic Carbon	415.1	25 mls	1 L. AG	H_3PO_4 pH<2 -Filtered	28 days
Carbonate & Bicarbonate	SM 2320	100 mls	20 ml HDPE	No additional	14 days
Inorganic Ions	300.0	50 mls	20 ml HDPE	No additional	28 days
Ammonium Perchlorate	314	500 mls	500 ml HPDE	No additional	14 days
Explosives	8330 Modified HPCL	500 mls	1 L. AG	No additional	7 days to extraction, 40 days after extraction

Notes:
HDPE = High Density Polyethylene Bottles with Teflon lined screw cap
AG = Amber glass bottle with Teflon lined screw cap
CWM = Clear Wide Mouth with Teflon lined screw cap
VOA vial = Vial with a screw cap with a hole in the center sealed with a TFE-faced silicone septum
ml = milliliters

3.0 GROUNDWATER SAMPLING

PBS conducted groundwater sampling for the 3rd Quarter 2007 event at 19 existing monitoring wells at two locations within Camp Bonneville. Monitoring wells were sampled during the period of September 17 to 24, 2007. The monitoring wells were sampled in accordance with the procedures established in the Draft Groundwater Sampling and Analysis Plan (SAP), dated October 31, 2006 and revised September 5, 2007. The SAP prepared by PBS and Michael Baker Jr., and submitted to WDOE. Health and safety procedures followed during site activities were in compliance with the procedures established in the Site Health and Safety Plan (HASP), dated October 30, 2006 and revised August 14, 2007. The HASP was prepared by Michael Baker Jr. and approved by WDOE.

3.1 Well Depth and Static Water Level Measurement

The total depth of the well casing was measured for each monitoring well prior to groundwater sampling. The static groundwater level was measured in each monitoring well using an electronic water level indicator. The water level in each monitoring well was measured immediately before collection of groundwater samples. Prior to sampling at each of the sampling areas, well caps for all monitoring wells were removed and refitted loosely so that the water level would equilibrate with atmospheric pressure by the time of purging and sampling. During groundwater sample collection, the water level in the well was monitored to determine drawdown conditions. Groundwater level measurements are presented in Table 7 (Appendix A).

Water level depths were measured to the reference mark on the rim of the PVC monitoring well casings. The measurement was recorded in the field logbook to a precision of 0.01 foot.

3.2 Low-Flow Purging

A low-flow, minimal drawdown technique was used for groundwater purging and sampling. This technique is described below and in the SAP. Low-flow sampling minimizes disturbance to the aquifer and is designed to ensure that samples collected from the wells are representative of groundwater. The low pumping rate induces laminar flow in the immediate vicinity of the sampling pump intake, thus drawing groundwater directly from the aquifer, horizontally through the well screen and into the sampling device.

Purging and sampling were performed with a Grundfos Redi-Flo 1.75-inch-diameter, stainless steel, electric submersible impeller pump, suspended in the well with a stainless steel safety cable. A polyethylene discharge hose dedicated to the specific monitoring well was attached to the pump and extended to the ground surface for sample collection. Each monitoring well was purged immediately before sample collection so that the sample represented fresh formation water rather than stagnant water that had accumulated in the well casing. Well purging equipment was positioned so that any potential volatile organic sources, such as vehicles, gasoline-driven generators and fuel tanks were downwind of the well. This reduced the potential for contamination caused by entrainment of volatile air contaminants in the sample.

The pump intake was positioned at a level adjacent to or slightly above the midpoint of the saturated screened interval. Care was taken to gently insert the pump to minimize disturbance of any sediment that may have accumulated in the monitoring well. Purging was accomplished by pumping groundwater from the monitoring well at a rate of approximately 0.2 to 0.5 liters per minute. Groundwater was purged into a 5-gallon

container and a YSI Model 556 water quality meter installed in a flow-through cell was used to measure specific conductance, temperature, pH, oxidation-reduction potential and dissolved oxygen during purging. Purged water was stored in a 5-gallon container with sealable lid at each monitoring well site. Purged water was later transferred to 55-gallon drums with sealable lids located at an on-site central drum storage area.

Water quality measurements made during purging were recorded in a field notebook at intervals ranging from 1 to 5 minutes. Purging was stopped, and groundwater samples collected, when readings stabilized over at least three consecutive measurements and a minimum of three gallons were pumped from the well. Stabilization was considered reached when three consecutive readings were within ±0.2 for pH, ±1° C for temperature, and ± 10 percent for specific conductance.

3.3 Sample Collection

Groundwater samples were collected after water quality parameters stabilized during purging. Samples that did not require filtering were collected into the sample container directly from the end of the dedicated discharge hose. Groundwater samples requiring preservatives were collected in sample bottles supplied by the contract laboratory and contained the appropriate amounts of preservative solution. Sample container types, preservation techniques and holding times for the chemical analyses are presented in Table 3.

Samples collected for dissolved metals analysis were field-filtered. An in-line, nitrocellulose, 0.45-micron cartridge filter was attached to the sample discharge line. Groundwater was rinsed through the filter for approximately 1 minute prior to filling the sample bottle. The sample bottle was then filled directly from the discharge outlet on the filter. Sample containers for VOCs and TPH were filled completely to the top of the container and the container cap screwed on to prevent any air remaining in the headspace of the container. Sample bottles containing preservatives were checked with pH test strips after filling the bottles to ensure that the sample contained the proper pH for preservation.

3.4 Decontamination Procedures

The objective of decontamination is to prevent cross-contamination of samples and wells by sampling equipment. Sampling equipment includes all devices that are used to collect or contain a sample prior to placement into a laboratory-provided sample container. Before initial use, sampling equipment that may contribute to the contamination of a sample must be thoroughly decontaminated, unless specific documentation exists to show that the sampling equipment has already been decontaminated. Pre-cleaned equipment and sample jars in factory-sealed containers do not require decontamination.

3.4.1 Sampling Equipment

Non-dedicated sampling equipment (water level meter) was decontaminated between sample locations by rinsing with organic-free deionized water. Decontaminated equipment was placed in clean pails to prevent recontamination. Decontamination wash water was placed in 55-gallon drums for later disposal in accordance with the SAP.

Water quality parameter meter sensors were thoroughly rinsed with deionized water. These sensors do not typically contact sample water or enter wells;

therefore, decontamination is primarily for protecting the meter and for obtaining accurate measurements.

3.4.2 Pump and Discharge Hose

The sampling submersible pump was decontaminated as follows: 1) The pump and discharge hose/power cable assembly was placed into a 4-inch PVC tube that is 3 feet long and capped at the bottom. The tube was filled with a solution of potable water and liquinox (phosphate-free detergent). The pump was then activated for a sufficient time to allow approximately 2 gallons of soapy water to pass through the entire discharge hose. 2) The pump intake was then placed into a second PVC tube. Approximately two gallons of deionized water was added to the PVC tube and pumped through the discharge hose. 3) The pump was stopped and removed from the PVC tube, and the water in the tube discarded into the 55-gallon drums. The pump body was then placed into a plastic bag and inserted into the holder on the pump reel until used at the next well.

A separate piece of new pump discharge polyethylene tubing was dedicated to each well. After use and decontamination procedures, the dedicated piece of tubing was stored in a clean, labeled plastic bag. The tubing was preserved in this manner throughout all of the groundwater monitoring rounds.

Prior to sampling groundwater during the 3rd Quarter 2007 event, the sampling pump was cleaned and thoroughly rinsed with deionized water. The internal lubrication water in the Grundfos pump was also drained and replaced prior to obtaining samples.

3.5 Investigation-Derived Waste

Investigation-derived waste (IDW) generated during well purging and sampling includes groundwater and decontamination rinse water which has the potential to be contaminated with low levels of COPC. The purge water and decontamination rinse water IDW was examined for odors and visual evidence of contamination and placed in 55-gallon drums on site pending laboratory results of groundwater samples. Solid IDW (filters, plastic, and paper) was disposed in trash bins on site.

3.6 Sample Numbering, Handling, and Documentation

Each sample collected was assigned a unique sample identification number, referenced to the monitoring well location. As an example, 16LC-MW01SW represents a sample taken during the sixteenth quarterly sampling event (16) performed by PBS (samples collected in September 2007) from monitoring well LC-MW01S at Lacamas Creek, which was a groundwater sample (W). The QC field duplicate sample and field/rinsate blank sample were identified with fictitious location numbers related to the primary sample number and recorded in the field logbook. No indication that a sample is a duplicate was provided on the sample label or chain-of-custody form. The sample to be used for matrix spike/matrix spike duplicate (MS/MSD) was specified in the comments section of the chain-of-custody. Field notes pertaining to sample collection were recorded in a permanently bound field logbook with waterproof paper.

Groundwater samples were collected in the appropriate sample containers and placed in the shipping cooler immediately upon sample collection. Each bottle was individually wrapped with bubble wrap. Sample jars were packaged with additional bubble wrap and styrofoam materials to minimize shifting of samples and prevent breakage of samples

during shipment. Ice packaged in plastic ziplock storage bags was placed in each cooler to maintain the temperature in the shipping containers at 4° C +/- 2° C. Along with samples and ice, a temperature blank provided by the laboratory was placed in each cooler. A chain-of-custody form was filled out for each cooler shipped, placed in a ziplock bag, and placed on top of the sample bottles inside the cooler. Field sampling personnel affixed two signed and dated custody seals to each cooler. The samples collected each day were shipped by Federal Express (FedEx) from Portland, Oregon, to Laucks Testing Laboratories in Seattle, Washington, by overnight delivery service.

Sample labels on the sample containers included the following information:

- PBS project number
- Sample identification number
- Date and time of sampling
- Initials of sampling personnel
- Analyses to be performed
- Type of preservative added

3.7 Quality Assurance/Quality Control Samples

Duplicate samples were collected at a frequency of 1 per 10 monitoring well samples. Matrix spike/matrix spike duplicate (MS/MSD) samples were collected at a frequency of 1 per 20 monitoring well samples. Trip blanks were submitted with shipments containing groundwater samples for VOC analyses. One field blank/rinsate sample was collected during sampling of the groundwater monitoring wells. The field blank/rinsate sample was collected by pumping deionized water through the sampling equipment and collecting the water in prepared containers.

4.0 ANALYTICAL METHODS

Field measurements were obtained for pH, specific conductance, temperature, oxidation-reduction potential and dissolved oxygen in groundwater samples using a YSI Model 556 water quality meter. Water color and turbidity were visually observed and noted. Analytical data were obtained by Laucks Testing Laboratories using standard, documented procedures to provide defensible data on contaminant characterization and contamination levels relative to appropriate regulatory and risk-based criteria. Specific laboratory analysis methods are presented in Table 2.

The specific analytical methodologies, along with the associated project-specified method detection limits (MDL), are presented in the QAPP. The MDLs are based on minimum detection levels that can be expected to be achieved reliably by the project analytical laboratories using the methodologies specified. As discussed in the QAPP, some of the analytical methodologies cannot achieve risk-based or cleanup goals for all analytes. Therefore, the analytical methodologies were selected to attain detection or quantitation limits that approach or achieve the risk-based goals for chemicals most likely to be present, with a secondary emphasis on approaching or achieving these goals for the maximum number of other possible contaminants. Analytical results falling between the method detection limit and the project-specified reporting limit have been reported and flagged as estimated values (J-flagged) on laboratory analysis data tables (Appendix A) and the laboratory report sheets (Appendix B).

5.0 DATA MANAGEMENT AND REVIEW

The laboratory data quality was evaluated before use according to the procedures described in the QAPP. The analytical results for total priority pollutant metals, SVOCs, TPH-Gx (gasoline),

TPH-Dx (diesel), explosive compounds (including HMX, RDX, NG, and PETN), picric acid, perchlorate, TOC, DOC, TSS, alkalinity, and inorganic ions are presented in Table 4 (Appendix A). Analytical results for dissolved metals from field filtered groundwater samples are presented in Table 5 (Appendix A). Specific VOCs and SVOCs detected above the laboratory MDLs are presented in Table 6 (Appendix A).

The analytical tables include the State of Washington MTCA levels for comparison with regulatory and risk-based criteria. MTCA Method A cleanup level values for groundwater were obtained from the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC) (WDOE, 2001). These cleanup levels are not site specific and are applicable to sites undergoing routine cleanup actions as defined in MTCA. MTCA Method B risk-based concentrations for groundwater were obtained from the MTCA Method B levels presented in the Volume 1, Multi-Sites Investigation Report for Camp Bonneville (Shannon & Wilson, 1999). The MTCA Method B values are based on a Risk Calculations (CLARC) II database (based on a 10^{-6} cancer risk or a hazard quotient of 1) (WDOE 1996; WDOE 2001) and are derived from formula values obtained from the February 1996 CLARC II Update (WDOE, 1996).

6.0 GROUNDWATER MONITORING RESULTS

6.1 Base Boundary at Lacamas Creek

Groundwater samples were collected from the four monitoring well pairs located at the Base Boundary at Lacamas Creek (Figure 3) on September 17 and 19, 2007. Paired shallow (S) and deep (D) monitoring wells consisted of sample numbers: 16LCMW01SW and 16LCMW01DW; 16LCMW02SW and 16LCMW02DW; 16LCMW03SW and 16LCMW03DW; and 16LCMW04SW and 16LCMW04DW. A field duplicate sample (labeled 16LCMW435W) was collected from monitoring well LC-MW01S on September 17, 2007. A MS/MSD field duplicate sample (labeled 16LCMW04DWMS/MSD) was collected from monitoring well LC-MW04D on September 19, 2007.

Water level depths in the wells ranged from 6.36 to 8.16 feet below the top of the PVC well casings. These represent water elevations in the wells ranging from 283.80 to 283.43 feet above mean sea level.

All samples were analyzed for TPH-Gx (gasoline), TPH-Dx (diesel), VOCs, SVOCs, explosive compounds (including HMX, RDX, NG, and PETN), picric acid, perchlorate, priority pollutant metals (total and dissolved), TOC, DOC, TSS, alkalinity, and inorganic ions. The laboratory analytical results are presented in Tables 4, 5, and 6. Groundwater field parameters (pH, temperature, conductivity, visual turbidity, and color) recorded at the time of sampling are presented in Table 7.

Volatile Organic Compounds or SVOCs were detected only in groundwater from monitoring well LCMW02D at the Base Boundary. Groundwater sample 16LCMW02DW had a detection of 1.8 μg/L of benzoic acid.

No diesel, oil or gasoline range petroleum hydrocarbons were detected in any of the Base Boundary groundwater samples. Explosive compounds, nitroglycerine (NG), pentaerythitol tetranitrate (PETN), picric acid, and perchlorate were not detected in any of the groundwater samples.

Total Organic Carbon and DOC concentrations were below laboratory detection limit of 1.0 mg/L in all monitoring well groundwater samples. Total Suspended Solids were

found above the laboratory detection limit of 2 mg/L in one of the eight monitoring wells; LCMW02S at 3 mg/L. Bicarbonate alkalinity in the groundwater samples ranged from 40 to 56 mg/L. Inorganic ions consisting of chloride (1.3 to 2.2 mg/L), sulfate (1.0 to 1.5 mg/L) and nitrate (0.18 to 0.3 mg/L) were detected slightly above laboratory MDLs in the monitoring wells.

Antimony, arsenic, cadmium, chromium, copper, mercury, nickel, selenium and zinc all were detected in one or more of the unfiltered (total metals) groundwater samples from the Lacamas Creek – Base Boundary monitoring wells (Table 4). Antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc all were detected in one or more of the filtered (dissolved metals) groundwater samples from the Lacamas Creek – Base Boundary monitoring wells (Table 5). No total or dissolved metals were detected at concentrations above MTCA Method A regulatory screening levels in samples from the Base Boundary monitoring wells.

Laboratory analysis results for duplicate sample 16LCMW435W were consistent with the concentrations in the original sample 16LCMW01SW, with the exception of total and dissolved metals. Laboratory analysis results for MS/MSD duplicate sample MS/MSD were consistent with the concentrations in the original sample 16LCMW04DW, with the exception of total and dissolved metals. Differences in the sample results are discussed in Section 8.2 of this report.

Blackberry vines growing in the area along the base boundary monitoring wells had been sprayed with herbicides immediately prior to the sampling days. The laboratory analysis data did not show indications of groundwater samples being affected by the herbicide application.

6.2 Landfill 4/Demolition Area 1

Groundwater samples were collected from monitoring wells at Landfill 4/Demolition Area 1 (Figure 4) on September 20, 21 and 24, 2007. Sample shallow (A) and deep (B) well pair numbers consisted of: 16L4MW01AW and 16L4MW01BW; 16L4MW02AW and 16L4MW02BW; 16L4MW03AW and 16L4MW03BW. Samples from individual monitoring wells consisted of sample numbers: 16L4MW04AW, 16L4MW05AW, 16L4MW07BW, 16L4MW17W, and 16L4MW18W. A field duplicate sample (labeled 16L4MW440W) was collected from monitoring well L4-MW07B on September 20, 2007.

Water level depths in the wells around the perimeter of the landfill ranged from 14.77 to 34.60 feet below the top of the PVC well casings. These represent water elevations in the wells ranging from 514.83 to 483.86 feet above mean sea level. The water level in the monitoring well located downstream of the landfill (L4-MW07B) was 40.88 feet below the top of the PVC well casing; equaling elevation 439.54 feet above mean sea level. Monitoring wells along North Fork Lacamas Creek at the base of the stream ravine, downstream of Landfill 4, had water levels below top of PVC casing at 11.23 feet in L4-MW17 and 12.12 feet in L4-MW18; equaling 350.25 feet and 350.72 feet above mean sea level, respectively.

All samples were analyzed for VOCs, explosive compounds (including HMX, RDX, NG, and PETN), and perchlorate. The laboratory analytical results are presented in Tables 4, 5, and 6 (Appendix A). Groundwater field parameters (pH, temperature, conductivity, visual turbidity, and color) recorded at the time of sampling are presented in Table 7 (Appendix A).

- Diesel range petroleum hydrocarbons were detected in the Lacamas Creek monitoring well LCMW02DW at 0.15 mg/L in January 2006, but have not been detected during subsequent sampling events.

Perchlorate

- Perchlorate decreased in Landfill 4/Demo Area 1 well L4MW04A.
- Perchlorate increased in Landfill 4/Demolition Area 1 wells L4MW02A and L4MW02B
- HMX concentrations are relatively consistent through the quarters.
- RDX concentrations are relatively consistent through the quarters, with a slight overall decrease from March to September 2007.

8.0 DATA QUALITY OBJECTIVES

The overall data quality objective is to provide data of known and sufficient quality to evaluate the physical extent and concentration ranges of chemicals of potential concern from analysis of groundwater samples and to assure compliance with environmental and health-related agencies. Data quality objectives for laboratory analysis are presented in the QAPP. Laboratory analytical data were evaluated with respect to quality assurance objectives for precision, accuracy, representativeness, comparability and completeness parameters. The project specifications were met for all of these analytes, indicating that the sampling and analysis procedures were reproducible. The laboratory report narratives (Laucks Testing Laboratories data set CAB36 – CAB40) state that all quality control parameters that affect sample analysis were met.

8.1 Field Data Quality Assessment

There are no specific data quality objectives for the measurement of field parameters, such as temperature, pH, conductivity and turbidity. Specific conductance, temperature, total dissolved solids and pH were measured during purging. Turbidity and water color were visually observed. Stabilization for groundwater sampling was reached when three successive readings were within ±0.2 for pH, ±1° C for temperature and ± 10 percent for specific conductance.

The criteria for field parameter measurements described in the SAP were met. Field parameter readings for groundwater samples collected from –September 17 to 24, 2007 were measured using a calibrated YSI Model 556 water quality meter installed in a flow-through cell, which also allowed measurement of oxidation-reduction potential and dissolved oxygen.

8.2 Quality Control Sample Assessment

A field equipment rinsate blank water sample (labeled 16LCMW430W) was collected on September 20, 2007. The rinsate sample consisted of deionized water run through the decontaminated pump and a new section of tubing. The rinsate sample was analyzed for the full suite of analytes described in this report.

The deionized water field equipment rinsate sample collected on September 20, 2007 (sample 16LCMW430W) had a detection of chloroform (6.2 μg/L). The unfiltered deionized water field rinsate sample contained detectable low levels of chromium (0.291 μg/L, estimated) and nickel (0.170 μg/L, estimated). The filtered deionized water field rinsate sample contained detectable low levels of chromium (0.278 μg/L, estimated), nickel (0.608 μg/L, estimated), selenium (0.266 μg/L, estimated) and zinc (7.51 μg/L, estimated). Compared to the results for the 2nd Quarter 2007, the field rinsate sample

total metals results for the 3rd Quarter 2007 are lower for detected metals. The dissolved metals results are slightly higher for nickel, selenium and zinc and lower for cadmium and chromium.

Trip blanks accompanied the samples for VOC analysis that were consolidated daily into one cooler and shipped to the laboratory. Trip blanks were shipped on September 17, 19, 20, 21 and 24, 2007. No VOCs were detected in any of the trip blanks.

One duplicate sample was collected from each of the study areas. The duplicate samples were analyzed for the same constituents as the source sample. Relative percent differences (RPD) were calculated for each duplicate and source sample where both results were detected above laboratory detection levels. Laboratory results for the duplicate sample 16LCMW435W (Lacamas Creek Base Boundary area) were mutually detected with the source sample 16LCMW01SW for total and dissolved metals, chloride and alkalinity. The resultant RPD values are presented on Tables 4 and 5. The total metals RPD values ranged from 0 percent to 26 percent for 4 analytes. None of the RPD values exceeded the generally accepted RPD goal of 50 percent. The dissolved metals RPD values ranged form 4 percent to 37 percent for five analytes. The alkalinity RPD was 0 percent.

Duplicate sample 16L4MW440W (Landfill 4/Demolition Area 1) and the source sample, 16L4MW07BW, had mutually detected values for perchlorate. The perchlorate RPD is 10 percent (Table 4). The RPD values for these samples meet the RPD goal of 50 percent.

8.3 Laboratory Analysis Chemical Data Quality

The analytical data quality evaluations performed by Laucks Testing Laboratories are presented in Appendix B with the analysis summary reports for the specific tests. Case narratives describing sample receipt, identification and general comments by laboratory personnel are included in Appendix B preceding the copies of the chain-of-custody forms.

No sample analytical laboratory results were rejected. The case narratives and analysis summary reports indicate that most analytical results are acceptable for use without qualification. Some individual sample results were qualified as estimated values that were low-level detections below the laboratory instrument practical quantification limits (PQL), and flagged with “J” on the laboratory summary reports.

MS/MSD duplicate analyses were performed on sample 16LCMW04DW. All recoveries and relative percentage differences were within the acceptance levels.

All samples were received within the holding times for transport from the collection site to the laboratory. Exceptions to the collection and analysis criteria are listed below and noted in the laboratory case narrative documentation in Appendix B.

- Air bubbles of less than one quarter-inch were present in several of the vials for TOC for these samples upon receipt at the laboratory: 16LCMW435W, Trip Blank on September 19, 2007, and Trip Blank on September 24, 2007. These conditions did not affect analyses.
- One 40-ml vial was broken for the TOC sample for 16LCMW01DW; one 40-ml vial was broken for the TOC sample for the MS/MSD duplicate of 16LCMW04DW; two 1-

liter amber bottles for explosive samples were broken for L4MW02BW. Enough sample remained for the analyses for each parameter.

- Coolers delivered by PBS on September 21, 2007 to FedEx in Vancouver, Washington, were held by FedEx and not shipped until September 23, 2007. These two coolers were picked up at FedEx in Seattle, Washington, by Laucks Lab on September 24, 2007. The temperature blanks in these coolers were 5.1 and 7.7 degrees Celsius.
- Laboratory blank spike recoveries were low for the explosives analysis of HMX and RDX (EPA Method 8330) for samples 16LCMW04SW, 16LCMW04DW, 16LCMW03SW, 16LCMW03DW, 16LCMW430W, 16L4MW17W, 16L4MW18W, 16L4MW07BW, 16L4MW440W, 16L4MW01AW, and 16L4MW01BW. The samples for ordnance and picric acid were re-extracted in the lab outside of the 7-day holding time. Both the initial run and the reanalysis results are presented in the laboratory report package.
- Acetone was detected in the analysis of one sample from Landfill 4, 16L4MW03BW (see Table 6). Chloroform was detected in the field equipment rinsate sample, 16L4MW430W (see Table 6). Detection of these chemicals in the sample analysis results appears to be a result of its presence in laboratory equipment, not in the groundwater sample.

8.4 Deviations to Standard Procedures

During the groundwater sampling event for the 3rd Quarter 2007, deviations from the standard procedures of the SAP included the following.

Monitor well L4MW17 ran dry during sampling on September 20, 2007. The samples for explosives consisted on one 1-liter bottle instead of two 1-liter bottles. The laboratory had enough sample to complete the analyses; therefore, analysis was not adversely affected.

Corrective Measure: This monitoring well should have enough yield in the 4th Quarter 2007 (December 2007) to fill all sample bottles.

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Pentaerythitol tetranitrate (PETN) and NG were not detected in any of the groundwater samples from shallow or deep monitoring wells. No explosive compounds (HMX and RDX) were detected in monitoring wells L4-MW01A, L4-MW01B, L4-MW07B, L4-MW17, and L4-MW18. HMX was detected in paired monitoring wells L4-MW02A (4.6 μg/L) and L4-MW02B (3.8 μg/L); other wells did not have detectable HMX. Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) was detected in monitoring wells L4-MW02A (30 μg/L), L4-MW02B (86 μg/L, estimated), L4-MW03A (10 μg/L), L4-MW03B (4.7 μg/L), L4-MW04A (2.1 μg/L), and L4-MW05A (5.1 μg/L).; other wells did not have detectable RDX.

Perchlorate was detected in groundwater samples from monitoring wells L4-MW01A (1.5 μg/L), L4-MW02A (280 μg/L), L4-MW02B (380 μg/L), L4-MW03A (94 μg/L), L4-MW03B (43 μg/L), L4-MW04A (29 μg/L), L4-MW05A (41 μg/L), and L4-MW07B (2.1 μg/L). No perchlorate was found above the laboratory detection limit of 1 μg/L in groundwater from monitoring wells L4-MW01B, L4-MW-17, and L4-MW18. The highest levels of HMX, RDX, and perchlorate were found in the groundwater samples from the paired monitoring wells L4-MW02A and L4-MW02B.

Groundwater from three of the monitoring wells contained detectable VOCs: L4-MW02B contained 1,1-Dichloroethane (28 μg/L), Dichlorodifluoromethane (74 μg/L), Tetrachloroethene (0.536 μg/L, estimated), 1,1,1-Trichloroethane (45 μg/L), and Trichloroethane (0.22 μ/L); L4-MW03B contained acetone (1.7 μ/L); L4-MW05A contained Tetrachloroethene (0.41 μg/L, estimated).

Total and dissolved metals were not analyzed for groundwater samples from the Landfill 4/Demolition Area 1 monitoring wells during the 3rd Quarter 2007.

Laboratory analysis results for duplicate sample 16L4MW440W were consistent with the concentrations in the original sample 16L4MW07BW. Differences in the sample results are discussed in Section 8.2 of this report.

7.0 RECENT TRENDS IN WATER QUALITY DATA

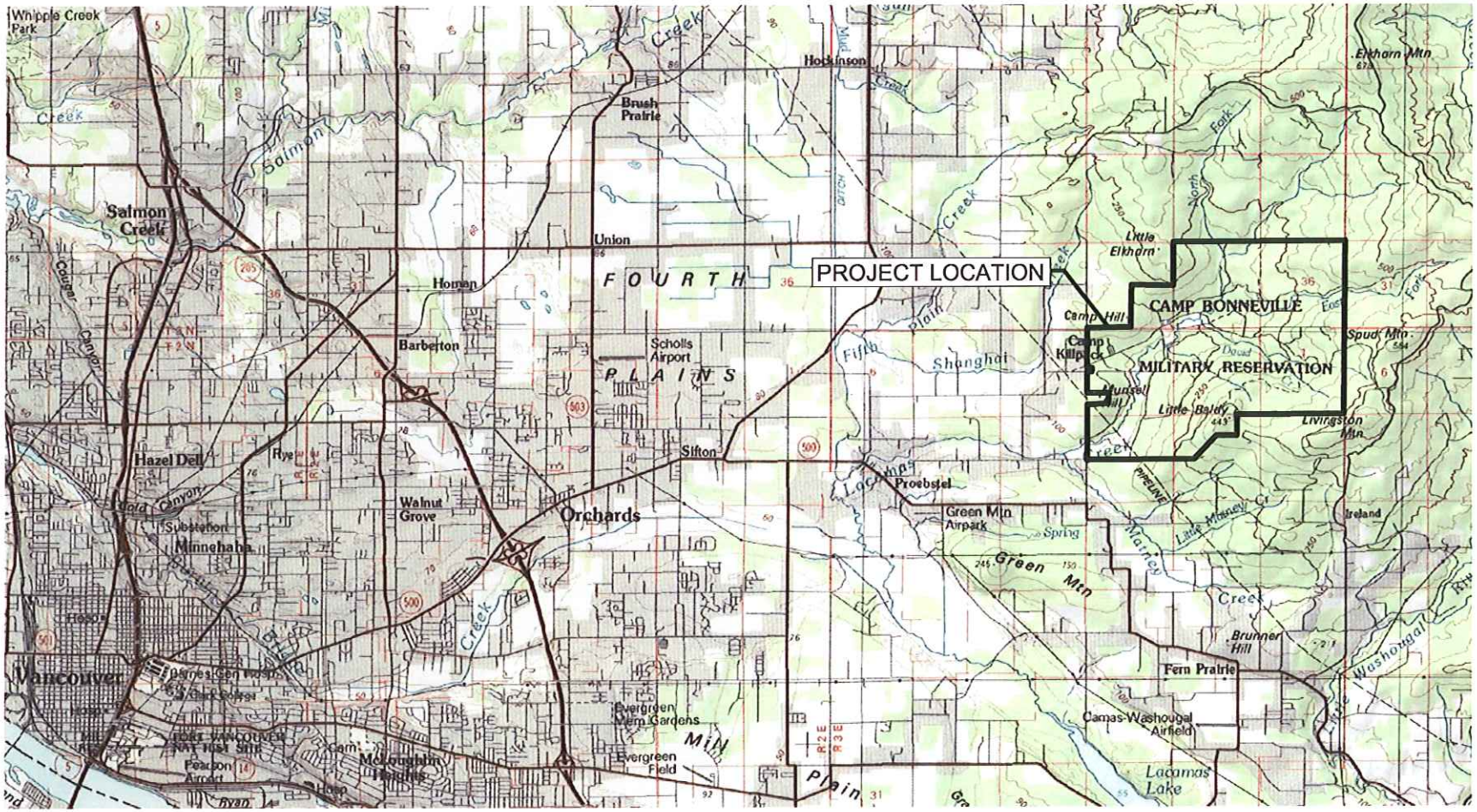
The laboratory results for the groundwater parameters were compared for the 3rd Quarter 2007 event and the four previous quarterly sampling events. These sampling quarters covered sampling periods of September 2006, December 2006, March 2007 and June 2006 and encompass the range of seasonal climatic (rainfall and temperature) and groundwater level conditions at the monitoring well sites. Groundwater parameter data which show significant (at least one order of magnitude) difference over these sampling events are listed below.

<u>Metals; Lacamas Creek/Boundary (metals are not included in the Landfill 4/Demolition Area 1 sampling)</u>

- All of the metal concentrations have been relatively stable during the last five quarters of sampling with the following exceptions.
    - Chromium (total) slightly increased in both total and dissolved metals samples.
    - Fluctuations of one or all of the analytes consisting of copper, nickel and zinc were observed in seven of the total metals samples (LCMW01S, LCMW01D,LCMW02S, LCMW02D,LCMW03D, LCMW04S, and LCMW04D).

<u>Petroleum Hydrocarbons</u>

FIGURES



WASHINGTON

PBS

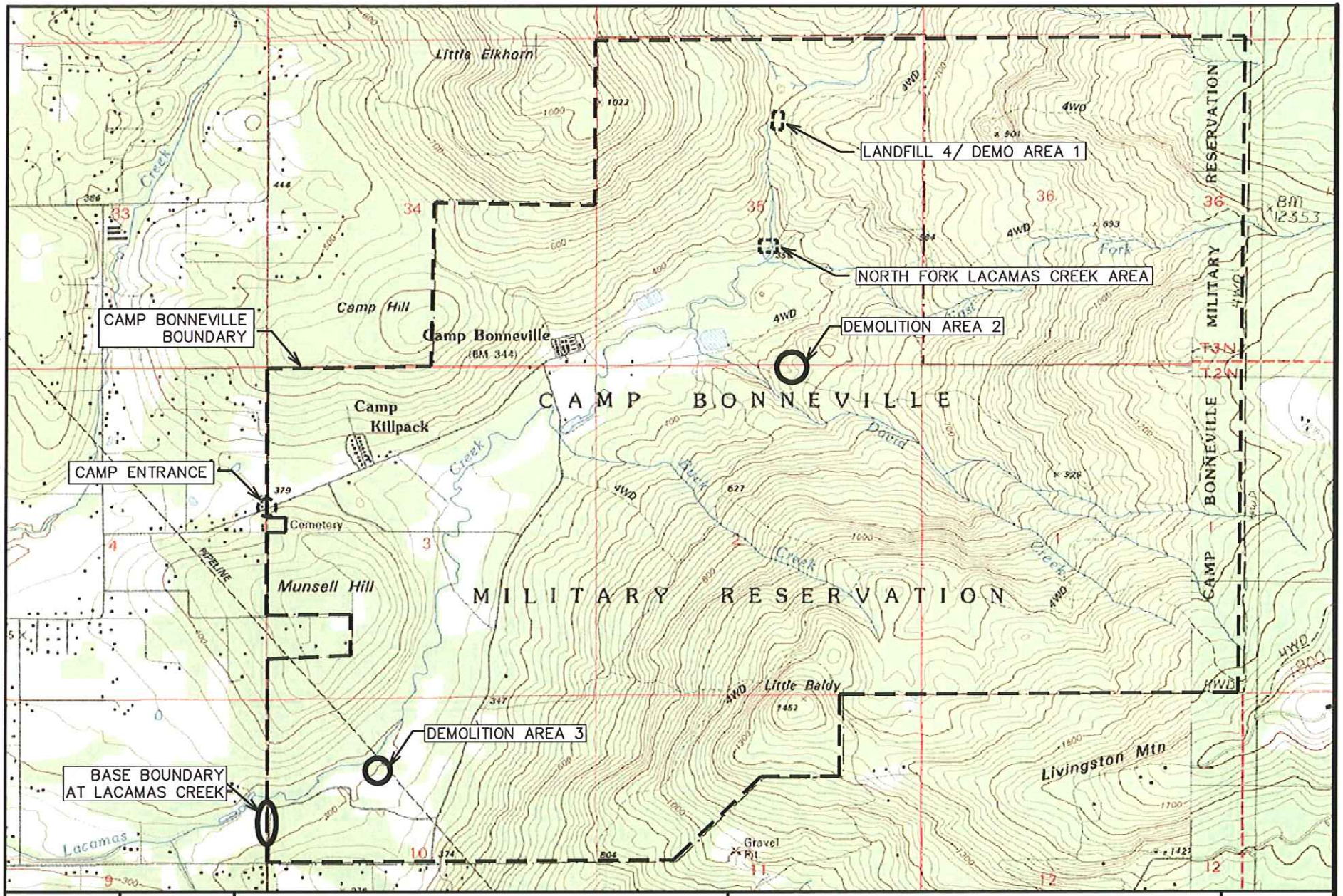
Project #: 70489.000
Task #: 6208
Date: NOV. 2007

0 1.5 MILE 3 MILE 6 MILE

SITE LOCATION MAP

CAMP BONNEVILLE
CLARK COUNTY, WASHINGTON

FIGURE 1



L:\PORTLAND\70000\70489_Camp_Bonn_MB\3rd Qtr 2007\DWG\70489.000_FIG_2-6_TASK6208.dwg Oct 18, 2007 11:50am johnr

PBS

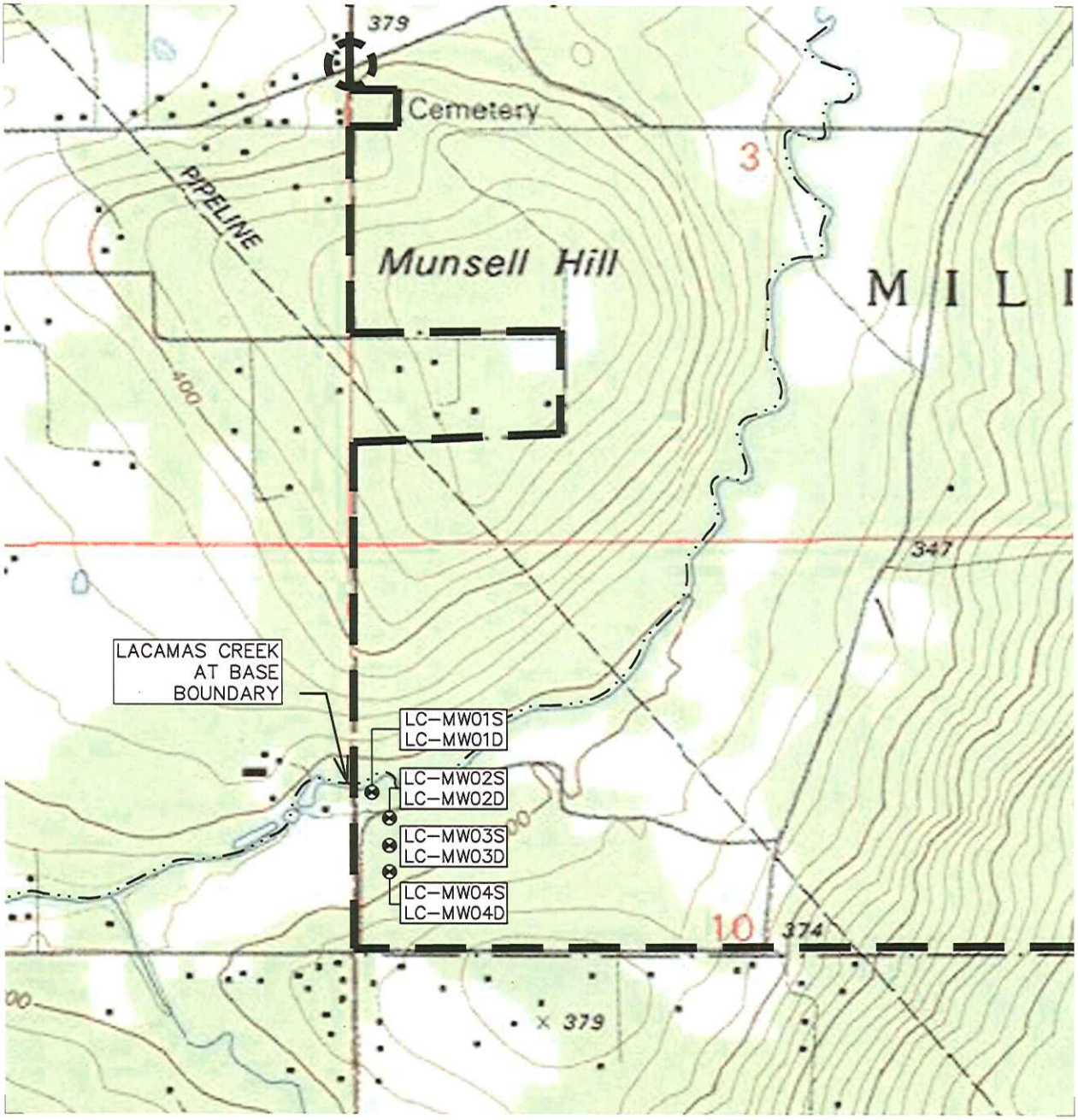
Project #: 70489.000
Task #: 6208
Date: NOV. 2007

0 1/8 MILE 1/4 MILE 1/2 MILE 1 MILE

INVESTIGATION AREAS WITHIN CAMP BONNEVILLE BOUNDARY

CAMP BONNEVILLE
CLARK COUNTY, WASHINGTON

FIGURE 2



LEGEND

LC–MW04S LC–MW04D	MONITORING WELL AND WELL NUMBER
	LACAMAS CREEK
	BASE BOUNDARY

0 1/8 MILE 1/4 MILE 1/2 MILE

PBS

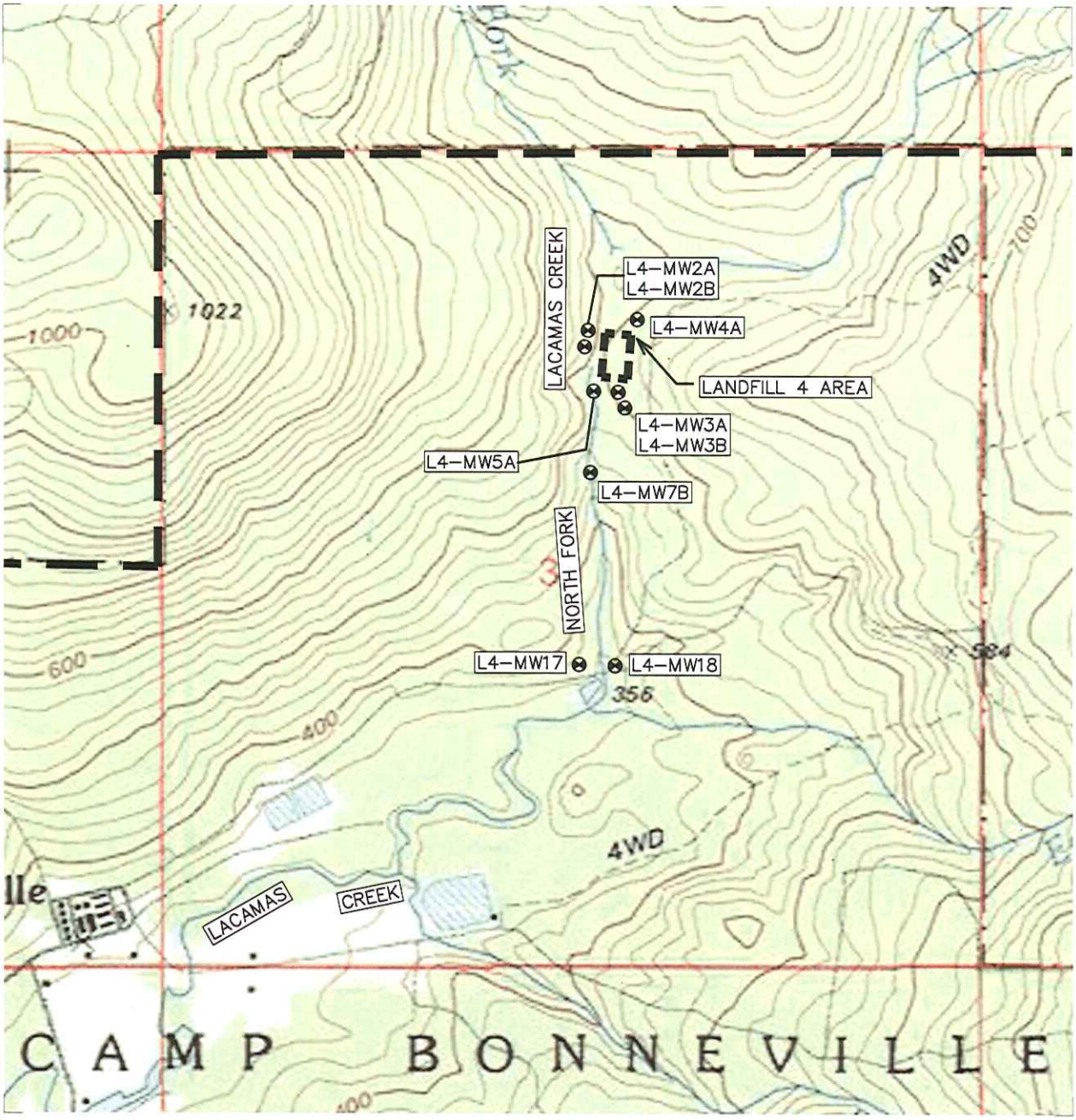
Project #: 70489.000
Task #: 6208
Date: NOV. 2007

MONITORING WELL LOCATIONS NEAR BASE BOUNDARY AT LACAMAS CREEK

CAMP BONNEVILLE
CLARK COUNTY, WASHINGTON

FIGURE 3

L:\PORTLAND\70000\70489_Camp_Bonn_MB\3rd Qtr 2007\DWG\70489.000_FIG_2-6_TASK6208.dwg Oct 18, 2007 11:50am johnr



LEGEND

LC–MW2A / LC–MW2B — MONITORING WELL AND WELL NUMBER

BASE BOUNDARY

0 1/8 MILE 1/4 MILE 1/2 MILE

PBS	Project #: 70489.000 Task #: 6208 Date: NOV. 2007	MONITORING WELL LOCATIONS NEAR LANDFILL 4/DEMO AREA 1 LANDFILL 4 - LACAMAS CREEK CLARK COUNTY, WASHINGTON	FIGURE 4

APPENDIX A

Field Parameters and Laboratory Analysis Data Tables

DRAFT

TABLE 4. CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES - 3rd QUARTER 2007
SUMMARY OF GROUNDWATER LABORATORY ANALYSIS
CAMP BONNEVILLE, VANCOUVER, WASHINGTON

Sample No.	Sample Date	Sample Location	Total Metals (µg/L)												VOCs (µg/L)	SVOCs (µg/L)	Petroleum Hydrocarbons (mg/L)			Ordnance Explosives Compounds (µg/L)		NG (µg/L)	PETN (µg/L)	Picric Acid (µg/L)	Perchlorate (µg/L)	TOC (mg/L)	DOC (mg/L)	TSS (mg/L)	Alkalinity (HCO3) (mg/L)	Alkalinity (CO3) (mg/L)	Ions (results above detection limits shown)
			Antimony	Arsenic	Beryllium	Cadmium	Chromium (total)	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc			NWTPH-Dx	Oil Range	NWTPH-Gx	HMX	RDX									
16LCMW01SW	9/17/2007	Lacamas Cr.	0.293(J)	0.218(J)	ND	ND	ND	0.986(J)	ND	0.04(J)	0.704(J)	ND	ND	ND	1.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	48	< 8.0	chloride 1.3 mg/L
16LCMW01DW	9/17/2007	Lacamas Cr.	ND	0.340(J)	ND	ND	.0740(J)	ND	ND	0.021(J)	1.24	ND	ND	ND	2.93(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	52	< 8.0	sulfate as SO_4 1.0 mg/L; chloride 1.4 mg/L
16LCMW02SW	9/17/2007	Lacamas Cr.	ND	0.356(J)	ND	0.097(J)	ND	0.848(J)	ND	0.026(J)	1.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	3	44	< 8.0	chloride 1.4 mg/L
16LCMW02DW	9/17/2007	Lacamas Cr.	ND	0.450(J)	ND	ND	0.728(J)	0.875(J)	ND	0.032(J)	1.53	ND	ND	ND	2.31(J)	ND	Detect: see VOC table	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	48	< 8.0	chloride 1.7 mg/L
16LCMW03SW	9/19/2007	Lacamas Cr.	ND	0.393(J)	ND	0.127(J)	0.983(J)	ND	ND	ND	0.905(J)	0.258(J)	ND	ND	3.12(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	44	< 8.0	nitrate as N 0.27 mg/L; chloride 1.3 mg/L
16LCMW03DW	9/19/2007	Lacamas Cr.	0.175(J)	0.657(J)	ND	0.140(J)	2.21(J)	ND	ND	ND	1.40	0.220 (J)	ND	ND	5.48(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	44	< 8.0	nitrate as N 0.30 mg/L; chloride 1.5 mg/L
16LCMW04SW	9/19/2007	Lacamas Cr.	0.136(J)	0.128(J)	ND	0.168(J)	1.01(J)	ND	ND	ND	0.878(J)	0.264(J)	ND	ND	3.75(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	40	< 8.0	nitrate as N 0.81 mg/L; chloride 2.2 mg/L
16LCMW04DW	9/19/2007	Lacamas Cr.	0.057(J)	1.03	ND	0.139(J)	2.51(J)	1.05(J)	ND	ND	1.97	0.237(J)	ND	ND	4.42(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 2	56	< 8.0	sulfate as SO_4 1.5 mg/L; chloride 1.6 mg/L
16L4MW01AW	9/20/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	ND	ND	ND	nt	1.5	nt	nt	nt	nt	nt	nt
16L4MW01BW	9/20/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	ND	ND	ND	nt	ND	nt	nt	nt	nt	nt	nt
16L4MW02AW	9/24/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	4.6	30	ND	ND	nt	280	nt	nt	nt	nt	nt	nt
16L4MW02BW	9/24/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	Detect: see VOC table	nt	nt	nt	nt	3.8	86(E)	ND	ND	nt	380	nt	nt	nt	nt	nt	nt
16L4MW03AW	9/21/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	10	ND	ND	nt	94	nt	nt	nt	nt	nt	nt
16L4MW03BW	9/21/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	Detect: see VOC table	nt	nt	nt	nt	ND	4.7	ND	ND	nt	43	nt	nt	nt	nt	nt	nt
16L4MW04AW	9/21/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	2.1	ND	ND	nt	29	nt	nt	nt	nt	nt	nt
16L4MW05AW	9/21/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	Detect: see VOC table	nt	nt	nt	nt	ND	4.1	ND	ND	nt	41	nt	nt	nt	nt	nt	nt
16L4MW07BW	9/20/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	ND	ND	ND	nt	2.1	nt	nt	nt	nt	nt	nt
16L4MW17W	9/20/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	ND	ND	ND	nt	ND	nt	nt	nt	nt	nt	nt
16L4MW18W	9/20/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	ND	ND	ND	nt	ND	nt	nt	nt	nt	nt	nt
16L4MW440W (field duplicate of 16L4MW07BW)	9/20/2007	Landfill 4	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	ND	ND	ND	ND	nt	1.9	nt	nt	nt	nt	nt	nt
RPD for duplicate 16L4MW440W																										10%						
MS/MSD (lab duplicate of 16LCMW04DW)	9/19/2007	Lacamas Cr.	0.056(J)	0.183(J)	ND	ND	2.72(J)	ND	ND	ND	1.70	0.237J)	ND	ND	4.42(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	< 1	56	< 8.0	sulfate as SO4 1.5 mg/L; chloride 1.6 mg/L; nitrate as N 0.18 mg/L
16LCMW435W (field duplicate of 16LCMW01SW)	9/17/2007	Lacamas Cr.	ND	0.232(J)	ND	ND	ND	1.08(J)	ND	0.033(J)	0.913(J)	0.122(J)	ND	ND	1.80(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	2	48	< 8.0	chloride 1.3 mg/L
RPD for duplicate 16LCMW435W				6%				9%		19%	26%				0%															0%		
16L4MW430W (field equipment rinsate)	9/20/2007	Landfill 4	ND	ND	ND	ND	0.291(J)	ND	ND	ND	0.170(J)	ND	ND	ND	ND	Detect: see VOC table	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 1.0	< 1.0	6.0	< 2	< 2.0	none above detection limits
Trip Blank 1	9/17/2007		nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Trip Blank 2	9/19/2007		nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Trip Blank 3	9/20/2007		nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Trip Blank 4	9/21/2007		nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Trip Blank 5	9/24/2007		nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	ND	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Lab detection limit			0.056	0.10	0.043	0.094	0.12	0.52	0.075	0.02	0.11	0.11	0.085	0.044	1.80	varies	varies	0.10 mg/L	0.40 mg/L	0.025 mg/L	0.48-0.60 µg/L	0.48-0.60 µg/L	2.4 µg/L	1.1 µg/L	1.0 µg/L	1.4 µg/L	1.0 mg/L	1.0 mg/L	2.0 mg/L	4 mg/L	2 - 4 mg/L	see lab data report for limits
WA MTCA Method A Cleanup Levels (µg/L)			n/a	5	n/a	5	50	n/a	15	2	n/a	n/a	n/a	n/a	n/a	varies	varies	500	500	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WA MTCA Method B Levels (µg/L)			1.4 - 8		0.02			592		4,800	320	80	80	1.1	4,800																	

Notes:
Only detected analytes are shown; see laboratory reports for complete listing of compounds tested
nt - Sample not tested
µg/L - micrograms per liter
mg/L - milligrams per liter
ND - Not detected to the limit of laboratory detection indicated
n/a - Not applicable. MTCA Method A Cleanup Level not provided.
Detect - VOC compound detected; see separate VOC table
J or E = value estimated
RPD = relative percent difference between sample versus duplicate
WA MTCA Method B Levels from "Multi-Sites Investigation Report", Shannon & Wilson, 1999.
BOLD Print indicates concentration exceeding WA MTCA Method A Cleanup Level

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TABLE 5. DISSOLVED METALS AND DOC - 3rd QUARTER 2007
SUMMARY OF GROUNDWATER LABORATORY ANALYSIS
CAMP BONNEVILLE, VANCOUVER, WASHINGTON

Sample No.	Sample Date	Sample Location	Dissolved Metals - field filtered (µg/L)													DOC (mg/L)
			Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	
16LCMW01SW	9/17/2007	Lacamas Cr.	0.086(J)	0.191(J)	ND	ND	ND	ND	ND	0.030(J)	0.693(J)	ND	ND	ND	1.96(J)	< 1.0
16LCMW01DW	9/17/2007	Lacamas Cr.	ND	0.270(J)	ND	ND	0.995(J)	ND	0.087(J)	0.025(J)	1.25	ND	ND	ND	1.85(J)	< 1.0
16LCMW02SW	9/17/2007	Lacamas Cr.	ND	0.383(J)	ND	ND	ND	ND	ND	0.026(J)	1.11	ND	ND	ND	2.34(j)	< 1.0
16LCMW02DW	9/17/2007	Lacamas Cr.	ND	0.441(J)	ND	ND	0.641(J)	0.983(J)	ND	0.033(J)	1.47	ND	ND	ND	2.32(J)	< 1.0
16LCMW03SW	9/19/2007	Lacamas Cr.	0.146(J)	0.388(J)	ND	ND	2.08(J)	ND	ND	ND	1.76	0.299(J)	ND	ND	5.90(J)	< 1.0
16LCMW03DW	9/19/2007	Lacamas Cr.	ND	0.693(J)	ND	ND	1.16(J)	ND	ND	ND	1.60	0.215(J)	ND	ND	5.30(J)	< 1.0
16LCMW04SW	9/19/2007	Lacamas Cr.	ND	0.122(J)	ND	0.437(J)	1.56(J)	ND	ND	ND	1.29	0.321(J)	ND	ND	2.60(J)	< 1.0
16LCMW04DW	9/19/2007	Lacamas Cr.	ND	1.10	ND	0.237(J)	2.23(J)	0.669(J)	ND	ND	2.66	0.313(J)	ND	ND	2.78(J)	< 1.0
MS/MSD (lab duplicate of 16LCMW04DW)	9/19/2007	Lacamas Cr.	ND	1.06	ND	0.163(J)	2.06(J)	ND	ND	ND	2.57	0.246(J)	ND	ND	3.02(J)	< 1.0
16LCMW435W (field duplicate of 16LCMW01SW)	9/17/2007	Lacamas Cr.	0.125(J)	0.183(J)	ND	ND	0.352(J)	0.677(J)	ND	0.036(J)	0.656(J)	0.125(J)	ND	ND	1.85(J)	< 1.0
RPD for duplicate 16LCMW01SW			37%	4%						18%	6%				6%	
16L4MW430W (field equipment rinsate)	9/20/2007	Landfill 4	ND	ND	ND	ND	0.278(J)	ND	ND	ND	0.608(J)	0.266(J)	ND	ND	7.51(J)	< 1.0
Lab detection limit			0.056	0.10	0.043	0.094	0.12	0.52	0.075	0.02	0.11	0.11	0.085	0.044	1.80	1.0
WA MTCA Method A Cleanup Levels (µg/L)			n/a	5	n/a	5	50	n/a	15	2	n/a	n/a	n/a	n/a	n/a	n/a
WA MTCA Method B Levels (µg/L)			1.4 - 8		0.02			592		4,800	320	80	80	1.1	4,800	

BOLD print indicates concentration exceeding WA MTCA Method A Cleanup Level
Only detected analytes are shown; see laboratory reports for complete listing of compounds tested
nt - Sample not tested
ug/L - micrograms per liter
J or E = value estimated
ND - Not detected to the limit of laboratory detection indicated
n/a - Not applicable. MTCA Method A Cleanup Level not provided.
RPD = relative percent difference between sample versus duplicate
WA MTCA Method B Levels from "Multi-Sites Investigation Report", Shannon & Wilson, 1999.

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TABLE 6. VOLATILE AND SEMI-VOLATILE ORGANIC COMPOUNDS
3rd QUARTER 2007
SUMMARY OF GROUNDWATER LABORATORY ANALYSIS
CAMP BONNEVILLE, VANCOUVER, WASHINGTON

Sample No.	Sample Date	Sample Location	VOCs (µg/l)											SVOCs (µg/l)	
			Acetone	2-Butanone	Chloroform	1,1-Dichloroethane	1,1-Dichloroethene	Dichlorodifluoromethane	Methylene Chloride	Trichloroethane	1,1,1-Trichloroethane	Tetrachloroethene	1,1,2,2-Tetrachloroethane	Benzoic Acid	bis(2-Ethylhexyl)phthalate
16L4MW03BW	9/21/2007	Landfill 4	1.7(J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	nt	nt
16L4MW02BW	9/24/2007	Landfill 4	ND	ND	ND	28	ND	74	ND	0.22(J)	45	0.53(J)	ND	nt	nt
16L4MW05AW	9/21/2007	Landfill 4	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.41(J)	ND	nt	nt
16LCMW02DW	9/17/2007	Lacamas Cr.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8(J)	ND
16L4MW430W (field equipment rinsate)	9/20/2007	Landfill 4	ND	ND	6.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lab detection limit			5.0	5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	0.6
WA MTCA Method A Cleanup Levels (µg/L)			n/a	n/a	n/a	n/a	n/a	n/a	5	n/a	200	5	n/a	n/a	n/a

Note:
Only analytes detected in at least one sample are shown; see lab reports for complete listing of compounds tested.
nt - Sample not tested
ND - Not detected to the limit of laboratory detection indicated
µg/L - micrograms per liter
J = value estimated
B = also detected in the method blank associated with the sample
n/a - Not applicable. MTCA Method A Cleanup Level not provided.
RPD = relative percent difference between sample versus duplicate

TABLE 7
FIELD PARAMETERS FOR GROUNDWATER SAMPLES - 3rd QUARTER 2007
CAMP BONNEVILLE, VANCOUVER, WASHINGTON

			Field Parameters at Time of Sampling									
Sample No.	Date	Time	Depth to Water in Feet*	Water Elevation in Feet amsl **	Temp. (degrees C)	Conductivity (µS/cm)	Oxidation Reduction Potential (millivolts)	Turbidity (NTUs)	pH	Dissolved Oxygen (mg/L)	Color and Cloudiness	Notes
16LCMW01SW	9/17/2007	1110	6.36	283.80	13.2	85	23.9	1.79	6.52	63.7	clear	collected duplicate
16LCMW01DW	9/17/2007	1300	6.83	283.42	12.9	90	24	2.45	6.58	71.00	clear	
16LCMW02SW	9/17/2007	1445	7.61	283.58	14.2	86	23	1.39	6.51	7.56	clear	
16LCMW02DW	9/17/2007	1630	8.16	283.43	13.2	90	2.2	2.20	6.56	7.19	clear	
16LCMW03SW	9/19/2007	1640	7.32	283.59	14.3	85	20.1	nr	6.43	7.63	clear	
16LCMW03DW	9/19/2007	1515	7.29	283.69	14.1	92	41.2	2.30	6.46	7.61	clear	
16LCMW04SW	9/19/2007	1015	7.36	284.27	13.4	86	90.2	4.22	5.93	6.70	clear	
16LCMW04DW	9/19/2007	1200	7.80	283.99	12.8	102	28.9	2.25	6.67	7.54	clear	collected MS/MSD duplicate
16L4MW01AW	9/20/2007	1400	17.53	513.87	14.8	28	121.7	9.41	5.13	6.89	clear	
16L4MW01BW	9/20/2007	1530	14.77	514.83	12.7	26	104.8	7.02	5.27	9.39	clear	
16L4MW02AW	9/24/2007	1200	29.53	490.40	16.1	24	103.4	26.5	4.93	7.21	clear	
16L4MW02BW	9/24/2007	1045	34.60	483.86	14.1	50	-17.5	2.64	5.56	0.94	clear	
16L4MW03AW	9/21/2007	1110	31.04	483.81	14.8	22	147.2	5.56	5.08	7.21	clear	
16L4MW03BW	9/21/2007	1300	28.92	482.55	13.9	43	146.1	4.60	5.42	6.26	clear	
16L4MW04AW	9/21/2007	0945	28.84	482.95	13.2	18	121.3	4.27	5.11	6.38	clear	
16L4MW05AW	9/21/2007	1415	25.69	484.22	14.5	28	128.7	18.56	5.21	6.37	clear	
16L4MW07BW	9/20/2007	1215	40.88	439.54	13.1	33	112.0	8.85	5.39	6.99	clear	collected duplicate
16L4MW17W	9/20/2007	0950	11.23	350.25	15.4	228	-21.5	5.01	7.08	3.99	clear	
16L4MW18W	9/20/2007	1050	12.12	350.72	13.5	124	66.9	26.3	6.13	8.49	clear	

Notes:
* = depth in feet measured from top of well PVC casing.
** = water level in feet above mean sea level, relative to top of casing elevation survey (see elevations, Table 8)
nr = value not recorded
Field parameters of temperature, conductivity, oxidation-reduction potential, dissolved oxygen, and pH measured with a YSI Model 556 meter.
Turbidity measured with Oaktron T100 meter.

TABLE 8

WELL NUMBER AND CONSTRUCTION DETAILS

CAMP BONNEVILLE, VANCOUVER, WASHINGTON

Well Number in PBS Work Contract	WADOE Well Tag Number	Well Location	Total Depth (ft)*	Screened Interval (ft)**	Top of PVC Casing Elevation (feet above mean sea level)	Well Number on Steel Casings/Caps (CHPPM No.)
LC-MW01S	AHA-359	Lacamas Cr.	22.73	15-20	290.16	LC-MW01S
LC-MW06D	AHA-358	Lacamas Cr.	42.20	30-40	290.25	LC-MW01D
LC-MW02S	AHA-364	Lacamas Cr.	17.50	12.5-17.5	291.19	LC-MW02S
LC-MW07D	AHA-357	Lacamas Cr.	37.85	25-35	291.59	LC-MW02D
LC-MW03S	AHA-363	Lacamas Cr.	20.10	13-18	290.91	LC-MW03S
LC-MW08D	AHA-362	Lacamas Cr.	39.40	27-37	290.98	LC-MW03D
LC-MW04S	AHA-375	Lacamas Cr.	16.54	7-17	291.63	LC-MW04S
LC-MW09D	AHA-361	Lacamas Cr.	37.00	25-35	291.79	LC-MW04D
L4-MW01A	N/A	Landfill 4	30.40	N/A	531.40	L4-MW01A
L4-MW01B	AGL-482	Landfill 4	55.40	43-53	529.57	L4-MW01B
L4-MW02A	N/A	Landfill 4	40.20	N/A	519.93	L4-MW02A
L4-MW02B	AGL-483	Landfill 4	74.60	62-72	518.46	L4-MW02B
L4-MW03A	AGL-466	Landfill 4	48.90	41-46	514.85	L4-MW03A
L4-MW03B	AGL-484	Landfill 4	62.90	49-59	511.47	L4-MW03B
L4-MW04A	AGL-465	Landfill 4	43.40	33-43	511.79	L4-MW04A
L4-MW05A	AGL-467	Landfill 4	36.60	30-35	509.91	L4-MW05A
L4-MW07B	N/A	Landfill 4	58.60	46-56	480.42	L4-MW07B
L4-MW17	ALB-252	Landfill 4	15.00	5-15	361.48	L4-MW17
L4-MW18	ALB-251	Landfill 4	20.00	10-20	362.84	L4-MW18

Notes:
* = depth in feet measured from top of well PVC casing
** = screened interval reported on well completion logs
N/A = not available

APPENDIX B

Laucks Testing Laboratories, Analytical Reports
(Separate electronic files on CD disk)

APPENDIX C

Monitoring Well Boring Logs

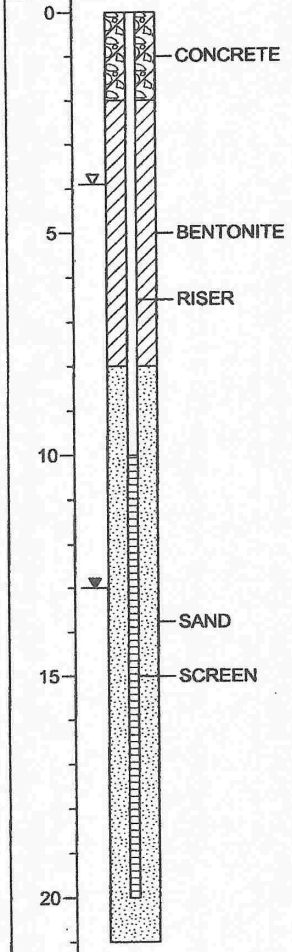
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-01S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling, Inc
Start Date	: 11/12/02	Drillers	: Todd Mecham
End Date	: 11/12/02		: Rowan Miller
Start Time	: 0830		
Weather	: Raining		

Well: LC-MW-01S
Elev.: 287.16



Depth in	DESCRIPTION	REMARKS
0	DARK YELLOWISH BROWN SILTY CLAY WITH GRAVEL	WET- LOTS OF RAIN INTO HOLE FOR 2 DAYS
10	SLIGHTLY SILTY GRAVEL- YELLOWISH BROWN SLIGHTLY SANDY SILTY GRAVEL- MIXED GRAVEL, PULVERIZED	
15	GRAY SILTY PULVERIZED RED GRAVEL WITH SOME SAND (5%)	WET
20	BOTTOM OF HOLE 21'	

BORING AND WELL CONSTRUCTION INFORMATION

BOREHOLE DEPTH : 21'
BORE DIAMETER : 7"

WELL LOCATION: NORTH BOUNDARY WELL BY LACAMAS CREEK

DRILLING METHOD: TRI-CONE ROLLER BIT ADVANCED THRU 7" CASING

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED

HEIGHT OF CASING ABOVE GROUND 3'

MONUMENT NO. AHA-359

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

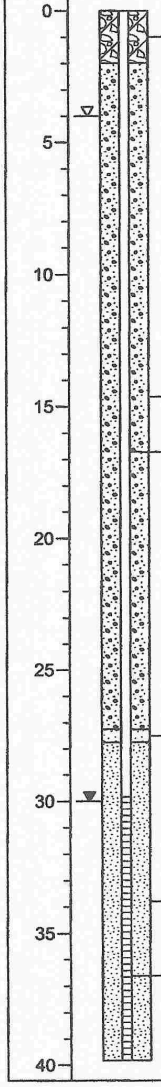
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-01D

CAMP BONNEVILLE, WA
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/9/02	Drillers	: Todd Mecham
End Date	: 11/10/02		: Rowan Miller
Start Time	: 1230		: David Gose
Weather	: Overcast, Showers, Some Sun		

Well: LC-MW-01D
Elev.: 287.58



Depth in	DESCRIPTION	REMARKS
0	DARK YELLOWISH-BROWN SILTY CLAY WITH 50% GRAVEL-FINE TO MEDIUM SOME PULVERIZED	MOIST
5	VERY DARK BROWN CLAYEY GRAVEL- 90% GRAVEL, SOME SILT POSSIBLE GRAVEL UP TO 1" SIZE, PULVERIZED	MOIST
	GRAVEL HAS CHERT, MORE OF THE SOLID GRAY GRAVEL. PULVERIZED WITH OLIVE-BROWN SILT COATING	BECOMING DRIER AT 8' 40 BLOWS/FT
10		10'-12' VERY LOOSE ZONE 2 BLOWS/2FT
	DARK GRAY SILTY SANDY MEDIUM GRAVEL AND COBBLES-BACK TO OLIVE-BROWN AT 12'	MOIST, PROBABLE WATER TABLE AT 12'-14'
15		CHECK FOR WATER AT 15'. POSSIBLE MOISTURE. 1st MATERIAL IS WET. DRILLING TO 35' AND LET SIT OVERNIGHT
20		
25		VERY WET 4-6 BLOWS/FT
	CLEAN PULVERIZED GRAVEL MOSTLY CHERT	MOIST TO WET 14 BLOWS/FT
30		WET
	FINE SANDY SILTY GRAYISH BROWN GRAVEL	STOP AT 35' LET SIT OVER NIGHT 11/10/02 0730 WATER AT 5' BGS. 0800 START BLOW 10 GAL. OF WATER OUT. STOP HERE TO AVOID GETTING EQUIPMENT PLUGGED SO WE DON'T HAVE TO INJECT WATER.
	CLEAN GRAY GRAVEL WITH SOME SILT AND VERY FINE SAND	
35	38' LIGHT OLIVE YELLOW SILT, VERY SLIGHT CLAY. POSSIBLE CONFINING ZONE OR TOP OF BEDROCK.	
40	BOTTOM OF HOLE 39.83'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 39'10"
Bore Diameter : 7"

WELL LOCATION: NORTH WELL LOCATION ALONG LACAMAS CREEK BOUNDARY.

DRILLING METHOD: ROLLER CONE BIT ADVANCED THROUGH 7" CASING.

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 2.67'

MONUMENT NO. AHA-358

USED FORMATION WATER TO HYDRATE BENTONITE.

ONE CENTRALIZER PLACED ABOVE WELL SCREEN.

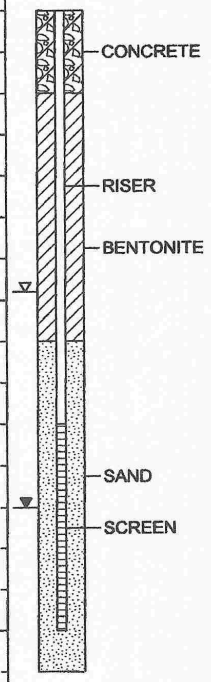
ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

LOG OF BORING LC-MW-02S

CAMP BONNEVILLE, WA.
38-EH-004M-03

GEOLOGIST	: Mary Grez	DRILLING COMPANY	: Cascade Drilling Inc.
START DATE	: 11/12/02	DRILLERS	: Todd Mecham
END DATE	: 11/12/02		: Rowan Miller
START TIME	: 1640		: Andre Bedrik
WEATHER	: Overcast, Some Sun		

Well: LC-MW-02S
Elev.: 288.49



Depth in	DESCRIPTION	REMARKS
0	REDDISH BROWN SLIGHTLY SANDY CLAYEY SILT WITH SOME GRAVEL	
10	LIGHT REDDISH BROWN CLAYEY SILT, LITTLE BIT OF GRAVEL AT 9'	WET AT 12 FEET
15	OLIVE BROWN SANDY SILTY GRAVEL	
	BOTTOM OF HOLE 16'	

BORING AND WELL CONSTRUCTION INFORMATION

BORE DEPTH : 16'
BORE DIAMETER : 7"

WELL LOCATION: 2ND WELL SITE SOUTH OF LACAMAS CREEK ALONG BOUNDARY.

DRILLING METHOD: TRI-CONE ROLLER BIT ADVANCED THRU 7" CASING

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 2.7'

MONUMENT NO. AHA- 364

FORMATION WATER USED TO HYDRATE BENTONITE.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

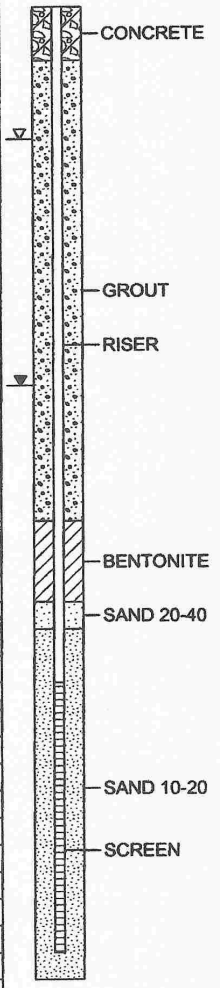
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-02D

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/12/02	Drillers	: Todd Mecham
End Date	: 11/12/02		: Rowan Miller
Start Time	: 1300		: David Gose
Weather	: Overcast, Raining		

Well: LC-MW-02D
Elev.: 288.49



Depth in	DESCRIPTION	REMARKS
0	REDDISH-BROWN SLIGHTLY SILTY SAND, SOME GRAVEL	PUMPING WATER INTO HOLE AT 3'
10		10 BLOWS/FT DONE PUMPING WATER USED ABOUT 40 GAL.
15	GRAVELLY REDDISH-BROWN SANDY SILTY GRAVEL. (PULVERIZED GRAY GRAVEL) GRADUALLY LESS SILT AND SAND, CLEANER GRAVEL	WET
20	OLIVE-BROWN SLIGHTLY SANDY SILTY GRAVEL, (ROUNDED PEBBLES AND PULVERIZED ROCK)	WATER BLEW OUT OF HOLE.
25	OLIVE-BROWN SLIGHTLY SILTY GRAVEL.(PULVERIZED GRAY ROCK). SOME VERY CLEAN GRAVEL LAYERS INTERSPERSED WITH SILT, SAND, AND GRAVEL LAYERS	PRODUCTIVE ZONE. WATER COMING UP OUT OF HOLE.
35	BOTTOM OF HOLE 36'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 36'
Bore Diameter : 7"

WELL LOCATION: 2ND WELL LOCATION SOUTH OF LACAMAS CREEK ALONG BOUNDARY.

DRILLING METHOD: TRI-CONE BIT ADVANCED THROUGH 7" CASING

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 3.1'

MONUMENT NO. AHA-357

HOLE HAND-AUGERED TO 6', NO WATER IN 6' BOREHOLE.

NO CENTRALIZERS USED.

SCREENED 25' TO 35' BECAUSE IT'S A PRODUCTIVE ZONE.

USED FORMATION WATER TO HYDRATE BENTONITE.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

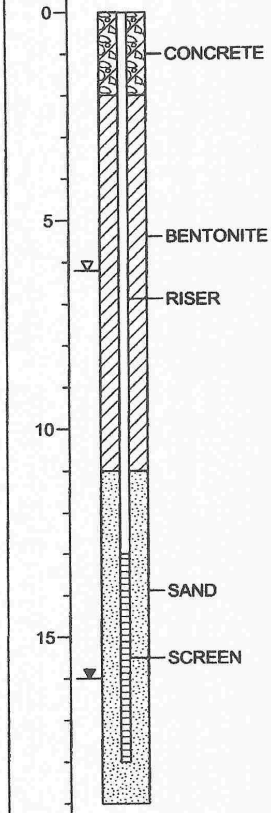
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-03S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/13/02	Drillers	: Todd Mecham
End Date	: 11/13/02		: Rowan Miller
Start Time	: 1400		: Andre Bedrik
Weather	: Rainy, Overcast		

Well: LC-MW-03S
Elev.: 288.56



Depth in	DESCRIPTION	REMARKS
0	REDDISH BROWN SLIGHTLY SANDY SILT WITH GRAVEL. UP TO 80% GRAVEL AND SMALL AMOUNT OF CLAY	VERY MOIST AT 7-8'
10	REDDISH BROWN SANDY CLAYEY SILT, VERY LITTLE GRAVEL.	WET GRAVEL
15	REDDISH BROWN, SANDY SILT, GRAY PULVERIZED GRAVEL	WATER IN HOLE
20	BOTTOM OF HOLE 19'	
25		

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 19'
Bore Diameter : 7"

WELL LOCATION: 3RD WELL LOCATION SOUTH OF LACAMAS CREEK ALONG BOUNDARY

DRILLING METHOD: TRI-CONE ROLLER BIT ADVANCED THRU 7" CASING

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 2.35'

MONUMENT NO. AHA -362

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

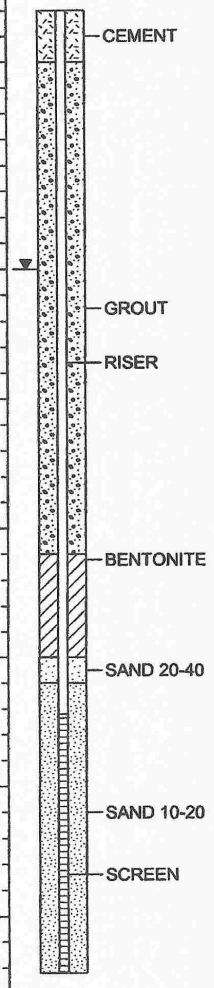
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-03D

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/13/02	Drillers	: Todd Mecham
End Date	: 11/14/02		: Rowan Miller
Start Time	: 1600		: Andre Bednik
Weather	: Overcast, Rainy		

Well: LC-MW-03D
Elev.: 288.50



Depth in	DESCRIPTION	REMARKS
0	REDDISH-BROWN SANDY SILT WITH GRAVEL	DRY 9-10 BLOWS/FT
10	OLIVE-BROWN SLIGHTLY SANDY SILT WITH SOME GRAVEL	MOIST VERY SOFT ZONE, WET
15	OLIVE-BROWN SLIGHTLY SANDY SILTY MIXED GRAVEL. SOME ZONES MOSTLY SILT, SOME MORE GRAVEL.	WATER COMING UP
20	MOSTLY GRAY PULVERIZED GRAVEL WITH SILT, SOME SAND.	EASY CASING PENETRATION
25	GRAYISH-BROWN CLAYEY SILT	
40	BOTTOM OF HOLE 37.17'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 37' 2"
Bore Diameter : 7"

WELL LOCATION: 3RD WELL LOCATION SOUTH OF LACAMAS CREEK BOUNDARY LOCATION.

DRILLING METHOD: TRI-CONE BIT ADVANCED THROUGH 7" CASING.

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

HEIGHT OF CASING ABOVE GROUND 2.48'

MONUMENT NO. AHA-363

BOREHOLE HAND-AUGERED TO 6'.

LEFT CASING IN GROUND OVERNIGHT AT 37'. ENCOUNTERED SILT AND STOPPED 2' SHORT OF GOAL DEPTH TO AVOID INJECTING POTABLE WATER INTO HOLE.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

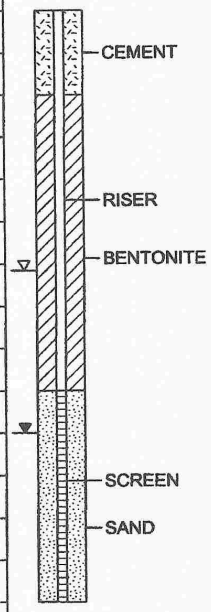
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-04S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/17/02	Drillers	: Matt Ross
End Date	: 11/17/02		: Jesse Cannon
Start Time	: 0815		: Matt Slobig
Weather	: Overcast, Passing Rain		

Well: LC-MW-04S
Elev.: 288.83



Depth in	DESCRIPTION	REMARKS
0	DARK BROWN GRAVELLY SILT, SOME CLAY AND SAND.	MOIST AT 5'
10	GRAYISH BROWN SILTY GRAVEL (UP TO 2" ROUND GRAVEL) WITH SOME SAND AND CLAY.	VERY HARD DRILLING BECAUSE OF GRAVEL AT 10'. WET AT 10' FINISHED HOLE AT 14' BECAUSE OF VERY HARD DRILLING WITH AUGER
14	BOTTOM OF HOLE 14'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 14'
Bore Diameter : 6"

WELL LOCATION: SOUTH WELL LOCATION FROM LACAMAS CREEK ALONG BOUNDARY.

DRILLING METHOD: CME 580 WITH 6" AUGER AND WOOD PLUG

HAND AUGER TO 5'

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED

HEIGHT OF CASING ABOVE GROUND 2.8'

MONUMENT NO. AHA-375

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

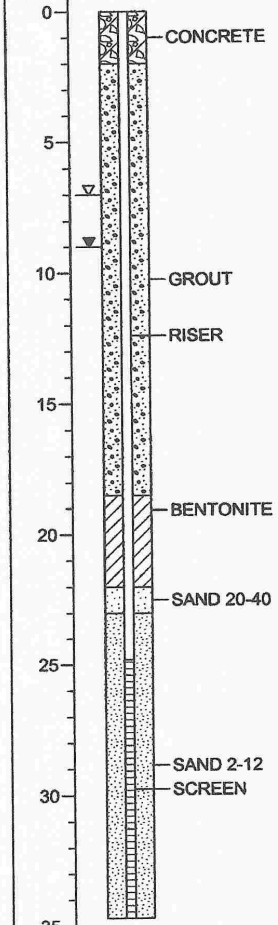
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-04D

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/13/02	Drillers	: Todd Mecham
End Date	: 11/13/02		: Rowan Miller
Start Time	: 0915		: Andre Bednik
Weather	: Rainy		

Well: LC-MW-04D
Elev.: 289.16



Depth in	DESCRIPTION	REMARKS	BORING AND WELL CONSTRUCTION INFORMATION
0	REDDISH-BROWN SLIGHTLY SANDY SILTY, MULTICOLORED GRAVEL.	PUSH CASING TO 6' AND USED POTABLE WATER TO CLEAN HOSES. STOPPED RUNNING WATER AT 7'. HARD DRILLING THROUGH GRAVEL, VERY WET AT 9'. WATER IN HOLE	Bore Hole Depth : 34' 8" Bore Diameter : 7"
10	OLIVE-BROWN SANDY SILTY PULVERIZED GRAY AND MULTICOLOR GRAVEL.	WET TO BOTTOM OF HOLE.	WELL LOCATION: SOUTH WELL PAIR FROM LACAMAS CREEK ALONG BOUNDARY. DRILLING METHOD: TRI-CONE BIT ADVANCED THROUGH 7" CASING. WELL INNER DIAMETER: 2 INCH WELL SLOT SIZE: 0.010 INCH WELL SCREEN MATERIAL: PVC OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING. CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED. HEIGHT OF CASING ABOVE GROUND 2.63' MONUMENT NO. AHA-361 STOPPED DRILLING AT 34' BECAUSE SILT WOULD PLUG HOSES. ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.
15	OLIVE-BROWN SANDY SILTY UNIFORM GRAY GRAVEL. CLEAN GRAVEL ZONE AT 17'-18' ALTERNATE CLEAN GRAVEL ZONES WITH SANDY SILT AND FINE GRAVEL TO B.O.H.		
20			
25			
30			
35	OLIVE-BROWN SILT AND SANDY SILT AT 34.67'		
	BOTTOM OF HOLE 34.67'		
40			

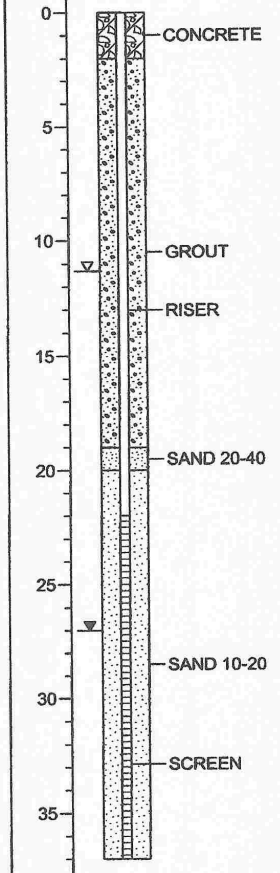
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-05S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/15/02	Drillers	: Matt Ross
End Date	: 11/15/02		: Jesse Cannon
Start Time	: 1140		: Matt Slobig
Weather	: Sunny, Slightly Cloudy		

Well: LC-MW-05S
Elev.: 306.40



Depth in	DESCRIPTION	REMARKS
0	VERY MOIST SLIGHTLY SANDY SILT. REDDISH BROWN SLIGHTLY SANDY SILT, BIT OF CLAY AND FINE GRAVEL	LC-MW-05S-10 LC-MW-05S-0 1140 10 BLOWS/ 6" MOIST AT 3'
5	DARK RED BROWN SILT WITH MOTTLES OF GRAY, VEINS OF RED, GRAY, AND PURPLE IN SPLITSPOON	LC-MW-05-2 1200 LC-MW-05S-5 1210 16 BLOWS/ 6"
10		GETTING VERY MOIST AT 13'-14'
15	BRIGHT BLUE-GRAY STIFF SILT	LC-MW-05S-15 1230
20	YELLOWISH-BROWN SLIGHTLY CLAYEY SILT WITH VARIABLE AMOUNTS OF GRAVEL AND INCREASING CLAY WITH DEPTH	STILL MOIST, NOT WET
25	CLAYEY SILT	WET AT 27'
30		
35		
40		
45	BOTTOM OF HOLE 37'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 37'
Bore Diameter : 6"

WELL LOCATION: EAST SIDE OF CRATER AT DA-3 PAIRED WITH LC-MW-05D

DRILLING METHOD: CME 580 WITH HOLLOW STEM AUGER AND 140 LBS HAMMER.

SAMPLES TAKEN WITH SPLIT SPOON SAMPLED AT 0', 2', 5', 15' DEPTHS SAMPLED FOR EXPLOSIVES, PETN, PERCHLORATE, AND TOTAL METALS. HAMMER USED TO COLLECT SAMPLES.

DUPLICATE LC-MW-05S-10 COLLECTED FROM LC-MW-05S-0.

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 3.7'

MONUMENT NO. AHA-374

PULLED UP 5' AT 25' AND LET SIT FOR 1 HOUR, NO WATER IN HOLE.

GREG JOHNSON, WA. DEPT. OF ECOLOGY SAID TO COMPLETE HOLE AT 37' TO BE 15' ABOVE LC-MW-05D.

TREMIED BENTONITE GROUT FROM TOP OF 20-40 SAND TO 2' BGS.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

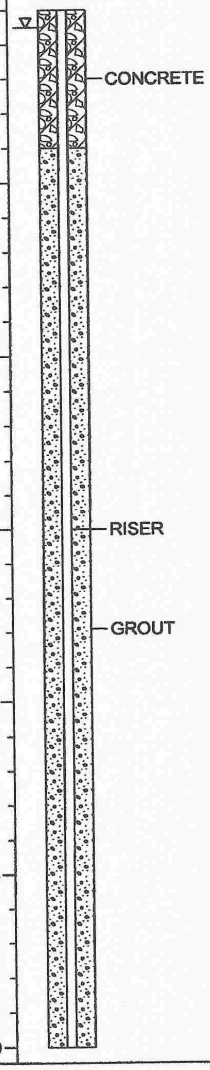
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-05D

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/7/02	Drillers	: Todd Mecham
End Date	: 11/8/02		: Rowan Miller
Start Time	: 1030		: David Gose
Weather	: Overcast, Rainy		

Well: LC-MW-05D
Elev.: 306.34



Depth in	DESCRIPTION	REMARKS
0	BROWN SLIGHTLY SANDY SILT WITH FINE GRAVEL.	DRY
	DARK BROWN SILT WITH 5% FINE GRAVEL.	SOMEWHAT MOIST
10	DARK REDDISH-BROWN SILTY CLAY WITH 25% FINE GRAVEL, ANGULAR AND 2% ROUNDED 1/2"-1" GRAVEL.	8 BLOWS/ FT MOIST (10')
	DARK REDDISH-BROWN SILTY CLAYEY GRAVEL. FINE TO 1/4" GRAVEL. ANGULAR TO ROUNDED. COARSENING WITH DEPTH.	
15	DARK YELLOWISH-BROWN SLIGHTLY SILTY CLAY WITH FINE GRAVEL.	
20	GRAYISH-BROWN SILT AND SLIGHTLY CLAYEY SILT, BARELY ANY GRAVEL.	14 BLOWS/ FT AT 20'.
25	GRAYISH-BROWN SILTY FINE TO MEDIUM GRAVEL	CHECK FOR GROUND WATER AT 24'. LET SIT FOR 20 MINUTES. NO WATER.
	FINE GRAVELY GRAYISH BROWN SILT	
30		

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 63.5'
Bore Diameter : 7"

WELL LOCATION: EAST SIDE OF DA-3 CRATER. WELL PAIR WITH LC-MW-05S

DRILLING METHOD: AIR HAMMER DRIVEN THROUGH 7" CASING.

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND N/A

MONUMENT NO. AHA-360

USE POTABLE WATER AT 20' BECAUSE HOSES ARE PLUGGING WITH SILT.

USED ABOUT 20 GALLONS WITH GOOD RECOVERY.

POTABLE WATER SOURCE: CITY OF PORTLAND.

PVC CASING EXTENDED ON 2/11/03 AND NEW TOP OF CASING MARKED FOR SURVEYING.

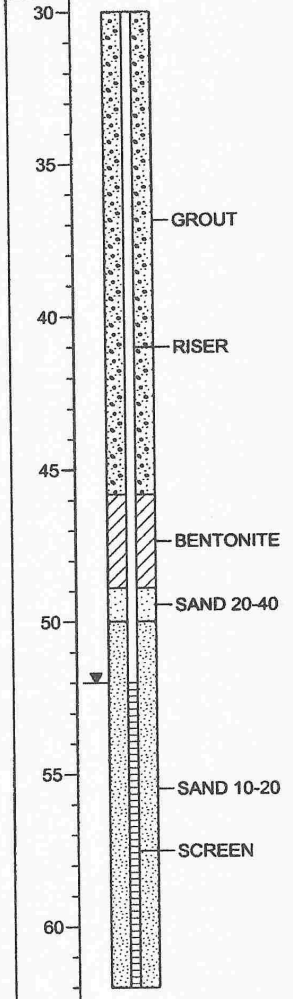
ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

LOG OF BORING LC-MW-05D

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/7/02	Drillers	: Todd Mecham
End Date	: 11/8/02		: Rowan Miller
Start Time	: 1030		: David Gose
Weather	: Overcast, Rainy		

Well: LC-MW-05D
Elev.: 306.34



Depth in	DESCRIPTION	REMARKS
	DARK YELLOWISH-BROWN SILTY CLAY AND CLAYEY SILT. VERY TIGHT.	40 BLOWS/ FT NO LONGER RUNNING WATER. SOIL IS MOIST.
	SAME WITH SOME FINE TO MEDIUM GRAVEL ANGULAR TO ROUNDED UP TO 1/2" NO GRAVEL, SAME OTHERWISE.	33 BLOWS/FT
	BROWN SLIGHTLY CLAYEY SILT.	UP TO 60 BLOWS/ FT.
	THIN DARKER BROWN LAYER.	FAINTLY MOIST
	FINE TO MEDIUM GRAVELLY BROWN SILT.	
	FINE TO MEDIUM GRAVELLY BROWN SILT, GRADING TO OLIVE BROWN SILTY FINE TO MEDIUM PULVERIZED GRAVEL. POSSIBLE TOP OF TROUTDALE.	
	DARK GRAYISH-BROWN SILTY GRAVEL/GRAVELLY SILT. GRAVEL IS PULVERIZED.	CASING PULLED TO 49' WAIT OVERNIGHT. 11/8/02 0745 START DRILLING. WATER AT 52'.
	DARK GRAYISH-BROWN TO GRAY PULVERIZED GRAVEL.	
	RED CLAY ON BOTTOM OF BIT	
	BOTTOM OF HOLE 63.5'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 63.5'
Bore Diameter : 7"

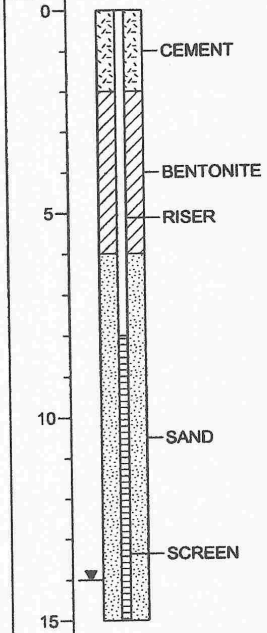
USACHPPM
Readiness from Health

LOG OF BORING LC-MW-06S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/16/02	Drillers	: Matt Ross
End Date	: 11/16/02		: Jesse Cannon
Start Time	: 1515		: Matt Slobig
Weather	: Overcast, Passing, Rain		

Well: LC-MW-06s
Elev.: 305.43



Depth in	DESCRIPTION	REMARKS
0	RED BROWN LOAMY SILT, LOTS OF ROOTS, SOME DECOMPOSED GRAVEL	LC-MW-06S-0 1515 MOIST
	PALE BROWN SILT WITH DECOMPOSED GRAVEL, RUST COLORED MOTTLES RETURNS ARE FAINTLY MOIST, RED BROWN SILT WITH DECOMPOSED GRAVEL AND ROOTS	LC-MW-06S-2 1525 DRY
5		LC-MW-06S-5 1530
10		VERY MOIST NOT WET
15	BOTTOM OF HOLE 15'	WET AT 15'
20		
25		

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 37'
Bore Diameter : 6"

WELL LOCATION: NORTH SIDE OF DA-3 CRATER.

DRILLING METHOD: CME 580 WITH 6" HOLLOW STEM AUGER AND 140 LBS HAMMER BIT.

SAMPLES TAKEN WITH SPLIT SPOON SAMPLED AT 0', 2', 5', DEPTHS SAMPLED FOR EXPLOSIVES, PETN, PERCHLORATE, AND METALS.

COULD NOT COLLECT 15' SAMPLE BECAUSE OF SATURATED CONDITIONS

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PV

HEIGHT OF CASING ABOVE GROUND 2.84'

MONUMENT NO. AHA-372

USED FORMATION WATER TO HYDRATE BENTONITE

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

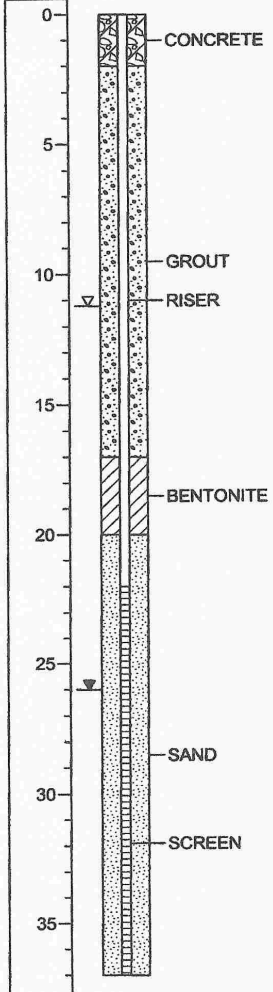
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-07S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/16/02	Drillers	: Matt Ross
End Date	: 11/16/02		: Jesse Cannon
Start Time	: 1100		: Matt Slobig
Weather	: Overcast, Passing Rains		

Well: LC-MW-07S
Elev.: 305.12



DESCRIPTION	REMARKS
PLATY RED-BROWN DRY SILT WITH SOME FINE GRAVEL	LC-MW-07S-0 1110 + DUPLICATE
DRY PALE YELLOWISH-BROWN SILT, A BIT OF FINE GRAVEL-DECOMPOSED ROCK.	LC-MW-07S-10 1140 LC-MW-07S-2 1125
RED-BROWN SILT, BARELY ANY GRAVEL	LC-MW-07S-5 1145 GETTING MOIST MOIST MOIST ZONE
GRAY STIFF SILT, LIGHT GRAYISH BROWN SILT CUTTINGS	LC-MW-07S-15 1210
OLIVE BROWN SILT. SOME CLAY AND GRAVEL	MOIST VERY MOIST TO WET
YELLOWISH-BROWN GRAVELLY SILT	
BOTTOM OF HOLE 37'	

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 37'
Bore Diameter : 6"

WELL LOCATION: WEST SIDE OF DA-3 CRATER.

DRILLING METHOD: CME 580 WITH 6" HOLLOW STEM AUGER AND 140 LBS HAMMER.

SAMPLES TAKEN WITH SPLIT SPOON SAMPLER AT 0', 2', 5', 15' DEPTHS. SAMPLED FOR EXPLOSIVES, PETN, PERCHLORATE, AND METALS.

LC-MW-07S-10 IS A DUPLICATE OF LC-MW-07S-0

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 3.8'

MONUMENT NO. AHA-371

COULDN'T RETRACT THE HAMMER BECAUSE THE CABLE BROKE. DRILLED TO 37' AND PULLED AUGER AND HAMMER THEN INSTALLED WELL SUCCESSFULLY IN OPEN BOREHOLE.

USED FORMATION WATER TO HYDRATE BENTONITE.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

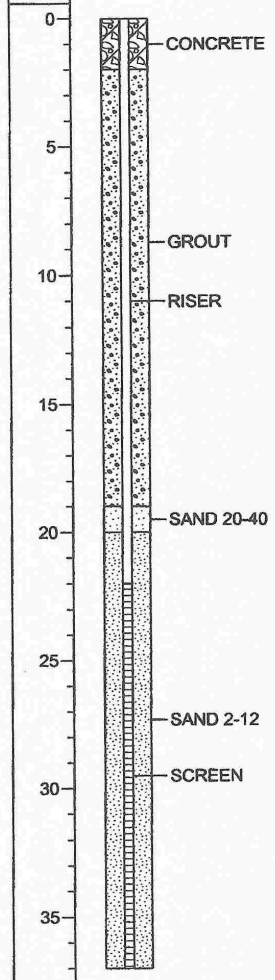
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-08S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/16/02	Drillers	: Matt Ross
End Date	: 11/16/02		: Jesse Cannon
Start Time	: 0740		: Matt Slobig
Weather	: Overcast		

Well: LC-MW-08S
Elev.: 306.10



Depth in	DESCRIPTION	REMARKS
0	BROWN SILTY LOAM LOTS OF ROOTS, SOME GRAVEL.	LC-MW-08S-0 0740 MOIST
	DRY SILTY GRAVEL, GRAYISH-BROWN DRY SILT WITH RUST COLORED MOTTLES	LC-MW-08S-2 0750 HAD TO MOVE 1' EAST BECAUSE OF ROOT
5	REDDISH-BROWN CLAYEY SILT WITH DECOMPOSED GRAVEL AND RED MOTTLES	LC-MW-08S-5 0800 FAINTLY MOIST
10		
		A LITTLE MORE MOIST AT 12' BECOMING WET AT 14'
15	STIFF GRAY SILT, BARELY MOIST	LC-MW-08S-15 0815 POOR RECOVERY DROVE ANOTHER SAMPLE TO COMPOSITE FROM 15'-18'
	OLIVE-BROWN STIFF SILT AT 17'	
20	MOIST REDDISH-BROWN SILT WITH VARIABLE CLAY AND FINE GRAVEL	
25		NEVER ENCOUNTERED WET ZONE WE SAW IN LC-MW-05S
30		
35	BOTTOM OF HOLE 37'	
40		

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 37'
Bore Diameter : 6"

WELL LOCATION: SOUTH SIDE OF DA-3 CRATER.

DRILLING METHOD: CME 580 WITH 6" HOLLOW STEM AUGER AND 140 LBS HAMMER.

SAMPLES TAKEN WITH SPLIT SPOON SAMPLER AT 0', 2', 5', 15' DEPTHS. SAMPLED FOR EXPLOSIVES, PETN, PERCHLORATE AND METALS

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

HEIGHT OF CASING ABOVE GROUND 3.68'

MONUMENT NO. AHA-373

NO WATER LEVELS TAKEN PRIOR TO SAMPLING BECAUSE OF SEDIMENT IN WELL.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

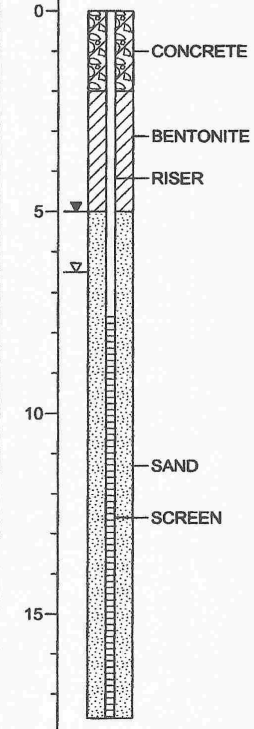
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-09S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/15/02	Drillers	: Matt Ross
End Date	: 11/15/02		: Jesse Cannon
Start Time	: 0737		: Matt Slobig
Weather	: Foggy		

Well: LC-MW-09S
Elev.: 344.91



Depth in	DESCRIPTION	REMARKS
0	DARK REDDISH-BROWN SLIGHTLY GRAVELLY, SLIGHTLY CLAYEY SILT	MOIST
5	CHATTER AT 5' GRAVEL LAYER	WET AT 5'
	A LITTLE MORE GRAVEL	
10	COLOR STARTING TO CHANGE TO DARK GRAYISH-BROWN	
15		
20		
	BOTTOM OF HOLE 17.5'	
25		

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 17.6'
Bore Diameter : 6"

WELL LOCATION: SW WELL LOCATION AT DA-2 NEAR CRATER.

DRILLING METHOD: CME 580 WITH 6" HOLLOW STEM AUGER WOODEN PLUG.

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING.
CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED.

HEIGHT OF CASING ABOVE GROUND 2.4'

MONUMENT NO. AHA-369

USED 10' SCREEN BECAUSE WATER WAS ENCOUNTERED AT 5' bgs.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

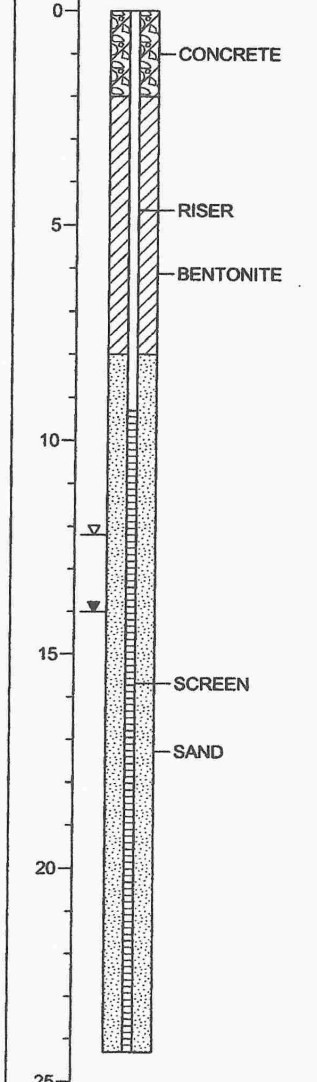
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-10S

CAMP BONNEVILLE, WA.
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/14/02	Drillers	: Matt Ross
End Date	: 11/14/02		: Jesse Cannon
Start Time	: 1530		: Matt Slobig
Weather	: Sunny, Partly Cloudy		

Well: LC-MW-10S
Elev.: 349.67



Depth in	DESCRIPTION	REMARKS	BORING AND WELL CONSTRUCTION INFORMATION
0	DARK YELLOWISH-BROWN SLIGHTLY CLAYEY SILT- NO GRAVEL	MOIST, PLASTIC	Bore Hole Depth : 24'3" Bore Diameter : 6" WELL LOCATION: SE WELL NEAR ROAD. DRILLING METHOD: CME 580 WITH 6' HOLLOW STEM AUGER AND WOOD PLUG. WELL INNER DIAMETER: 2 INCH WELL SLOT SIZE: 0.010 INCH WELL SCREEN MATERIAL: PVC OPEN TRIANGLE: DEPTH TO WATER BEFORE DEVELOPING. CLOSED TRIANGLE: DEPTH WATER ENCOUNTERED. HEIGHT OF CASING ABOVE GROUND 1.8' MONUMENT NO. AHA-370 ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.
5		MORE MOIST	
10			
15	GRAYISH-BROWN TO DARK REDDISH-BROWN OR MAROON SLIGHTLY FINE GRAVELY SILT.	NO RETURN FROM 14' WATER AT 14'	
20			
25	BOTTOM OF HOLE 24.25'		

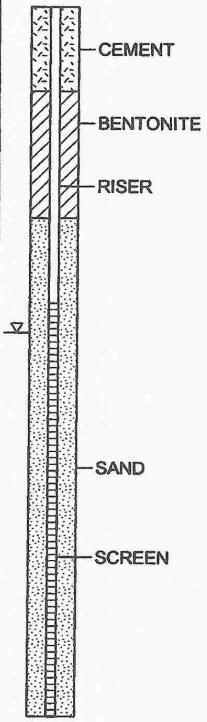
USACHPPM
Readiness thru Health

LOG OF BORING LC-MW-11S

CAMP BONNEVILLE, WA
38-EH-004M-03

Geologist	: Mary Grez	Drilling Company	: Cascade Drilling Inc.
Start Date	: 11/14/02	Drillers	: Matt Ross
End Date	: 11/14/02		: Matt Slobig
Start Time	: 1430		: Jesse Cannon
Weather	: Sunny, Partly Cloudy		

Well: LC-MW-11S
Elev.: 342.72



Depth in	DESCRIPTION	REMARKS
0	DARK YELLOWISH-BROWN SILT, SOME GRAVEL, POSSIBLE FILL MATERIAL	WATER AT GROUND SURFACE
	GRAYISH-BROWN SLIGHTLY FINE SANDY SILT CAN HEAR SOME GRAVEL IN HOLE	CHATTER AT 10'
17	BOTTOM OF HOLE 17'	WATER IN BOTTOM OF HOLE

BORING AND WELL CONSTRUCTION INFORMATION

Bore Hole Depth : 17'
Bore Diameter : 6"

WELL LOCATION: NORTH WELL AT DA-2 NE OF POND.

DRILLING METHOD: CME 580 WITH 6" HOLLOW STEM AUGER AND WOOD PLUG.

WELL INNER DIAMETER: 2 INCH
WELL SLOT SIZE: 0.010 INCH
WELL SCREEN MATERIAL: PVC

WATER IS AT GROUND SURFACE IN UXO AUGER HOLE.

HEIGHT OF CASING ABOVE GROUND 3.0'

MONUMENT NO. AHA-368

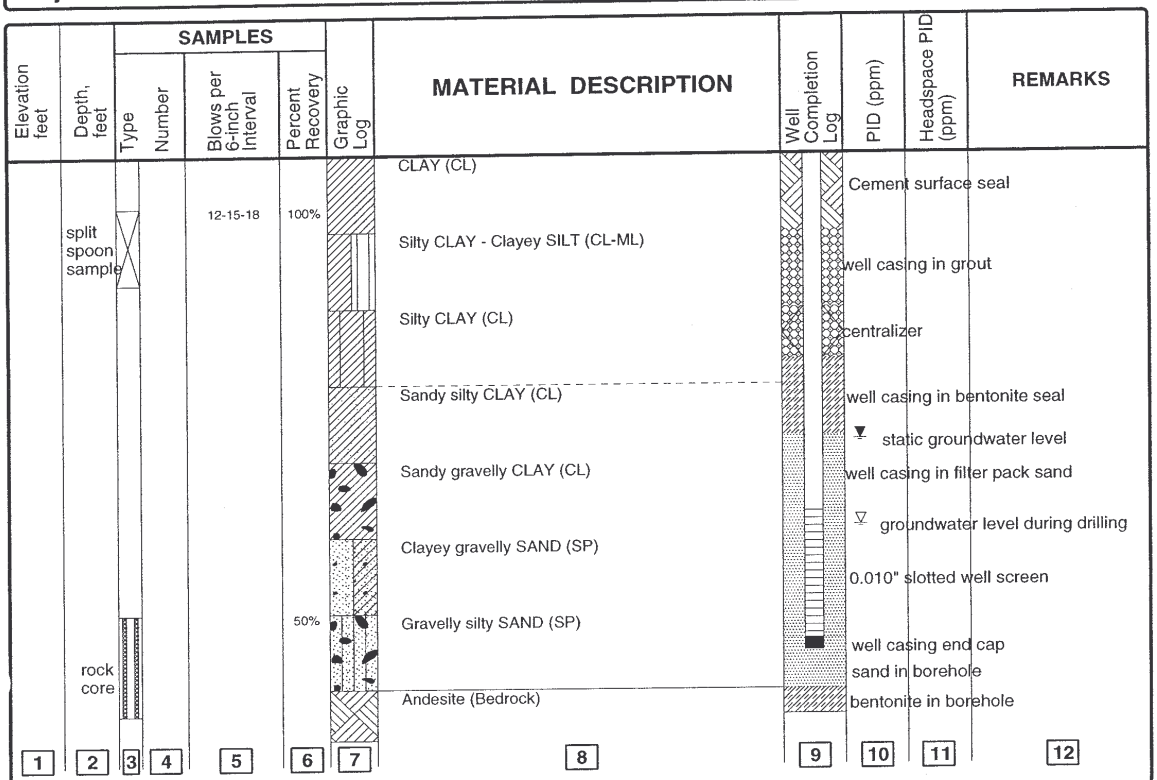
USED 10' SCREEN BECAUSE OF SHALLOW WATER TABLE.

USED FORMATION WATER TO HYDRATE BENTONITE.

ALL WELLS COMPLETED WITH STEEL SURFACE MONUMENT SET 2' DEEP INTO CONCRETE WITH A CONCRETE PAD AND THREE PROTECTIVE BALLARDS PAINTED YELLOW.

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Key to Log of Borings



COLUMN DESCRIPTIONS

1	**Elevation:**	Elevation (in feet) with respect to mean sea level or assumed datum.
2	**Depth:**	Vertical distance (in feet) below ground surface.
3	**Sample Type:**	Type of soil sample collected at depth interval depicted; symbols explained above.
4	**Sample Number:**	Sample identification number.
5	**Blows per 6 inches:**	Number of blows required to advance driven sampler each 6-inch drive interval.
6	**Percent Recovery:**	Percentage of sample recovered for given sample interval; blank if not recorded.
7	**Graphic Log:**	Graphic depiction of subsurface material encountered.
8	**Material Description:**	Description of subsurface material encountered, including USCS soil designation.
9	**Well Completion Log:**	Graphic depiction of well subsurface material.
10	**PID (ppm):**	Photoionization detector readings in parts per million (ppm) of standard gas.
11	**Headspace PID readings:**	PID readings taken of enclosed portion of soil sample at recorded depth.
12	**Remarks:**	Comments or observations pertinent to drilling/sampling.

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System (USCS) and include consistency/relative density (where standard blow count correlation is possible), moisture, and color. Field descriptions may have been modified to reflect results of laboratory tests.
2. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

URS

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW03A

Sheet 1 of 2

Date(s) Drilled	6/5/2001	Logged By	J.Rapp	Checked By	S. Wolfe
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (feet)	46.5
Drill Rig Type	CME-75	Sampler Type	18" Split Spoon	Surface Elevation	511.9 NGVD
Groundwater Level	28.50 feet bgs 6/5/01 1410	Hammer Weight and Drop	30" 140 lb	Top of PVC Elevation	514.9 NGVD
Diameter of Hole (inches)	8.75	Diameter of Well (inches)	2	Type of Well Casing	Pre-packed V wire mesh	Screen Perforation	0.010"
Type of Sand Pack	20/40, 10/20 Silica	Type and Depth of Seal(s)	filter sand (38'-46' bgs); bentonite (2'-38' bgs); cement (0'-2')		
Comments	Monitoring well coordinates: Easting 1,154,413.64 Northing 141,287.41				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Boring Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
510	0						Silty CLAY - Clayey SILT (CL-ML); moist; reddish-brown; low to medium plasticity					UXO avoidance to 8' bgs
	5						same as above					
505												
	10			7-7-7	100		same as above - increasing clay content		0	0	1150	
500												
	15			6-6-6	100		Silty CLAY (CL) - moist; light brown; soft; trace of sand		0	0	1156	
495												
	20			2-2-5	100		same as above - very soft		0	0	1206	
490												
	25			14-15-8	100		black-grey lenses of weathered sand		0	0	1227	
485												groundwater le 28.50' bgs (6/5/ 1410)
	30											

URS

Report: ENV_23A; Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\OB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW03A

Sheet 2 of 2

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
480	30			4-3-4	100		Clay (CL) - very moist; soft; light brown		0	0	1250	
475	35			5-5-5	100		same as above - very soft; highly weathered sand grains; white; black; yellow-orange		0	0	1300	
470	40			3-3-4	100		Sandy silty CLAY (CL) - wet; weathered sand grains; mottled pink-white-black		0	0	1310	
465	45			11-30-42	100		same as above - wet; low plasticity; hard		0	0	1324	groundwater encountered at approx. 43' bgs (6/5/01 1320)
460	50						Boring terminated at approximately 46.5' bgs on 6/5/01 at 1330					
455	55											
450	60											
445	65											
	70											

URS

Report: EN : Project File: I:\PROJECTS\WCFS-A--1\BONNEL--1\DELIVE--1\JOHNRI--1\BORING--1\CB_L4.GPJ; Data e:\WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW04A

Sheet 1 of 2

Date(s) Drilled	6/4/2001	Logged By	J.Rapp	Checked By	S. Wolfe
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (feet)	54.0
Drill Rig Type	CME-75	Sampler Type	18" Split Spoon	Surface Elevation	508.8 NGVD
Groundwater Level	35 feet bgs 6/5/01 0730	Hammer Weight and Drop	30" 140 lb	Top of PVC Elevation	511.8 NGVD
Diameter of Hole (inches)	8.75 / Diameter of Well (inches) 2	Type of Well Casing	Pre-packed V wire mesh	Screen Perforation	0.010"
Type of Sand Pack	20/40, 10/20 Silica	Type and Depth of Seal(s)	bentonite (2'-30', 43'-54'); filter sand (30'-43'); cement (0'-2')		
Comments	Monitoring well coordinates: Easting 1,154,420.93 Northing 141,521.95				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Boring Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
	0						Silty CLAY - Clayey SILT (CL-ML); moist; reddish-brown; low to medium plasticity		0	0	0815	UXO avoidance to 8' using a backhoe
505	5						same as above					
500	10						same as above - very soft clay		0	0	0820	
495	15						Silty CLAY (CL) - moist; light brown; soft; mottled grey-black					
490	20						same as above - weathered sand grains; mottled orange with black lenses		0	0	0830	Rig down for repairs 0900 - 1130
485	25			25-20-6	100		same as above - medium stiff; trace of yellow gravel		0	0	1155	
480	30											

URS

Report: ENV_23A; Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW04A

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
480	30			6-5-6	100		Sandy silty CLAY (CL) - very moist; highly weathered sand grains; yellow; red; black		0	0	1207	
				20-13-16	100				0	0	1220	Depth to groundwater approx. 33' bgs on 6/4/01 1345
475	35			6-6-7	100		same as above - highly weathered sand grains; white; black; yellow-orange; very soft		0	0	1228	
470	40			9-14-20	100		same as above - wet; weathered sand grains; mottled white-black	▽	0	0	1300	Groundwater encountered at approx. 41' bgs on 6/4/01 1313
				14-30-33	100				0	0	1313	
465				14-56/6"	50				0	0		
	45			20-50/4"	25		weathered andesite fragments, hard		0	0		
460	50						same as above					
455							Boring terminated at approximately 54 feet bgs on 6/4/01 1500					
	55											
450	60											
445	65											
440	70											

URS

Report: ENV. Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data T .WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW05A

Sheet 1 of 2

Date(s) Drilled	6/6/2001	Logged By	J.Rapp	Checked By	S. Wolfe
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (feet)	36.5
Drill Rig Type	CME-75	Sampler Type	18" Split Spoon	Surface Elevation	506.9 NGVD
Groundwater Level	29.30 feet bgs 6/6/01 1130	Hammer Weight and Drop	30" 140 lb	Top of PVC Elevation	509.9 NGVD
Diameter of Hole (inches)	8.75	Diameter of Well (inches)	2	Type of Well Casing	Pre-packed V wire mesh	Screen Perforation	0.010"
Type of Sand Pack	20/40, 10/20 Silica	Type and Depth of Seal(s)	bentonite (2'-25', 34'-36' bgs); filter sand (25'-34' bgs); cement (0'-2')		
Comments	Monitoring well coordinates: Easting 1,154,337.25 Northing 141,243.45				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Boring Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate 24-hour (Time clock)	REMARKS
505	0						Silty CLAY - Clayey SILT (CL-ML); moist; reddish-brown; low to medium plasticity		0	0	0940	UXO avoidance to 8' bgs
	5						same as above					
500												
	10			4-7-10	100		same as above		0	0	0946	
495												
	15			5-7-9	100		Silty CLAY (CL) - moist; light brown; mottled grey-black; medium plasticity		0	0	0954	
490												
	20			4-7-9	100		same as above		0	0	1001	
485												
	25			6-10-18	100		Sandy CLAY (CL) - wet; stiff; red-brown; weathered sand; trace of yellow gravel		0	0	1008	
480												Depth to ground... 28.3' bgs on 6/6/01 1130
	30											

URS

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW05A

Sheet 2 of 2

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
	30			4-5-7	100		same as above - decreasing stiffness		0	0	1016	Groundwater encountered at approx. 31' bgs 6/6/01 1110
475												
	35			5-7-10	100		same as above - wet; medium stiff; red-brown; some gravel		0	0	1023	
470							Boring terminated at approximately 36.5' bgs on 6/6/01 1136					
	40											
465												
	45											
460												
	50											
455												
	55											
450												
	60											
445												
	65											
440												
	70											

URS

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Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW06A

Sheet 1 of 1

Date(s) Drilled	9/9/02	Logged By	J. Rapp	Checked By	S. Wolfe
Drilling Method	Hand Auger	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (FT BGS)	6.0
Drill Rig Type	NA	Sampler Type	18" Split Spoon	Surface Elevation	
Groundwater Level	6 feet bgs	Drill Bit Size/Type	4" OD hand auger	Top of PVC Elevation	
Diameter of Hole (inches)	4 / Diameter of Well (inches) 0.75	Type of Well Casing	Schedule 40 PVC	Screen Perforation	0.010"
Type of Sand Pack	10/20 Silica	Type and Depth of Seal(s)	bentonite (0-4'); filter sand (4-6')		
Comments	Monitoring well coordinates: Easting: Northing:				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Time 24-hr clock	SAMPLES Dye test	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	Water/Soil Sheen Test	Soil - UV Fluorescence	PID Readings (ppm)	REMARKS
	0						Surface vegetation Brown silty CLAY (CL-ML) - dense, moist, some to trace yellow sub-rounded to rounded gravel, gravel size is 0.125" median diameter					No odor or evidence of contamination
	1											
	2											
	3			0930			Same as above with trace black, weathered, angular bedrock (andesite) fragments					
	4											
	5						Same as above 30% black sub-angular to angular bedrock in silty clay matrix					
	6						Soil boring terminated at 6 feet bgs (due to refusal) on 9/9/02 at 0930					
	7											
	8											
	9											
	10											

URS

Report: ENV_23A; Project File: E:\PROJECTS\BONNEL~1\DELIVE~1\JOHNRI~1\BORING~1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 10/30/02

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-SB07A

Sheet 1 of 2

Date(s) Drilled	12/16/02	Logged By	J. Rapp	Checked By	S. Wolfe
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8.75" OD auger	Total Depth Drilled (feet)	40.0
Drill Rig Type	CME-150	Drilling Contractor	Cascade Drilling Inc.	Top of PVC Elevation (feet)	NA
Groundwater Level (feet)	40 feet bgs on 12/16/02	Hammer Weight/ Drop (lbs/in.)	30" 140 lb	Approx. Surface Elevation (feet)	476.35 NGVD
Diameter of Hole (inches)	8	Diameter of Well (inches)	NA	Type of Well Casing	NA	Screen Perforation	NA
Type of Sand Pack	NA	Type/Thickness of Seal(s)	NA		
Comments	Soil boring abandoned and backfilled with bentonite chips. Boring coordinates: Northing: 140745.21 Easting: 1154417.20				

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows/foot	Headspace (ppm)	Graphic Log	MATERIAL DESCRIPTION	Drilling Progress (24-hour clock)	Well Completion Log	REMARKS AND WELL DETAIL
475	0						Reddish-brown silty CLAY (CL) - medium dense, moist, medium plasticity, trace fine rock fragments	0856		0-40 feet: No odor or visual evidence of contamination
470	5			6 11 14				0900		
465	10			7 17 20			Reddish-brown clayey SILT to silty CLAY (CL-ML) - dense, moist, slight plasticity, some sub-round yellow-orange fine gravel, trace weathered black sand grains	0906		
460	15			6 8 10			Reddish-brown CLAY (CL) - medium stiff, moist, mottled gray and black, medium to low plasticity	0916		auger retracted - no groundwater present
455	20			4 9 19				0923		auger retracted - no groundwater present
	25									

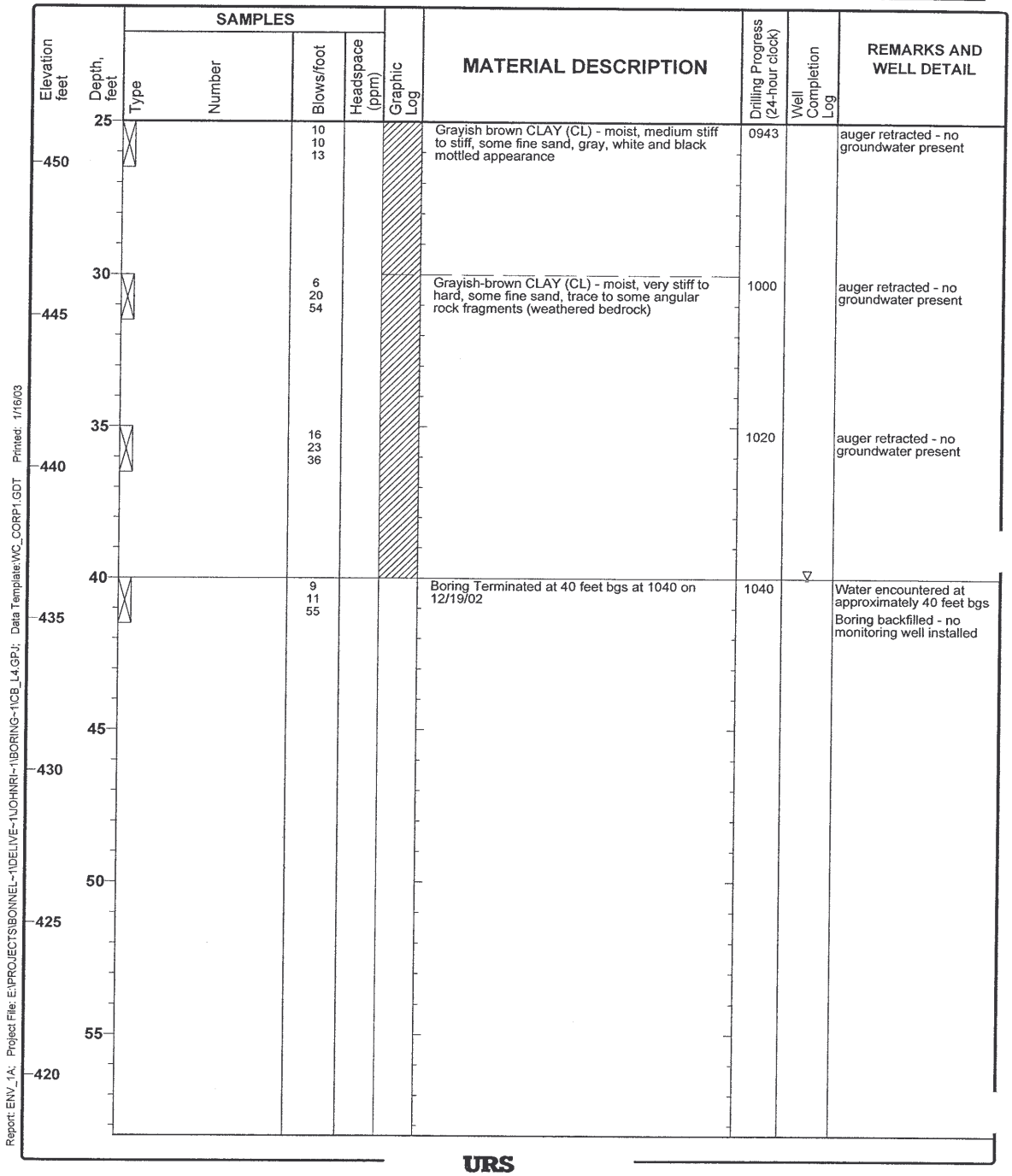
Report: ENV_1A; Project File: E:\PROJECTS\BONNEL~1\DELIVE~1\JOHNRI~1\BORING~1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 1/16/03

URS

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-SB07A

Sheet 2 of 2



Report: ENV_1A; Project File: E:\PROJECTS\BONNEL~1\DELIVE~1\JOHNRI~1\BORING~1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 1/16/03

URS

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW01B

Sheet 1 of 3

Date(s) Drilled	6/14/2001 to 6/18/2001	Logged By	J.Rapp	Checked By	S. Wolfe
Drilling Method	Air Rotary Tubex	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (feet)	76.0
Drill Rig Type	IR T3W Ingersoll Rand	Sampler Type	NA	Surface Elevation	526.6 NGVD
Groundwater Level	11 feet bgs 6/19/01 1120	Hammer Weight and Drop	NA	Top of PVC Elevation	529.6 NGVD
Diameter of Hole (inches)	10	Diameter of Well (inches)	2	Type of Well Casing	Schedule 40 PVC	Screen Perforation	0.010"
Type of Sand Pack	20/40 Silica	Type and Depth of Seal(s)	bentonite (35'-38', 58'-76'); filter sand (38'-58'); cement grout (2'-35'); cement (0'-2')		
Comments	Monitoring well coordinates: Easting 1,154,600.01 Northing 141,304.73				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Boring Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
525	0						Silty CLAY - Clayey SILT (CL-ML); moist; reddish-brown; low to medium plasticity		0	0	0810	UXO Avoidance to 10'
	5						same as above		0	0	0812	
520												
	10						same as above		0	0	0828	Depth to groundwater 11' bgs (6/19/01 at 1120)
515												
	15						Silty CLAY (CL) - moist; light brown; soft;		0	0	0836	
510												
	20						same as above - weathered sand grains; mottled orange with black lenses of weathered sand		0	0	0859	centralizer at 20' bgs
505												
	25						same as above - trace of yellow gravel		0	0	0905	
500												
	30											

URS

Report: ENV Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data s:\WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW01B

Sheet 2 of 3

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time 24-hour clock)	REMARKS
495	30						Sandy silty CLAY (CL) - moist; red-brown; medium stiff; trace of gravel		0	0	0942	
490	35						same as above		0	0	0945	
485	40						Sandy CLAY (CL) - moist; mottled; yellow; black; weathered sand grains; weathered bedrock; trace yellow gravel		0	0	0959	centralizer at 40' bgs
480	45						same as above		0	0	1003	bentonite seal 45-49' bgs
475	50						Sandy gravelly CLAY (CL) - wet; black; white; green; weathered bedrock; angular		0	0	1041	water encountered at approx. 50' bgs (6/14/01 1140) advance 7" steel casing fromn 49' bgs
470	55						same as above - calcite nodules, weathered bedrock		0	0	1240	air rotary drilling through weathered bedrock zone, no coring
465	60						Gravelly SAND (SP-GP) - wet, black, angular fragments of andesite		0	0	1301	
	65								0	0		bentonite seal placed at 65' bgs rock coring started on 6/15/01 0737
460	70		Run #1		92%		top of apparent competent bedrock Phaneritic Andesite - unweathered bedrock; porphyritic; hornblende; olivine; hard horizontal fracture (8 degrees); crystalline-carbonate infilling fracture (5 degrees) vesicles		0	0		advance rock core bit from 66' bgs a 0 RPM

URS

Report: ENV_23A; Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW01B

Sheet 3 of 3

Elevation, feet (MSL)	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Blows per 6-inch Interval	SAMPLES: Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
455	70		Run #2		46%		vesicles horizontal fracture vesicles horizontal fracture horizontal fracture fracture (15 degrees)		0	0		Run #1 66' - 71' bgs; 92% recovery; 86% RQD 73.2' bgs bottom of recovered rock core
450	75						Boring terminated at approx. 76' bgs (6/18/01 @ 1052); bottom 2.8' of core not recovered					Run #2 71' -76' bgs; 46% recovery; 100% RQD
445	80											
440	85											
435	90											
430	95											
425	100											
420	105											
	110											

Report: ENV Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data : 3:WC_CORP1.GDT Printed: 11/26/01

URS

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW02B

Sheet 1 of 3

Date(s) Drilled	6/19/2001 to 6/22/2001	Logged By	J.Rapp	Checked By	S. Wolfe
Drilling Method	Air Rotary Tubex	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (feet)	85.0
Drill Rig Type	IR T3W Ingersoll Rand	Sampler Type	NA	Surface Elevation	515.5 NGVD
Groundwater Level	32.8 feet bgs 6/25/01 1133	Hammer Weight and Drop	NA	Top of PVC Elevation	518.5 NGVD
Diameter of Hole (inches)	10	Diameter of Well (inches)	2	Type of Well Casing	Schedule 40 PVC	Screen Perforation	0.010"
Type of Sand Pack	20/40 Silica	Type and Depth of Seal(s)	bentonite (35'-38', 72'-85'); filter sand (57'-72'); cement grout (2'-35'); cement (0'-2')		
Comments	Monitoring well coordinates: Easting 1,154,354.30 Northing 141,385.97				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Boring Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
515	0						Gravelly silty SAND (SP) - dry; light brown; possible imported fill		0	0	1440	UXO Avoidance to 8' bgs advance 9.75" steel casing
510	5								0	0	1443	
												rock obstruction
505	10						Rock - aphanitic; mica, horneblend, crystalline carbonate, possible boulder		0	0	1512	casing pushed off center. Use 14" hammer to open hole past rock obstruction.
500	15						Silty CLAY - Clayey SILT (CL-ML); moist; reddish-brown; low to medium plasticity		0	0		approximate bottom of rock obstruction
									0	0	1627	resume drilling 6/20/01
												centralizer at 19' bgs
495	20						same as above		0	0		
490	25						same as above - trace of yellow gravel		0	0		
									0	0	1654	
	30											

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Report: ENV_23A; Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW02B

Sheet 2 of 3

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
485	30						same as above - mottled yellow orange					
												static water level recorded on 6/25/01 1133
480	35						same as above					
									0	0	1706	
												centralizer at 39' bgs
475	40						Sandy CLAY (CL) - moist; mottled; yellow; black; weathered sand grains; weathered bedrock; trace yellow gravel; low plasticity					
												water encountered at 41.6' on 6/21/01 0843
470	45						same as above		0	0	1732	
									0	0	1745	resume drilling 6/21/01
465	50						same as above					
460	55						same as above					
									0	0	0815	
												centralizer at 59' bgs
455	60						same as above					
450	65						same as above - wet; hard; stiff		0	0	0857	
	70								0	0	0921	

Report: EN\ Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data : WC_CORP1.GDT Printed: 11/26/01

URS

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW02B

Elevation, feet (MSL)	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Blows per 6-inch Interval	SAMPLES: Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
445	70						Clayey gravelly SAND (SW) - wet; black; white; green; weathered andesite; angular		0	0	0938	
440	75		Run #1		40%		top of apparent competent bedrock Phaneritic Andesite - unweathered bedrock; porphyritic; hornblende; olivine; hard vesicles horizontal fracture horizontal fracture		0	0	1240	bentonite seal; begin rock coring at 75' bgs
435	80		Run #2		0%				0	0	1320	end of core Run #1; 40% recovery; 100% RQD
430	85						Boring terminated at 85' bgs on 6/21/01 1500		0	0	1446	end of core Run #2; 0% recovery
425	90											
420	95											
415	100											
410	105											
	110											

URS

Report: ENV_23A; Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW03B

Sheet 1 of 2

Date(s) Drilled	6/25/2001 to 6/27/2001	Logged By	J.Rapp	Checked By	S. Wolfe
Drilling Method	Air Rotary Tubex	Drilling Contractor	Cascade Drilling Inc.	Total Depth Drilled (feet)	70.0
Drill Rig Type	IR T3W Ingersoll Rand	Sampler Type	NA	Surface Elevation	508.5 NGVD
Groundwater Level	27 feet bgs 6/26/01 0755	Hammer Weight and Drop	NA	Top of PVC Elevation	511.5 NGVD
Diameter of Hole (inches)	10	Diameter of Well (inches)	2	Type of Well Casing	Schedule 40 PVC	Screen Perforation	0.010"
Type of Sand Pack	20/40 Silica	Type and Depth of Seal(s)	bentonite (42'-45', 60'-70'); filter sand (45'-60'); cement (2'-42'); cement (0'-2')		
Comments	Monitoring well coordinates: Easting 1,154,398.22 Northing 141,268.17				

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per 6-inch Interval	SAMPLES Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Boring Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
	0						Silty CLAY - Clayey SILT (CL-ML) - moist; red-brown; some sand; trace gravel; low to medium plasticity		0	0	1330	UXO Avoidance to 8' bgs advance 9.75" steel casing
505												
	5						same as above		0	0	1334	
500												centralizer at 7' bgs
	10						same as above					
495												
	15						same as above		0	0	1355	
490												
	20						same as above		0	0	1400	
485												
	25						same as above - medium stiff; trace of yellow gravel					
480												Depth to groundwater 27' bgs 6/26/01 0755 centralizer at 27' bgs
	30						same as above - some sand, some gravel		0	0	1450	
475												
	35											

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Report: ENV Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data 1 I:\WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW03B

Sheet 2 of 2

Elevation, feet (MSL)	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 6-inch Interval	Percent Recovery	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	PID (ppm)	Headspace PID (ppm)	Drilling Rate (Time, 24-hour clock)	REMARKS
475	35						same as above					
470	40						Sandy CLAY (CL) - mottled; weathered sand grains; some yellow gravel		0	0	1457	
465	45						same as above - some gravel to 1"; weathered andesite fragments					centralizer at 47' bgs
460	50						same as above - weathered andesite, altered sand grains, quartz nodules		0	0	1550	groundwater encountered at approx. 50 feet bgs 6/25/01 1600
455	55						same as above - weathered andesite		0	0	1605	
450	60		Run #1		93%		Phaneritic Andesite - unweathered bedrock; porphyritic; hornblende; olivine; hard horizontal fracture fracture 30 - 35 degrees vesicles horizontal fracture		0	0		9.75" casing on top of competent bedrock; bentonite seal set prior to rock coring
445	65		Run #2		100%		fracture 2 degrees healed fracture; crystalline carbonate infilling		0	0		Bottom of Run #1; 93% Recovery; 100% RQD
440	70						Boring terminated at 70' bgs on 6/26/01 at 1416					Bottom of Run #2; 100% Recovery; 100% RQD
435	75											
430	80											

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Report: ENV_23A; Project File: I:\PROJECTS\WCFS-A-1\BONNEL-1\DELIVE-1\JOHNRI-1\BORING-1\CB_L4.GPJ; Data Template:WC_CORP1.GDT Printed: 11/26/01

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW07B

Sheet 1 of 2

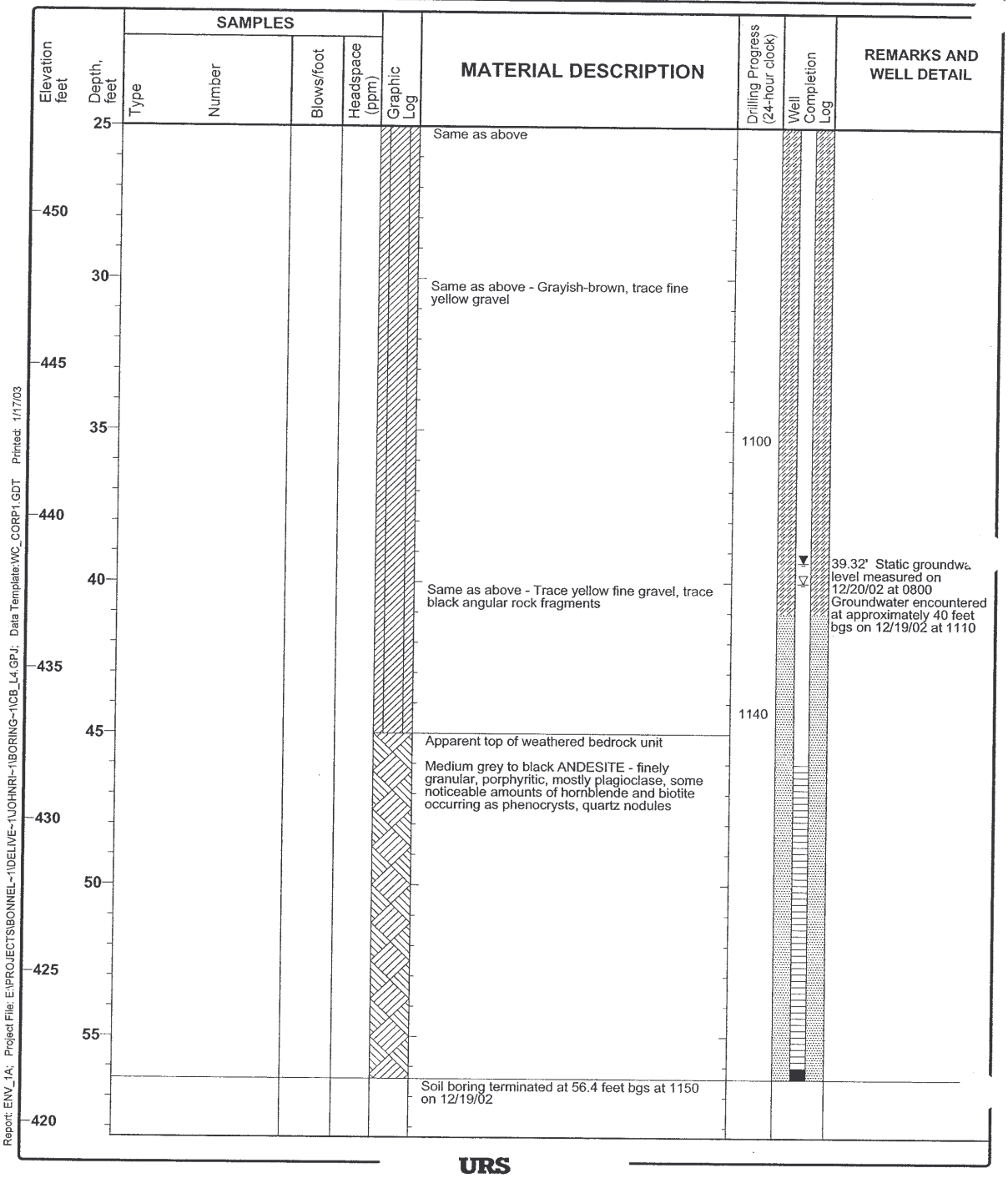
Date(s) Drilled	12/19/02	Logged By	J. Rapp	Checked By	S. Wolfe
Drilling Method	Air Rotary	Drill Bit Size/Type	Tricone	Total Depth Drilled (feet)	56.4
Drill Rig Type	IR T3W Ingersoll Rand	Drilling Contractor	Cascade Drilling Inc.	Top of PVC Elevation (feet)	480.80
Groundwater Level (feet)	39.32 feet bgs on 12/20/02 0800	Hammer Weight/ Drop (lbs/in.)	NA	Approx. Surface Elevation (feet)	477.89 NGVD
Diameter of Hole (inches)	10 / Diameter of Well (inches) 2	Type of Well Casing	Schedule 40 PVC V-wrap	Screen Perforation	0.010"
Type of Sand Pack	20/40, 10/20 Silica	Type/Thickness of Seal(s)	bentonite (2'-43' bgs); filter sand (41'-56' bgs); cement (0'-2'); screen interval (46-56')		
Comments	Monitoring well coordinates: Easting: 1154434.64 Northing: 140735.34				

Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/foot	SAMPLES Headspace (ppm)	Graphic Log	MATERIAL DESCRIPTION	Drilling Progress (24-hour clock)	Well Completion Log	REMARKS AND WELL DETAIL
480	0						Reddish-brown silty CLAY (CL) - moist, soft, low to medium plasticity, trace of fine sand	0955		0-56 feet: No odor or visual evidence of contamination
475	5									
470	10						Reddish-brown clayey SILT to silty CLAY (ML-CL) - moist, soft to medium stiff, low plasticity, trace fine sand			
465	15							1015		
460	20						Same as above - medium stiff, trace to some fine sand			
455	25									

Project: Landfill 4/Demolition Area 1
Project Location: Camp Bonneville, WA
Project Number: 53-F0072323.00

Log of Boring L4-MW07B

Sheet 2 of 2



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URS

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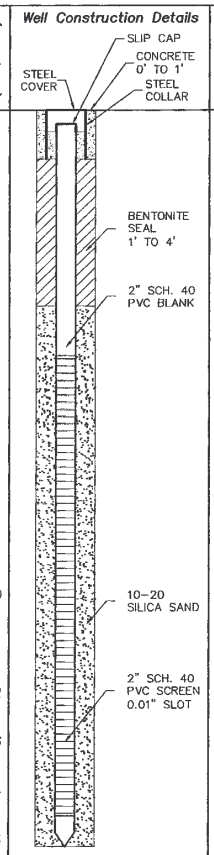
4412 SW CORBETT
PORTLAND, OREGON
97239
(503) 248-1939
FAX
(503) 248-0223

Bore Hole/Well Construction Log

Project Number:	Boring/Well Number:	Sheet
16978.004	L4-MW17	1 of 1

Project Name: CAMP BONNEVILLE
Project Location: LACAMAS CREEK/ LANDFILL 4
Driller/Equipment: CASCADE DRILLING/ AIR ROTARY
Geologist/Engineer: ANDREW HARVEY
Sample Method: DAMES AND MOORE SAMPLER

TOC Elevation (feet above datum): 361.48
Surface Elevation (feet above datum): 358.81
Start/End Date: 5/17/04
Hole Depth: 15 FEET
Outer Hole Diameter: 8 INCH



NOTES

1. SOIL INTERFACES AND DESCRIPTIONS ARE INTERPRETIVE AND ACTUAL CHANGES AND TRANSITIONS MAY BE GRADUAL.
2. WATER LEVEL IS FOR DATE SHOWN AND MAY VARY WITH TIME OF YEAR.
3. SOIL DESCRIPTIONS NOT INTENDED TO BE USED FOR GEOTECHNICAL DESIGN PURPOSES.

REV. —

MW-17

8/5/04 11:49 P:\16000\16978 Camp Bonneville GW\16978.004 - 2nd qtr 2004\16978.004_Monitoring_Wells_2nd_Quarter_2004.dwg

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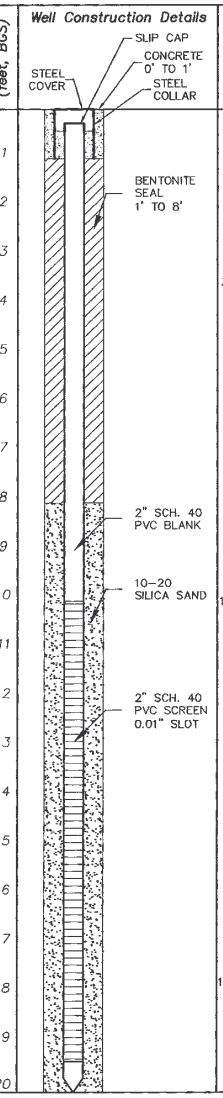
4412 SW CORBETT
PORTLAND, OREGON
97239
(503) 248-1939
FAX
(503) 248-0223

Bore Hole/Well Construction Log

Project Number:	Boring/Well Number:	Sheet
16978.004	L4-MW18	1 of 1

Project Name: CAMP BONNEVILLE
Project Location: LACAMAS CREEK/ LANDFILL 4
Driller/Equipment: CASCADE DRILLING/ AIR ROTARY
Geologist/Engineer: ANDREW HARVEY
Sample Method: DAMES AND MOORE SAMPLER

TOC Elevation (feet above datum): 362.48
Surface Elevation (feet above datum): 360.47
Start/End Date: 5/18/04
Hole Depth: 20 FEET
Outer Hole Diameter: 8 INCH



BOTTOM OF BORING AT 20'
Well finished with aboveground steel pipe monument set in concrete pad.

NOTES

1. SOIL INTERFACES AND DESCRIPTIONS ARE INTERPRETIVE AND ACTUAL CHANGES AND TRANSITIONS MAY BE GRADUAL.
2. WATER LEVEL IS FOR DATE SHOWN AND MAY VARY WITH TIME OF YEAR.
3. SOIL DESCRIPTIONS NOT INTENDED TO BE USED FOR GEOTECHNICAL DESIGN PURPOSES.

REV. ____

MW-18

8/5/04 11:48 P:\16000\16978 Camp Bonneville GW\16978.004 - 2nd qtr 2004\16978.004_Monitoring_Wells_2nd_Quarter_2004.dwg

APPENDIX D

Previous Quarterly Groundwater Monitoring Report Tables
by PBS Engineering + Environmental, on enclosed CD disk