Draper Aden Associates
CONSULTING ENGINEERS
Twenty Five Years of Service

2206 South Main St.
Blacksburg, Virginia 24060
(540) 552-0444
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Rcvd Date 06-06-97

June 3, 1997

Carmen Johnson
Fac/Perm/Co ID # 95-02 Date 6/6/12 Doc ID# DIN

Scanned by	Date	Doc ID #
RC	9/24/08	RCO

Mr. Mark Poindexter
Hydrogeologist
Solid Waste Section
North Carolina Department of Environment, Health and Natural Resources
P.O. Box 27687
Raleigh, N.C. 27611-7687

RE: Watauga County Landfill, Assessment Monitoring Program,
DAA Job No. 6520-21

Dear Mr. Poindexter:

Enclosed you will find preliminary, unvalidated analytical result summary tables for the third semi-annual Assessment Monitoring sampling event, conducted at the Watauga County Landfill (Permit #95-02) on April 8-9, 1997 by Draper Aden Associates. Assessment monitoring was performed in accordance with monitoring program revisions detailed in the Remedial Investigation and Alternatives Report (DAA, January 12, 1996), conditionally approved by the NCDEHNR on March 27, 1996.

The analytical data obtained from this sampling event is currently being validated and evaluated. A formal, comprehensive report presenting the validated results of the second semi-annual assessment event is anticipated to be available in late June, 1996.

If you should have any questions or comments concerning the enclosed summary table or upcoming Assessment activities, please do not hesitate to contact me.

Sincerely,
DRAPER ADEN ASSOCIATES

Jeffrey E. Smith
Project Geologist

Attachments

cc: Mr. James S. Ratchford, Watauga County Manager
Mr. Bob Frye, Assistant Watauga County Manager
Mr. Richard M. DiSalvo, Jr., P.E., Principal, DAA
Mr. Michael D. Lawless, P.G., Groundwater Project Manager, DAA

J:\PROJECTS\06\5\20\06520-21\CORRESP\LETTERS\JESMP03.DOC

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
06/03/97

Table 2A
Third Semi-Annual Monitoring Event
Assessment Target Parameter Analytical Results
Core Groundwater Monitoring Wells - Inorganic and Organic Analyses

PRELIMINARY, UNVALIDATED

Parameters	Event	Results ug/L(ppb)																								NCS (ug/L)	MCL (ug/L)
		MW-1		MW-2		MW-3		MW-7		MW-8		MW-9		MW-10		MW-11		MW-12		MW-15		MW-17		MW-19			
METALS, TOTAL																											
Barium, Total	4/8/97	171	B	219		97.0	B	615		259		659		83.0	B	137	B	145	B	77.3	B	106	B	36.8	B	2000	2000
Chromium, Total	4/8/97	8.2	U	0.90	B	3.7	B	4.2	B	24.2		1.1	B	3.7	B	1.2	B	0.90	U	2.8	B	0.90	U	1.9	B	50	100
Cobalt, Total	4/8/97																									-	-
Iron, Total	4/8/97	8760		30.5	B	1830		10300		11500		764		302		40.0	B	15.5	B	32.8	B	93.1	B	147		300*	300*
Nickel, Total	4/8/97	7.9	B	1.9	B	6.0	B	10.6	B	45.5		4.3	B	12.8	B	3.7	B	4.0	B	3.8	B	4.1	B	5.2	B	100	100
Vanadium, Total	4/8/97	12.0	B	1.6	B	4.6	B	8.4	B	35.1	B	0.80	U	2.2	B	0.80	U	0.80	U	3.4	B	0.80	U	0.80	U	-	-
ORGANICS																											
Benzene	4/8/97	1.00	U	100	U	10.0	U	4.83		10.0	U	10.0	U	100	U	1.00	U	10.0	U	1.00	U	10.0	U	1.00	U	1	5
Chloroethane	4/8/97	1.00	U	1.00	U	45.7		58.0		38.5		110		1.00	U	12.3		39.9		1.00	U	29.8		1.00	U	-	-
Dichlorodifluoromethan	4/8/97	1.00	U	1.00	U	6.37		1.00	U	17.2		11.2		1.00	U	2.95		10.2		1.00	U	1.00	U	1.00	U	~~0.19~~	-
1,1-Dichloroethane	4/8/97	1.00	U	84.5		90.2		9.36		52.3		27.8		26.6		25.8		82.4		1.00	U	75.8		1.00	U	700**	-
1,1-Dichloroethene	4/8/97	1.00	U	155		1.91		1.00	U	4.86		0.546	J	84.4		1.13		2.71		0.770	J	1.20		1.00	U	7	7
1,2-Dichloroethene (cis)	4/8/97	1.00	U	1.00	U	58.2		4.39		34.1		12.8		1.00	U	17.0		60.2		1.00	U	100		1.00	U	70	70
,2-Dichloroethene (trans	4/8/97	1.00	U	1.00	U	1.00	U	3.42		1.00	U	0.963	J	1.00	U	1.00	U	1.00	U	1.00	U	0.624	J	1.00	U	70	70
Methylene Chloride	4/8/97	1.00	U	1.00	U	0.710	J	1.42		1.55		100		1.00	U	0.697	J	1.13		0.656	J	0.631	J	1.00	U	5	5
Tetrachloroethene	4/8/97	1.00	U	11.4		20.7		1.00	U	13.3		3.40		4.36		11.2		23.2		1.00	U	21.4		1.00	U	0.7	5
Trichloroethene	4/8/97	1.00	U	1.87		11.7		0.533	J	10.6		3.14		1.20		3.98		14.5		1.00	U	16.2		1.00	U	2.8	5
1,1,1-Trichloroethane	4/8/97	1.00	U	768		8.18		1.00	U	4.47		1.52		570		6.09		10.8		4.13		2.91		1.00	U	200	200
Vinyl Chloride	4/8/97	1.00	U	1.00	U	0.979	J	1.00	U	2.97		1.00	U	1.00	U	1.00	U	2.76		1.00	U	4.01		1.00	U	0.015	2

2800 ppb (proposed)
1400 ppb
not proposed - actual EL standard

Notes:
NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Level (IDL) for Inorganics and not detected above Limit of Quantitation (LOQ) for Organics
J Denotes an estimated value
* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
** Denotes a proposed NCS
\- Denotes Not Avaliable or Not Sampled
Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.

(1) Metal parameters were analyzed in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0.
CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method for metal analysis
(2) Organic parameters were analyzed in accordance with EPA SW-846 Method #8021.

H:\6520-21\TABLE2A3.XLS

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1

06/03/97

PRELIMINARY, UNVALIDATED

Table 2B
Third Semi-Annual Monitoring Event
Assessment Target Parameter Analytical Results
Surface Water Monitoring Locations - Inorganic and Organic Analysis
Contract Laboratory Program (CLP) Statements of Work (SOW)

Parameters	Sampling Date	Results ug/L(ppb)												NCS (ug/L)	MCL (ug/L)
		S-1		S-2		S-3		S-4		S-5		S-6			
METALS, TOTAL															
Barium, Total	4/8/97	122	J	732		253		72	J	11500		54.9	J	2000	2000
Chromium, Total	4/8/97	0.90	U	0.90	U	0.90	U	0.90	U	41.9		0.90	U	50	100
Cobalt, Total	4/8/97													-	-
Iron, Total	4/8/97	7480		29100		5300		529		2E+05		962		300*	300*
Nickel, Total	4/8/97	3.0	J	3.2	J	2.7	J	3.6	J	31.0	J	2.4	J	100	100
Vanadium, Total	4/8/97	0.80	U	0.80	U	0.80	U	0.80	U	104		0.80	U	-	-
ORGANICS															
Benzene	4/8/97	10	U	2	J	10	U	10	U	10	U	10	U	1	5
Chloroethane	4/8/97	10	U	50		10	U	1	J	23		10	U	-	-
Dichlorodifluoromethane	4/8/97	10	U	10	U	10	U	10	U	10	U	10	U	0.19	-
1,1-Dichloroethane	4/8/97	10	U	14		10	U	12		10	U	14		700**	-
1,1-Dichloroethene	4/8/97	10	U	10	U	10	U	10	U	10	U	10	U	7	7
1,2-Dichloroethene (total)	4/8/97	10	U	6	J	10	U	15		10	U	16		70	70
Methylene Chloride	4/8/97	10	U	3	J	1	J	10	U	10	U	10	U	5	5
Tetrachloroethene	4/8/97	10	U	10	U	10	U	4	J	10	U	4	J	0.7	5
Trichloroethene	4/8/97	10	U	1	J	10	U	3	J	10	U	3	J	2.8	5
1,1,1-Trichloroethane	4/8/97	10	U	10	U	10	U	10	U	10	U	1	J	200	200
Vinyl Chloride	4/8/97	10	U	2	J	10	U	10	U	10	U	10	U	0.015	2

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Detection Limit(IDL) for Inorganics,
and not detected above Contract Required Quantification Limit (CRQL) for Organics.
J Denotes an estimated value
* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
** Denotes a proposed NCS
\- Denotes Not Available or Not Sampled

Note: CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0 for metal analysis. Organic parameters were analyzed in accordance with USEPA CLP SOW OLMO3.2.

Groundwater and Surface Water
Assessment Monitoring Results Report
April 8-9, 1997 Event

Watauga County Landfill
Watauga County, North Carolina
NCDEHNR Permit No. 95-02

Prepared for:

Watauga County Board of Commissioners

and

North Carolina Department of Environment, Health and Natural Resources
Division of Solid Waste Management
Solid Waste Section

Prepared by:

Draper Aden Associates
Consulting Engineers
2206 S. Main Street
Blacksburg, Virginia 24060
~~(703)~~ 540 552-0444

DAA Job No. 6520-21

June 19, 1997

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
06/03/97

Table 3
Third Semi-Annual Assessment Monitoring Event
Detected Non-Target Organic Parameters

PRELIMINARY, UNVALIDATED

CLP Methods

Parameter	Event	S-1		S-2		S-3		S-4		S-5		S-6		NCS (ug/L)	MCL (ug/L)	NCSW std
Acetone	4/8/97	~		~		9	J	~		~		~		~~700~~	-	
2-Butanone	4/8/97	~		3	J	~		~		~		~		-	-	154
1,2-Dichloroethane	4/8/97	~		1	J	~		~		~		~				42
Ethylbenzene	4/8/97	~		2	J	~		~		~		~		~~29~~	700	29000
Toluene	4/8/97	~		2	J	~		~		~		~		~~1000~~	1000	11
Xylene (total)	4/8/97	~		6	J	~		~		~		~		~~530~~	10000	88.5

SW-846 Methods

Parameter	Event	MW-3		MW-9		MW-12		MW-17						NCS (ug/L)	MCL (ug/L)
1,2-Dichloroethane	4/8/97	1.52		~		1.09		1.76						-	-
1,2-Dichloropropane	4/8/97	0.689	J	~		0.657	J	0.972	J					-	-
Trichlorofluoromethane	4/8/97	1.02		1.38		1.29		~						-	-

Notes:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
~ Denotes Not Detected
- Denotes Not Available
J Denotes an estimated value
N Denotes tentatively identified

Organic parameters were analyzed in accordance with USEPA CLP SOW OLMO1.9 (3/90) and EPA H:6520-21\TABLE3A3.xls

Draper Aden Associates
CONSULTING ENGINEERS
2206 South Main Street
Blacksburg, Virginia 24060
Phone: (540) 552-0444
Fax: (540) 552-0291

Post-it® Fax Note 7671	Date 8/25	# of pages ▶ 1
To MARK POINDEXTER	From [illegible]	
Co./Dept. NCDEHNR	Co.	
Phone #	Phone # [illegible]	
Fax # 919 733 4810	Fax # [illegible]	

July 29, 1997

Mr. Mark Poindexter
Hydrogeologist
Solid Waste Section
North Carolina Department of Environment, Health and Natural Resources
P.O. Box 27687
Raleigh, N.C. 27611-7687

RE: Watauga County Landfill, Assessment Monitoring Program
DAA Job No. 6520-21

Dear Mr. Poindexter:

Please find enclosed a copy of the 3rd Semi-annual Assessment Monitoring Event Report (7th Assessment event) for the Watauga County Landfill. The enclosed report presents the validated results of the 3rd semi-annual Assessment Monitoring event, conducted on April 8-9, 1997 by Draper Aden Associates. Preliminary summary analytical data tables for this event were sent to you on June 3, 1997.

The report discusses sampling procedures, analytical results, and overall conclusions of the 3rd semi-annual event. Appendix E, in the CD-ROM format, contains copies of all associated laboratory data.

Note that the report recommends for NCDEHNR approval of the initiation of annual rather than semiannual monitoring, withdrawal of the metal target assessment parameters, and continued withdrawal of select non-impacted assessment monitoring wells from routine groundwater monitoring.

If the recommendation for the initiation of annual rather than semiannual monitoring is approved, the next Assessment Monitoring Event will be scheduled to be performed by Draper Aden Associates in April, 1998.

If you should have any questions or comments concerning the enclosed report, or the next Assessment Monitoring Event, please do not hesitate to contact me.

Sincerely,
DRAPER ADEN ASSOCIATES

for

Jeffrey E. Smith
Project Geologist

JES/sgh
Enclosures

cc: Mr. Jim Ratchford, Watauga County Manager
Mr. Bob Frye, Watauga County Assistant Manager
Mr. Bill Ross, Brooks, Pierce, McLendon, Humphrey and Leonard, L.L.P.
Mr. Richard M. DiSalvo, Jr., P.E., Principal, DAA
Mr. Michael D. Lawless, P.G., Groundwater Project Manager, DAA

call Jeff and ask for a faxed copy of 1st pg. of this letter - misplaced in mailing.

Done 8/25/97

Draper Aden Associates
CONSULTING ENGINEERS
2206 South Main Street
Blacksburg, Virginia 24060
(703) 552-0444

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Received
Solid Waste
Section

FACSIMILE TRANSMITTAL

To: MARK POINDEXTER (EXT. 261)

From: JEFF SMITH

Fax No.: (919) 733-4810 Job No. 6520-21

Subject: RE: WATAUGA COUNTY LANDFILL
ASSESSMENT MONITORING PROGRAM
APPROVAL REQUEST.

ORIGINAL 10/23/97 CORRESPONDENCE
WAS "RETURN TO SENDER".
IS ADDRESS CORRECT?

This transmittal consists of 2 pages to follow.
If you did not receive legible copies, please call
(703)552-0444 or fax to (703 552-0291
as soon as possible

Date: NOV 3

Time: 8:40

Draper Aden Associates
CONSULTING ENGINEERS
Twenty Five Years of Service

3206 South Main St.
Blacksburg, Virginia 24060
(540) 552-0444
Fax: (540) 552-0291

October 23, 1997

Mr. Mark Poindexter
Hydrogeologist
Solid Waste Section
North Carolina Department of Environment, Health and Natural Resources
P.O. Box 27687
Raleigh, N.C. 27611-7687

RE: Watauga County Landfill, Assessment Monitoring Program
DAA Job No. 6520-21

Dear Mr. Poindexter:

The following correspondence is in regard to your review of the 3rd Semiannual Assessment Monitoring Event Report (7th Assessment event) for the Watauga County Landfill submitted on July 29, 1997. The referenced report presents the validated results of the monitoring event conducted on April 8-9, 1997. Preliminary summary analytical data tables for this event were sent to you on June 3, 1997.

The report recommends for NCDEHNR approval of the initiation of annual rather than semiannual monitoring, withdrawal of the metal target assessment parameters, and continued withdrawal of select non-impacted assessment monitoring wells from routine groundwater monitoring. The report notes that if the recommendation for the initiation of annual rather than semiannual monitoring is approved, the next monitoring event will be scheduled for April, 1998.

In order to schedule the next Assessment Monitoring Event, we request NCDEHNR approval of the Assessment Monitoring Program revisions as proposed. Watauga County is interested in keeping the Assessment Monitoring Program for Watauga County Landfill in compliance. Wautaga County will intiate the next Assessment Monitoring Event in accordance with your response.

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Solid Waste
Section

If you should have any questions or comments concerning the proposed program revisions or the next Assessment Monitoring Event, please do not hesitate to contact me.

Sincerely,
DRAPER ADEN ASSOCIATES

Jeffrey E. Smith
Project Geologist

JES

cc: Mr. Jim Ratchford, Watauga County Manager
Mr. Bob Frye, Watauga County Assistant Manager
Mr. Bill Ross, Brooks, Pierce, McLendon, Humphrey and Leonard, L.L.P.
Mr. Richard M. DiSalvo, Jr., P.E., Principal, DAA
Mr. Michael D. Lawless, P.G., Groundwater Project Manager, DAA

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Section

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Section 2.1	-	Data Validation Forms
Section 2.2	-	Revisions to Original Data Set
Section 2.3	-	SW-846 Volatiles Original Analytical Data Package

SECTION 3.0 **CLP METALS**

Section 3.1	-	Data Validation Forms
Section 3.2	-	Revisions to Original Data Set
Section 3.3	-	CLP Metals Original Analytical Data Package

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LIST OF ACRONYMS

Acronyms and Terms

ADHD	Appalachian District Health Department
BREMCO	Blue Ridge Electric Memebership Company
CFR	Code of Federal Regulations
CLP	Contract Labrotory Program
COC	Chain of Custody
CRQL	Contract Required Quantittion Limit
CVAA	Cold Vapor Atomic Absorption
DAA	Draper Aden Associates
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
EQL	Estimated Quantitation Limit
GC	Gas Chromatography
GC/MS	Gas Chromatography with Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption
GMP	Groundwater Monitoring Program
IDL	Instrument Detection Level (IDL)
ICP	Inductively Coupled Plasma
LLRA	Low Level Risk Assessment
LOD	Limit of Detection
LOQ	Limit of Quantitation
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MW	Monitoring Well
NCDEHNR	North Carolina Department of Environment, Health, and Natural Resources
NCS	North Carolina groundwater standard
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance / Quality Control
SOW	Statements of Work
SW-846	USEPA Solid Waste document 846
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Units of Measure

μ	micron (10^{-6} meters)
ml	milliliter (0.001 liter)
l	liter
μg/l	microgram per liter (equivalent to parts per billion - ppb)
μS/cm	microsiemens per centimeter
°C	degrees Celsius

LIST OF ACRONYMS

Acronyms and Terms

ADHD	Appalachian District Health Department
BREMCO	Blue Ridge Electric Memebership Company
CFR	Code of Federal Regulations
CLP	Contract Labrotory Program
COC	Chain of Custody
CRQL	Contract Required Quantittion Limit
CVAA	Cold Vapor Atomic Absorption
DAA	Draper Aden Associates
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
EQL	Estimated Quantitation Limit
GC	Gas Chromatography
GC/MS	Gas Chromatography with Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption
GMP	Groundwater Monitoring Program
IDL	Instrument Detection Level (IDL)
ICP	Inductively Coupled Plasma
LLRA	Low Level Risk Assessment
LOD	Limit of Detection
LOQ	Limit of Quantitation
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MW	Monitoring Well
NCDEHNR	North Carolina Department of Environment, Health, and Natural Resources
NCS	North Carolina groundwater standard
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance / Quality Control
SOW	Statements of Work
SW-846	USEPA Solid Waste document 846
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Units of Measure

μ	micron (10^{-6} meters)
ml	milliliter (0.001 liter)
l	liter
μg/l	microgram per liter (equivalent to parts per billion - ppb)
μS/cm	microsiemens per centimeter
^{o}C	degrees Celsius

EXECUTIVE SUMMARY

This report presents the results of the third semiannual sampling event for Assessment Groundwater and Surface Water Monitoring at the Watauga County Landfill, NCDEHNR Permit No. 95-02, Watauga County, North Carolina, conducted on April 8-9, 1997 by Draper Aden Associates. Assessment monitoring was conducted in accordance with the Watauga County Landfill Assessment Plan (DAA, September 3, 1993), approved by the NCDEHNR on September 30, 1993, and monitoring program revisions detailed in the Remedial Investigation and Alternatives Report (DAA, January 12, 1996), conditionally approved by the NCDEHNR on March 27, 1996.

The analytical results obtained from the third semiannual assessment monitoring event are similar to the results obtained from the previous assessment events. Although concentrations of individual assessment monitoring parameters have both increased and decreased at various monitoring locations, parameter concentration and distribution trends indicate steady state conditions, where sourcing of contaminants is balanced by removal, are predominant across the site. The analytical results indicate the northern edge of the occurrence of assessment target parameters in the groundwater primarily exists within the construction right-of-way for the proposed Route 421 bypass. South of the proposed bypass, the detection of assessment target parameters was concentrated between the saddle, located between the landfill and the Rocky Mountain Heights Subdivision, and the west and north drainages below the landfill.

An additional assessment monitoring well, MW-19, was installed in the west drainage in response to trace level detections observed in the Blue Ridge Electric Company's (BREMCO) potable well. These trace level detections suggest groundwater flow within the west drainage may follow a N55°W lineament set within the west drainage. At this location in the west drainage, a geologic contact between two rock units coincides with the N55°W lineament set trace. The presence of the geologic contact along the N55°W lineament set trace represents a preferential groundwater flow or core fracture zone within the bedrock fracture system. Abundant groundwater was observed at this depth and the monitoring well was completed at 70 feet in depth and screened over the geologic contact. The recent sampling of MW-19 resulted in no detected volatile organic compounds.

The report also presents the results of the second and third semiannual potable well sampling events performed in the fall, 1996 and spring, 1997. The potable well sampling program is jointly conducted by the Appalachian District Health Department (ADHD) and the North Carolina State Laboratory of Public Health. In summary, review of the analytical results from all the potable well sampling conducted recently, performed by the NC Department of Epidemiology, indicate that the recently sampled well waters are acceptable for all uses due to either nondetection or very low level detection of the organic analytes.

EXECUTIVE SUMMARY (cont.)

A remedial cap was installed at the facility in the fall, 1996. The remedial cap focuses on source containment as an immediate remedial action, as established by the EPA's presumptive remedy directive (EPA 540-F-93-035, September 1993). Additional risk assessment activities address exposure pathways outside the source area. These activities include the provision of potable water via the extension of public water along the existing Route 421 alignment. Response actions for exposure pathways outside the source area are being combined with the presumptive remedy to develop a comprehensive site response. Source containment, implemented through a remedial cap, supplemented by risk assessment, institutional controls, natural attenuation, and continuing assessment investigation comprise the broad package of remedial actions currently being conducted at the site.

Based on an evaluation of risk, combined with the steady state conditions observed in the third semiannual assessment monitoring event and six previous assessment events, Draper Aden recommends herein the initiation of annual rather than semiannual monitoring, withdrawal of the metal target assessment parameters, and continued withdrawal of select non-impacted assessment monitoring wells from routine groundwater monitoring for NCDEHNR approval.

1.0. INTRODUCTION

This report presents the results of the third semiannual sampling event for Assessment Groundwater and Surface Water Monitoring at the Watauga County Landfill, NCDEHNR Permit No. 95-02, Watauga County, North Carolina, conducted on April 8-9, 1997 by Draper Aden Associates. Assessment monitoring was conducted in accordance with the Watauga County Landfill Assessment Plan (DAA, September 3, 1993), approved by the NCDEHNR on September 30, 1993, and monitoring program revisions detailed in the Remedial Investigation and Alternatives Report (DAA, January 12, 1996), conditionally approved by the NCDEHNR on March 27, 1996. Appendix I of the Assessment Plan, The Groundwater and Surface Water Monitoring Program, details the schedule and procedures to be implemented for collecting groundwater and surface water samples, analyzing the samples for specified parameters, and evaluating and reporting the resultant water quality data.

This report discusses sampling procedures, analytical results, and overall conclusions of the third semiannual Assessment sampling event. Appendix E (on CD-ROM) contains copies of all associated laboratory data. Appendix E also contains Data Validation Forms summarizing the guidelines and results of the data validation procedures utilized for evaluating the data discussed in this report.

1.1. Groundwater Monitoring Well Network

Nineteen groundwater monitoring wells comprise the assessment groundwater monitoring well network at the Watauga County Landfill. Monitoring well locations are shown on the Groundwater and Surface Water Monitoring Program site map (Figure 1).

In order to maximize the effectiveness and efficiency of the Groundwater Monitoring Program, the assessment well network is stratified into two groups of "core" and "boundary" wells. Core assessment wells are selected based on the well's ability to monitor and characterize migration of potential slugs of contaminants. Boundary assessment wells are selected based on the well's ability to monitor and characterize the limits of the horizontal and vertical extent of the contaminants.

Eleven of the nineteen groundwater monitoring wells were installed in January and February of 1994. For the first quarter background event, four of the previous seven monitoring wells, MW-2, MW-3, MW-4, and MW-6, were denoted as core assessment wells based available data. The upgradient well MW-1 was also evaluated similarly for purposes of comparison. All other assessment monitoring wells were initially denoted as boundary assessment wells for this initial assessment background sampling event.

Based on the analytical data obtained from the first quarter background event, the assessment monitoring well network was restratified for the following background monitoring events. Revisions to the network of core and boundary assessment wells resulted in the upgrading of six of the eleven additional monitoring wells to "core" status (MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17).

Upon review of the analytical data obtained from all four background events, two additional monitoring wells, MW-4 and MW-7, were also restratified for the following semiannual monitoring events. MW-7 was upgraded to "core" status and MW-4 was downgraded to "boundary" status. Due to the repeated detection of low levels of 1,1,1-TCA observed in the boundary well MW-15 during the past five assessment monitoring events, MW-15 was also upgraded to core status for the second semiannual assessment monitoring event.

As approved by NCDEHNR, monitoring wells MW-6 and MW-16 were abandoned subsequent to the second semiannual assessment monitoring event. The abandonment of monitoring well MW-6 was necessary to permit construction of the landfill cap (Figure 1) and the abandonment of monitoring well MW-16 was necessary to permit construction of the 421 bypass (Figure 2). As requested by NCDEHNR, an additional assessment monitoring well (MW-19) was drilled and installed on March 11 and 12, 1997 in the west drainage adjacent to the Blue Ridge Electric Company's (BREMCO) potable well (well reference no. 5, see Figure 1), along the N55°W lineament set trace.

The current stratification of the assessment monitoring well network is as follows:

CORE WELLS	BOUNDARY WELLS
MW-1	MW-4
MW-2	MW-5
MW-3	MW-13
MW-6 (abandoned)	MW-14
MW-7	MW-16 (abandoned)
MW-8	MW-18
MW-9	
MW-10	
MW-11	
MW-12	
MW-15	
MW-17	
MW-19 (new)	

The decision criteria utilized for the classification of boundary wells in the assessment monitoring well network is the exceedance of the analytical method limit of detection as determined by the laboratory for parameters identified as target parameters in the core assessment monitoring wells. The presence of target parameters above the analytical method limit of detection are evaluated with respect to repeated sampling events prior to confirmation.

After the first semiannual assesment monitoring event (the fifth assessment event), the non-impacted boundary wells (i.e.: MW-4, MW-5, MW-13, MW-14, MW-16, and MW-18) were withdrawn from the routine compliance monitoring program. Draper Aden Associates recommends that the current twelve core assessment monitoring wells continue to be monitored on an annual rather than semiannual basis. The six non-impacted boundary wells will remain operational to allow for future monitoring based on temporal contaminant distribution trends observed after each semiannual event .

The conditional NCDEHNR approval of monitoring program revisions detailed in the Remedial Investigation and Alternatives Report (DAA, January 12, 1996), requested that the boundary wells be rotated in and out of routine monitoring on a regular basis. The monitoring results obtained from the network of core assessment monitoring wells as a result of the recent second semiannual monitoring event, described herein, do not indicate any significant changes in contaminant concentrations. Therefore, it is suggested that additional sampling of the non-impacted boundary wells is not warranted at this time (i.e. fourth semiannual sampling event, tenatively scheduled to occur October, 1997). If temporal contaminant distribution trends observed after future semiannual events indicate significant changes in contaminant concentrations have occured, sampling of non-impacted boundary wells will be reevaluated.

As indicated in the Assessment Monitoring schedule (Table 1, Appendix A), all core assessment monitoring wells were analyzed for organic parameters using Low Level Risk Assessment (LLRA) screening methods (i.e. EPA SW-846 Method 8021) for the third semiannual assessment monitoring event. Metal parameters were analyzed using CLP statements of work.

1.2 Surface Water Sampling

The goal of the surface water monitoring system at Watauga County Landfill is to provide representative surface water samples for assessing the potential impact of landfill runoff and leachate on the streams located downgradient of the waste disposal area. Six surface water monitoring points, combined with the sampling of any observed leachate production, serve to provide this objective.

- (S-1) The last of the series of sediment ponds is sampled to provide a representative sample for assessing the quality of the surface water originating from the landfill before the water discharges into the stream.

- (S-2) The spring capture outfall located adjacent to the last of the series of sediment ponds is sampled to provide a representative sample for assessing the quality of the water originating from the spring capture system located beneath the fill area.

- (S-3) The stream is sampled at the landfill property boundary (approximately 600 feet below the last sediment pond) to provide a representative sample for assessing the water quality of the stream below the waste disposal area. No sampling location is available upstream of the waste disposal area since the stream originates immediately below the adjacent tot he disposal area.

- (S-4) The stream located below the Bolick site is sampled approximately 30 feet below the landfill property boundary to provide a representative sample for assessing the water quality of the surface water below the Bolick site. This sampling location is chosen instead of the sediment pond located on the Bolick site to provide a sample that is more representative of the potential influence of groundwater from the soil aquifer.

- (S-5) A seep, located below the waste disposal area and directly above the sediment pond, was observed flowing during the first quarter background event. This seep is sampled in addition to the four originally proposed surface water sampling locations when observed flowing during routine surface water sampling events.

- (S-6) An additional surface water monitoring point, located below the existing surface water monitoring point S-4, was proposed subsequent to the first semiannual sampling event. This monitoring point will provide information to assess the persistence of surface water impacts observed at S-4 further downgradient along this west drainage.

As outlined in the Assessment Monitoring schedule (Table 1, Appendix A), surface water samples were analyzed using CLP statements of work.

In addition to these six surface water sampling locations, any leachate production observed during surface water sampling events is also sampled. A grid field screening inspection of the landfill was conducted concurrent with the third semiannual event to verify the presence or absence of leachate production. No leachate production was observed. Observations resulting from the inspection is documented in the field notes (Appendix B).

1.3 Sampling and Analysis Schedule

Groundwater

During the first year of Assessment groundwater monitoring, four quarterly background sampling events were conducted on each groundwater monitoring well. Semiannual sampling is currently conducted.. The third semiannual Assessment monitoring event was conducted on April 8-9, 1997, after installation and development of an additional assessment monitoring well (MW-19). The groundwater Assessment monitoring schedule proposed for subsequent monitoring events is outlined in Table 1.

The analytical scans performed on each monitoring well during the first year of assessment background groundwater monitoring were designed to analyze for all the target parameters detected and tentatively confirmed as a result of the initial comprehensive sampling event performed on the previously existing monitoring well network MW-1 through MW-7 on March 5, 1993. The initial March 5, 1993 sampling event was comprised of the complete EPA Appendix II List of Hazardous Inorganic and Organic Parameters (40 CFR, Part 258) currently required for Assessment Monitoring under the NCDEHNR requirements for Municipal Solid Waste Landfills (15A NAACO 13B Section .1600). A summary results table of the initial March 5, 1993 sampling event are contained in Appendix C of this report and detailed in Sections II and III of the Assessment Plan (DAA, September 3, 1993).

The complete EPA Appendix II analysis was repeated on the revised network of core plume assessment wells during the first semiannual event, performed on July 10-13, 1995. Additional parameters detected, and verified through QA/QC validation as being present, that were not identified in prior Assessment monitoring events, were added to the assessment target parameter list. Target parameters not detected during all five previous assessment monitoring program events, and verified through QA/QC validation as not being present, were deleted from the assessment target parameter list. As required, amendments to the existing target parameter list were evaluated and aproved by the NCDEHNR, prior to implementation. For amended target parameters, it was proposed that four independent samples be collected and analyzed for those additional parameters during the following four semiannual sampling events at all core assessment wells to establish background.

Revisions to the target inorganic parameter list involved adding four metal parameters; i.e.: chromium, cobalt, nickel, and vanadium, and deleting two other metal parameters; i.e.: cadmium and mercury. The presence of cadmium and mercury in the groundwater at the site was not supported by the analytical results of all four assessment background or the first semiannual monitoring events. Chromium, cobalt, nickel, and vanadium were observed in three (3) or more core monitoring wells, although also at levels far below EPA MCL and North Carolina groundwater standards, as a result of the comprehensive EPA Appendix II analytical scan performed during the first semiannual assessment sampling event.

As a result of three successive assessment sampling events, all the assesment target metal parameters (including chromium, cobalt, nickel, and vanadium) were observed at levels far below EPA MCL and North Carolina groundwater standards. Draper Aden Associates recommends herein the withdrawal of the metal target assessment parameters from routine groundwater monitoring.

Revisions to the target organic parameter list involved deleting trans-1,3-dichloropropene. The analytical results of the four background monitoring events and the first semiannual assessment sampling event confirmed the absence of trans-1,3-dichloropropene in the groundwater and surface

waters at the site. Thus, per the decision criteria outlined in the Assessment Plan, trans-1,3-dichloropropene was removed from the target parameter list. No additions to the organic target parameter list were warranted. No additional revisions to the organic target parameter list are proposed at this time.

Groundwater monitoring events will continue to be conducted on all core wells on a annual basis for the organic target parameters detected as a result of the complete EPA Appendix II analysis. Reevaluation of the site network and monitoring scheme will be conducted after review of the results of each sampling event. The groundwater monitoring program will continue to follow a two-tiered analytical approach utilizing both EPA Contract Laboratory Program Statement of Work (CLP SOW) - Organic and Inorganic analytical methods, and Low Level Risk Assessment (LLRA) screening by EPA-SW846 analytical methods. The CLP SOWs are utilized to generate high-level quality data with documented QA/QC protocols. The LLRA methods (EPA-SW-846) are utilized for risk assessment screening to preliminary identify low levels of parameters that may be present. The groundwater analysis schedule proposed for subsequent assessment monitoring events, indicating analytical methods designated for each event, is outlined in Table 1.

During the first year of background Assessment Monitoring, analyses of the core assessment monitoring wells utilized CLP SOWs for all four quarterly events. Organic analyses of the boundary assessment monitoring wells alternated between CLP and LLRA analytical methods for each quarterly event. Metal analyses of all assessment monitoring wells utilized CLP analytical methods for all events.

After completed the first year of quarterly background sampling, the core assessment monitoring wells are currently monitored on a semiannual basis. The first semiannual assessment monitoring event analyzed for all the assessment monitoring parameters included in the EPA Appendix II List of Hazardous Inorganic and Organic Parameters (40 CFR Part 258), utilizing LLRA analytical methods for organic parameters and CLP analytical methods for metal parameters. As approved by the NCDEHNR, monitoring of additional EPA Appendix II parameters that have not been confirmed in any of monitoring wells to date is no longer required.

The second semiannual assessment monitoring event analyzed for all target assessment monitoring parameters (both organic and metal) using CLP-SOWs. The third semiannual assessment monitoring event analyzed for all target assessment monitoring parameters in the core assessment monitoring wells utilizing LLRA analytical methods for organic parameters and CLP analytical methods for metal parameters.

The proposed assessment monitoring schedule for following sampling events will alternate between CLP and LLRA analytical methods for groundwater organic analyses each annual event.

Surface Water

Surface water and leachate monitoring was conducted on a semiannual basis during the first year of the Assessment Plan groundwater monitoring program and as proposed herein will continue annually thereafter. The analytical scans that are performed on the surface water and leachate samples utilize CLP SOW and are designed to analyze for all the target parameters detected as a result of the comprehensive Appendix II analysis. The surface water assessment monitoring schedule proposed for subsequent assessment monitoring events is outlined in Table 1.

2.0. GROUNDWATER AND SURFACE WATER SAMPLING FIELD PROCEDURES

Groundwater and surface water samples were collected according to the Watauga County Landfill Groundwater and Surface Water Monitoring Plan (DAA, September 3, 1993), to insure representative samples were collected, received by the laboratory and subject to analysis. Field notes, contained in Appendix B, document groundwater sample collection procedures.

2.1 Well Purging and Sample Collection

Dedicated stainless steel and TEFLON electrical submersible pumps were permanently installed in the new well network subsequent to the first event. Environmental Technicians from Draper Aden Associates used the dedicated pumps to purge and collect groundwater samples from the monitoring well network during the April 8-9, 1997 sampling event. All non-dedicated equipment was decontaminated between sampling of each monitoring well.

A minimum of three well volumes of groundwater, inclusive of water residing in the well casing and filter pack, were removed from each monitoring well prior to sample collection. A well volume was calculated from measurements of depth to water, and total well depth taken prior to purging. Stabilization of field analyses for pH and Specific Conductivity were used to verify that stagnant water within the well was removed during purging, and that groundwater representative of the near-aquifer was being sampled. Field notes recorded during each sampling event, contained in Appendix B, summarize and document well purging calculations and results.

The potentiometric surface, inferred from static water level elevations obtained during the recent April sampling event (presented in Table 4) is presented on the enclosed Groundwater and Surface Water Monitoring Program Site Map (Figure 1, Appendix A).

2.2 Field Meter Calibration

Measurements of pH and specific conductivity were analyzed at each well by completing multiple measurements in the field, at the time of groundwater purging. Although pH and specific

conductivity are not assessment monitoring parameters, the measurements were used to ensure groundwater quality and stabilization.

A Corning Checkmate 90 pH/Conductivity/Temperature meter was used for the field measurement of pH, and conductivity. The meter was calibrated in the field using laboratory-grade buffers for pH, and KCl solution for specific conductivity. Field notes in Appendix B document field meter calibration methods for each sampling event.

2.3 Quality Control Blank Samples

Due to the use of dedicated purging and sampling equipment for each monitoring well, field blanks were not collected.

Trip blanks were utilized as part of the assessment monitoring program. Trip blanks were prepared by the analyzing laboratory to accompany the sample kits at all times. The trip blanks employed sample containers and volumes identical in physical and chemical integrity to the samples used for actual sample collection. The trip blank was analyzed for all parameters included in the sampling event. The trip blank served as a control on sample kit preparation, analysis in the laboratory, and sample kit transportation.

2.4 Sample Containers and Shipment

Groundwater samples were collected in U.S. EPA approved containers prepared and supplied by the analyzing laboratory. Where applicable, the analyzing laboratory prepared organic sample containers with hydrochloric acid (HCl) prior to sample collection. Total metal samples were preserved in the field using nitric acid supplied by the analyzing laboratory. All samples were placed on ice in a cooler at approximately 4°C immediately after collection. A chain of custody seal was placed on each sample and each cooler to verify samples were not disturbed during transport. The coolers were shipped to the analyzing laboratory by overnight courier service.

2.5 Chain of Custody Documentation

Chain of Custody documentation and analysis requests are contained the laboratory report. Laboratory analytical data sheets are found in Appendix E.

Chain of Custody (COC) forms provided by the analyzing laboratory or developed by Draper Aden Associates were used to document the custody of the samples from the time they were collected in the field to the time the custody of the samples was relinquished by Draper Aden personnel. Relinquishing custody of the samples was accomplished by shipping through an overnight carrier service. The information recorded in the COC included sampling location, sampling points, number of samples, type of sampling containers, sample preservation procedures,

matrix spike samples, if any, blanks accompanying the samples, date and time of sample collection, and the date and time custody was relinquished. These COC forms were sent with the samples to the analyzing laboratory. Analysis request forms which included lists of parameters required to be analyzed for the different analytical methods to be used were also attached along with the COC forms. Draper Aden Associates also requested the analyzing laboratory to attach these COC documents with the certificate analysis supplied by them after analysis of samples was complete.

3.0. LABORATORY ANALYSIS AND DATA VALIDATION

3.1 List of Laboratories

Volatile organic analyses and total metal analyses by EPA Contract Laboratory Program (CLP) statements of work (SOW) were performed by Compuchem Environmental Corporation of Research Triangle Park, North Carolina.

Volatile organic analyses by EPA SW-846 Method 8021 were performed by CT&E Environmental Services, Inc. of Charleston, West Virginia.

3.2 Analytical Methods

All CLP analytical techniques used were in accordance with the procedures listed in the Contract Laboratory Program SOW Organics OLMO1.9 (3/90), Inorganics ILMO3.0.

All LLRA analytical techniques (SW-846) used were in accordance with the procedures listed in the U.S. EPA document Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846 (latest edition).

3.3 Data Quality Objectives

Quality Assurance Objectives for Measurements

Data quality objectives (DQO) are established to ensure that the data collected throughout is sufficient and of adequate quality for the intended use. Overall data quality objectives included the following:

- Precision - A measurement of the reproducibility of measurements compared to their average value. Precision is measured by the use of splits, replicate samples, or co-located samples and field audit samples.

- Accuracy - This measures the bias in a measurement system by comparing a measured value to a true or standard value. Accuracy is measured by the use of standards, spiked samples, and field audit samples.

- Representativeness - This is the degree to which a sample represents the characteristic of the population being measured. Representativeness is controlled by defining sample collection protocols and adhering to them throughout the evaluation.

- Completeness - This is the ratio of validated data points to the total samples collected. Completeness is achieved through duplicate sampling and resampling, when necessary.

- Comparability - This is the confidence that one data set can be compared to another. Comparability is achieved through the use of standard methods to control the precision and accuracy of the data sets to be compared by use of field audit samples.

The CLP SOWs are utilized to generate a high level quality data with documented QA/QC protocols. The SW-846 methods are utilized to generate organic data for risk assessment to preliminary identify low levels of analytes that may be present. Estimated CLP SOW results, between the instrument detection limit (IDL) and the contract required detection limit (CRDL) for inorganics, and less than the contract required quantitation limit (CRQL) for organics, are similarly provided for preliminary assessment purposes only. Estimated data is not intended for use in determining regulatory compliance issues.

Analytical Procedures

Analytical methods and detected parameters for the third semiannual assessment monitoring event, described herein, are provided in Tables 2A-B and Table 3 (Summary Tables - Assessment Monitoring Results; Appendix A).

Internal Quality Control

i. Field Quality Control - Field quality control procedures are summarized in Section II of this report.

ii. Analytical Quality Control - Analytical quality control procedures for CLP analytical techniques are guided by adherence to Contract Laboratory Program (CLP) deliverables. All quality control data and records generated by the laboratory were examined by Draper Aden Associates for adherence to method requirements. A laboratory quality control report generally consists of the following components:

- spikes
- blanks
- duplicates
- raw data
- surrogate parameters
- instrument adjustment
- calibration
- quantification
- chromatograms
- additional QC requirements (organic and inorganic)

For this project, QC reports are provided with the target parameter analytical results for all sampling events.

4.0. DATA VALIDATION

The CLP analyses for organic as well as inorganic parameters were performed in adherence to the relevant Contract Laboratory Program-Statement of Work (CLP-SOW). LLRA analyses for organic parameters were performed in adherence to relevant SW-846 method requirements and guidance. Results of the CLP-SOW analyses were summarized and reported by the analyzing laboratory in standard CLP reporting format. Draper Aden Associates conducted data validation of each data set. The results from each sampling event were evaluated in association with corresponding QA/QC information provided by the analyzing laboratory.

4.1 Laboratory Reporting Qualifiers

Two different types of qualifiers were associated with laboratory analyses and data validation: they were **laboratory reporting qualifiers** and **data validation qualifiers**.

The laboratory used **laboratory reporting qualifiers** to flag sample results with reference to relevant QA/QC criteria. Laboratory reporting qualifiers were unique to the analyzing laboratory and are defined in the laboratory data package presented in volume II of this report. The defined **organic** laboratory reporting qualifiers are not equivalent to the defined **inorganic** laboratory reporting qualifiers and review of the definitions is recommended. In addition to the laboratory reporting qualifiers defined in Appendix E, project specifications required the laboratory performing the analytical services to utilize the following additional data qualifiers and definitions:

<u>Qualifiers</u>

D - Denotes the sample was diluted to obtain the result.
S - Method of Standard Additions was utilized to obtain the result.
E - Laboratory recoveries fell outside EPA control limits. Results are approximate concentrations.
TI - The laboratory tentatively identified the parameter.

Definitions

CRDL. Contract Required Detection Limit (associated with CLP-inorganics only).

IDL. Instrument Detection Limit (Associated with CLP-inorganics only). Inorganic Data qualified with a "U" refers to IDL.

CRQL. Contract Required Quantitation Limit (associated with CLP organics only). Organic Data qualified with a "U", refer to CRQL.

4.2 Data Validation Qualifiers

Data validation was completed using guidance from the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", (Document 1) USEPA, February, 1993; and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review - February 1994" (Document 2).

Data Validation was performed on the results presented in the laboratory analysis report, and the validated results were flagged, where required, using the appropriate national **data validation qualifiers** defined from the aforementioned CLP guidance documents. The data validation qualifiers were divided into two categories; **organic** data validation qualifiers and **inorganic** data validation qualifiers. The **data validation qualifiers** (as defined in Documents 1 and 2 above) are different from the **laboratory reporting qualifiers**. Definitions of the nationally recognized data validation qualifiers used by Draper Aden Associates in the validation process and for the reported results are presented below.

Organic Data Validation Qualifiers

U - The parameter was analyzed for, but was not detected above the reported sample limit of quantitation (LOQ).

J - The parameter was positively identified; the associated numerical value is the approximate concentration of the parameter in the sample.

N - The analysis indicates the presence of an parameter for which there is presumptive evidence to make a "tentative identification".

NJ - The analysis indicates the presence of an parameter that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ - The parameter was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the parameter in the sample.

R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the parameter cannot be verified.

Inorganic Data Validation Qualifiers

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample detection limit.

J - The associated value is an estimated quantity.

R - The data are unusable. (Note: Parameter may not be present)

UJ - The material was analyzed for, but was not detected. The associated result is an estimate and may be inaccurate or imprecise.

4.3 Inorganic Data Review

Draper Aden Associates performed a limited review of the analytical results for six inorganic target parameters *viz.* barium, iron, chromium, cobalt, nickel and vanadium for this third semiannual Assessment monitoring event. Sampling for this Assessment monitoring event was performed on April 8-9, 1997. Inductively Coupled Plasma (ICP) method 6010A was used to analyze for barium, chromium, cobalt, iron, nickel, and vanadium.

Compuchem Environmental (Compuchem), a division of Liberty Analytical of RTP, North Carolina performed all the inorganic analyses. Compuchem submitted results to Draper Aden Associates in a final certificate of analysis which included sample analytical results as well as relevant documentation to verify and validate the results. The results of this data validation presented here are based upon a limited review of QA/QC information including holding times, preservation procedures and standards, spike analysis on sample matrix, blank samples analyses (method, trip, and calibration blanks), duplicate sample analyses, interference check sample results, laboratory control samples (LCS), serial dilution criteria, IDL/CRDL information.

Review was limited mainly to summary sheets provided by the laboratory, unless a notable discrepancy in the data package required review of the raw data. The completeness of the data package was verified including the presence of raw analytical data, chain of custody and preparation logs.

CLP-ICP Method 200.7 Review

All samples were analyzed for the six target parameters by Inductively Coupled Plasma (ICP) technique, method EPA-200.7M. All analyses were performed in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILM03.0. All the above target metals were analyzed for their total concentrations. Designated Quality Control (QC) samples for duplicate analyses and matrix spike analyses were MW3S and MW3D. The original certificate of analysis (dated may 1, 1997) supplied by Compuchem incorrectly listed calcium as a target parameter in place of cobalt, and presented analytical results for that calcium. Draper Aden then reviewed the raw instrument results from which it was noted that all samples were also analyzed for cobalt, but the results were not compiled from the raw data and presented in the data summaries. Compuchem was contacted regarding this discrepancy and a revised certificate of analysis reflecting the required changes was provided.

The revised certificate of analysis appeared complete in its presentation and the data was of acceptable quality. The certificate of analysis demonstrated the ability of the laboratory to achieve the reported LOQ for each target parameter. All LOQs were equal to or less than the respective MCLs, where applicable.

All relevant instrument calibration and calibration verification criteria were met. Interference check sample (ICS-AB), spike sample and lab control samples recovered within control limits. Representative duplicate sample analysis results were also within control limits.

Reported blank sample results included barium in trip blank (3.5 ug/l), and several calibration blanks and preparation blank, iron in trip blank (163 ug/l), and nickel also in trip blank (3.1 ug/l). None of the sample results for barium were deemed to be affected by the observed blank results. However, results for iron in samples MW-10, MW-11, MW-12, MW-15, MW-17, MW-19, MW-2 and MW-9, and all sample results for nickel less than 15 ug/l (approximately 5 times blank result), were deemed attributable to the observed blank contamination source and were hence validated as "U" per validation criteria. The analytical result for iron on sample S-5 from the original run exceeded the upper limit of the ICP linear concentration range. Hence this sample was reanalyzed following a 1:10 dilution of the sample, and the reanalysis results were acceptable. ICP serial dilution analysis results for chromium, cobalt, and nickel were reported to be outside control limits. However, from a closer review it was apparent that serial dilution comparisons were irrelevant due to those parameter concentrations being well below any reasonable limits wherein such dilution verifications would be meaningful.

All sample results unaffected by the above data validation process were recorded as reported by the laboratory or, if the reported value was less than the IDL, validated and reported as "U".

4.4 Organic Data Review

CLP Volatile Organic Data Review

Draper Aden Associates performed a limited review of the analytical results for volatile organic parameters analyzed by EPA CLP 3/90 Statement of Work (SOW) Document Number OLM03.2. The parameter list included dichlorodifluoromethane. Surface water samples were collected from locations denoted as S-1, S-2, S-3, S-4, S-5 and S-6 during the April 8-9, 1997 semiannual Assessment monitoring event at the Watauga County Landfill.

CompuChem Environmental Corporation, a division of Liberty Analytical Corp., (Compuchem), of Research Triangle Park, North Carolina performed the GCMS analysis. Compuchem submitted results to Draper Aden Associates in a final Certificate of Analysis which included sample analytical results as well as relevant documentation to validate and verify the results.

The evaluation of Compuchem's compliance with the method was based on a limited review of the following items: QC deliverables package, QC history documentation, case narrative, technical holding time and preservation requirements, laboratory control samples (LCS), instrument performance check, instrument calibrations, blank analysis, surrogate spike recoveries, matrix spike analysis, internal standard requirements and confirmation of detected parameters. Review of transcriptions from raw data to summary sheets was performed. Specific representative calculations were not performed except where noted.

Matrix spike and matrix spike duplicate analyses were performed on sample MW-3 at a 1:10 dilution.

The original certificate of analysis was complete and presented data which were of acceptable quality.

Technical holding time, and sample preservation requirements were met for all samples. All QC history documentation was provided and met criteria. A laboratory control sample (LCS) was analyzed and met quality control requirements. All initial and continuing calibration requirements were met. There was minimal acetone contamination in the holding blank at 2 μg/l and in VBLKNK at 1 μg/l. The laboratory method blank and the trip blank were free from contamination. All surrogate recoveries, internal standard area, and internal standard retention time

requirements were fulfilled. Overall instrument performance appeared stable and dependable.

Numerous target parameters were detected, both above and below the as listed on the Analytical Data Set Notes. CompuChem reported acetone in S-3 at 9 µg/l. This result was considered laboratory contamination and was qualified accordingly, as per validation guidelines. A review of tentatively identified compound (TIC) results revealed the presence of dichlorofluoromethane and ether in sample S-2 as listed in the analytical data set notes. Laboratory artifacts, such as CO_2 and siloxanes, are not listed on the analytical data set notes.

SW-846 Method 8021 Volatile Organic Data Review

Draper Aden Associates performed a limited review of the analytical results for 36 volatile organic parameters analyzed by SW-846 Method 8021. Groundwater samples were collected from monitoring wells MW-1, MW-2, MW-3, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-15, MW-17, and MW-19 during the April 7-9, 1997 semiannual Assessment monitoring event at the Watauga County Landfill.

all case wells

CT&E Environmental Services, Inc. (CT&E), of Charleston, West Virginia performed the GC analyses. CT&E submitted results to Draper Aden Associates in a final Certificate of Analysis which included sample analytical results as well as relevant documentation to validate and verify the results.

The evaluation of CT&E's compliance with Method 8021 was based on a limited review of the following items: QC deliverables package, QC history documentation, case narrative, technical holding time and preservation *requirements*, laboratory control samples (LCS), instrument performance check, instrument calibrations, blank analysis, surrogate spike recoveries, matrix spike analysis, and internal standard requirements, where applicable. Review of transcriptions from raw data to summary sheets was performed. Specific representative calculations were not performed. A summary of data review results and any observed deviations is provided below.

The original certificate of analysis for Method 8021 was complete and presented data which was of acceptable quality. The data sets exhibited the analyst's ability to achieve the reported LOQ of 1.0 ug/l for each target parameter, as outlined by the precision and accuracy data. All LOQs were equal to or less than respective MCLs.

Technical holding time, and sample preservation requirements were met for all samples. All QC history documentation was provided and met criteria. All QC check sample criteria were met. The LCS recovery met criteria. All initial and continuing calibration criteria were met. All blank analysis criteria were fulfilled. No target parameters were detected in any associated method or trip blank. All surrogate recovery criteria were

met. Retention time criteria were met. Internal standard requirements were met. All sample results were reviewed for transcription errors from the instrument data to the laboratory report and no errors were noted. No target parameters were reported above or below the LOQ in any sample.

Matrix spike and matrix spike duplicate analyses were performed on the MW-5 sample. All percent recovery and RPD criteria were met with the exception of vinyl chloride. The vinyl chloride result for MW-5 was qualified as estimated due to the observed matrix interference. All remaining results were validated as "U".

5.0. DISCUSSION OF ANALYTICAL RESULTS

Tables 2A-B (Assessment Target Parameter Analytical Results; Appendix A) provide a summary of the target parameter analytical results obtained from the third semiannual sampling event. The analytical results obtained from the third semiannual assessment monitoring event are similar to the results obtained from the previous assessment events. These results were validated in-house by Draper Aden Associates according to the discussion provided in Sections 3.0 and 4.0 of this report. Tables 2A-B lists for each parameter, as applicable, a Maximum Contaminant Level (MCL) established by the USEPA and groundwater quality standards established by the state of North Carolina (NCS), the Instrument Detection Level (IDL) for CLP-Inorganic results, the Contract Required Quantittion Limit (CRQL) for CLP-Organic results, the Limit of Quantitation (LOQ) for LLRA-Organic results, and the analytical method.

Estimated analytical results for the target parameters are provided in Tables 2A-B for preliminary assessment purpose only. Estimated analytical data is not intended for use in determining regulatory compliance issues.

A summary of additional non-target parameter analytical results obtained from the second semiannual assessment sampling event is provided in Table 3. Non-target parameter data is provided for preliminary assessment purpose only and is not intended for use in determining regulatory compliance issues.

5.1 Inorganic Analytical Results

The evaluation of existing inorganic data on metal parameters, collected prior to development of the Assessment Plan, indicated the tentative presence of four metals at elevated concentrations in the groundwater beneath the Watauga County Landfill. Previous metal concentrations detected in the groundwater are generally low or are below analytical method quantitation limits. However, two metals, cadmium and iron, were historically observed at levels above those established by the EPA MCL and Secondary MCL, respectively. Barium, a common naturally occurring parameter, was also observed at relatively elevated levels, but below water

quality standards. Mercury was also detected, although only once for each well in the six or more sampling and analysis events previously conducted.

Since cadmium and mercury were not detected as a result of the initial four background and the first semiannual assessment monitoring analyses, cadmium and mercury were removed from the existing target parameter list.

As a result of the comprehensive EPA Appendix II analyses performed during the first semiannual monitoring event, four additional metals were observed in three or more core monitoring wells, although also at levels far below EPA MCL and North Carolina groundwater standards.

- chromium
- cobalt
- nickel
- vanadium

These four metals were added to the existing metal target parameter list. Three independent samples were collected and analyzed for these four metals during the three previous semiannual sampling events at all core assessment wells to establish background.

The analytical results for the current six target metal parameters, barium, chromium, cobalt, iron, nickel, and vanadium, obtained from the third semiannual assessment sampling event, are summarized in Tables 2A and 2B and discussed below. A discussion of parameter distribution trends for each target parameter is presented in the following Section 6.0. As a result of three successive assessment sampling events, all the assesment target metal parameters (including chromium, cobalt, nickel, and vanadium) were observed at levels far below EPA MCL and North Carolina groundwater standards. Draper Aden Associates recommends herein the withdrawal of the metal target assessment parameters from routine groundwater monitoring.

The two target metal parameters, barium and iron, both common naturally occurring parameters, have been detected in all monitoring wells and surface water sampling locations, as a result of the previous background Assessment monitoring events. Although observed in all of the monitoring wells and surface water sampling locations, barium was detected at levels below the Federal Primary Drinking Water Standard (EPA MCL) and North Carolina groundwater standard (NCS) of 2,000 μg/l as a result of all previous Assessment background monitoring events. Concentrations of iron were often at levels significantly above associated water quality criteria. No EPA MCL or NCS exists for iron. Barium and iron concentrations obtained during the third semiannual monitoring event are similiar to those observed as a result of previous assessment monitoring events.

0.3 ppm

The results obtained during the third semiannual monitoring event for the four metal parameters recently added to the target parameter list are at levels far below EPA MCL and North Carolina groundwater standards. Most of the chromium and nickel concentrations were detected at trace levels, below the analytical method's Contract Required Quantification Limit (CRQL). Chromium and nickel were both only detected in one surface water sample: S-5, the seep located below the waste disposal area, directly above the landfill's sediment pond. Cobalt was detected in 8 of 12 monitoring wells and 5 of 6 surface water sampling locations, although all concentrations were detected at low levels. Vanadium was detected in 7 of 12 monitoring wells, although all concentrations were detected at low levels. Vanadium was only detected in the surface water sample collected from the seep located below the waste disposal area, directly above the landfill sediment pond (S-5). No EPA MCL or North Carolina groundwater standard exists for cobalt or vanadium.

5.2 Organic Analytical Results

i. Target Organic Parameters

The evaluation of existing organic data, compiled prior and during development of the Assessment Plan, indicated the tentative presence of twelve primary target organic parameters occurring in the groundwater beneath the Watauga County Landfill. The presence of one of the original twelve target organic parameters, trans-1,3-dichloropropene, in the groundwater at the site was not supported by the analytical results of the background and first semiannual assessment monitoring events. Since upon completion of background data collection and the first annual EPA Appendix II list sampling event (utilizing LLRA analytical methods), the presence of trans-1,3-dichloropropene in the groundwater and surface waters at the site was not confirmed, trans-1,3-dichloropropene was removed from the target parameter list.

The analytical results for the eleven current target organic parameters obtained from the second semiannual assessment sampling event are summarized in Tables 2A-B. The recent analytical results obtained from each target organic parameter is individually discussed below. A discussion of distribution trends for each target organic parameter is presented in the following Section 6.0.

<u>1,1-Dichloroethane (1,1-DCA)</u>

1,1-dichloroethane (1,1-DCA) was detected at concentrations below the ~~proposed~~ North Carolina groundwater standard (NCS) of 700 µg/l in nine downgradient groundwater monitoring wells (MW-2, MW-3, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12 and MW-17). 1,1-DCA was not detected in the upgradient well MW-1 or the two recent additions to the core well network, MW-15 and MW-19. No EPA MCL exists for 1,1-DCA. Concentrations of 1,1-DCA were also observed below the proposed NCS at three surface water sampling locations (S-2, S-4 and S-6).

Tetrachloroethene (PCE)

Tetrachloroethene (PCE) was detected at concentrations above the EPA MCL of 5 µg/l in six groundwater monitoring wells (MW-2, MW-3, MW-8, MW-11, MW-12 and MW-17) and estimated above the NCS of 0.7 µg/l in two additional monitoring wells (MW-9 and MW-10) and two additional surface water sampling locations (S-4 and S-6).

Trichloroethene (TCE)

Trichloroethene (TCE) was detected at concentrations above the EPA MCL of 5 µg/l in six groundwater monitoring wells (MW-3, MW-8, MW-9, MW-11, MW-12 and MW-17) and estimated (detected below the method CRQL) above the NCS of 2.8 µg/l in two additional surface water sampling locations (S-5 and S-6). TCE was also detected and/or estimated (detected below the method CRQL) at concentrations below the EPA MCL and NCS in three additional groundwater monitoring wells (MW-2, MW-7 and MW-10) and one additional surface water sampling location (S-2).

cis-1,1-Dichloroethene (cis-1,2-DCE)

As previously discussed in Section III, CLP-SOW analytical results for cis-1,2-dichloroethane (utilized with surface water samples only) are reported as part of a total concentration of cis- and trans- isomers of the parameter.

Cis-1,2-Dichloroethene (cis-1,2-DCE) was detected at concentrations above the EPA MCL and NCS of 70 µg/l in one groundwater monitoring well (MW-17). Cis-1,2-DCE was also detected below the EPA MCL and NCS in six additional monitoring wells (MW-3, MW-7, MW-8, MW-9, MW-11, and MW-12). Total 1,2-DCE was detected and/or estimated at concentrations below the EPA MCL and NCS at three surface water sampling locations (S-2, S-4 and S-6).

Dichlorodifluoromethane

1400

Dichlorodifluoromethane was detected at concentrations above the NCS of 0.~~19~~ µg/l in five groundwater monitoring wells (MW-3, MW-8, MW-9, MW-11, and MW-12). No EPA MCL exists for dichlorodifluoromethane. No dichlorodifluoromethane was detected at any surface water sampling locations.

1,1,1-Trichloroethane (1,1,1-TCA)

1,1,1-Trichloroethane (1,1,1-TCA) was detected at concentrations above the EPA MCL and NCS of 200 µg/l in two groundwater monitoring wells (MW-2 and MW-10). 1,1,1-TCA was also detected below the EPA MCL and NCS in seven additional monitoring wells (MW-3, MW-8, MW-9, MW-11, MW-12, MW-15 and MW-17). An estimated concentration of 1,1,1-TCA (below the method CRQL) was also observed below the EPA MCL and NCS at one surface water sampling location (S-6).

1,1-Dichloroethene (1,1-DCE)

1,1-Dichloroethene (1,1-DCE) was detected at concentrations above the EPA MCL and NCS of 7 µg/l in two monitoring wells (MW-2 and MW-10). 1,1-DCE was also detected and/or estimated (observed both above and below the method LOQ) at concentrations below applicable water quality standards in six additional wells (MW-3, MW-8, MW-9, MW-11, MW-12 and MW-17). 1,1-DCE was not detected in any of the surface water samples.

Benzene

Concentrations of benzene were detected below the EPA MCL of 5 µg/l and above the NCS of 1 µg/l in five monitoring wells (MW-1, MW-7, MW-8, MW-9, MW-12 and MW-17). Benzene was also estimated (below the method CRQL) at concentrations below the EPA MCL but above the NCS in one surface water sampling location (S-2).

Vinyl Chloride

Vinyl chloride was observed at estimated concentrations (due to coelution) above the EPA MCL of 2 µg/l and above the NCS of 0.015 µg/l in three core groundwater monitoring wells (MW-8, MW-12, and MW-17). An estimated concentration of vinyl chloride (detected below the method CRQL) was observed at a concentration equal to the EPA MCL of 2 µg/l and above the NCS of 0.015 µg/l in one additional groundwater monitoring well (MW-3) and at one surface water sampling location (S-2).

Methylene Chloride

Simliar to previous assessment monitoring events, methylene chloride was detected at concentrations above the EPA MCL and NCS of 5 µg/l in only one groundwater monitoring well (MW-9). Methylene chloride was detected and/or estimated (observed both above and below the method LOQ) at concentrations below the EPA MCL and NCS in seven additional groundwater monitoring wells (MW-3, MW-7, MW-8, MW-11, MW-12, MW-15 and MW-17). Methylene

chloride was estimated (detected below the method CRQL) at concentrations below the EPA MCL and NCS at two surface water sampling locations (S-2 and S-3).

Chloroethane

Chloroethane was detected in seven groundwater monitoring wells (MW-3, MW-7, MW-8, MW-9, MW-11, MW-12 and MW-17) and detected and/or estimated (detected below the method CRQL) at three surface water sampling locations (S-2, S-4 and S-5). No EPA MCL or NCS exists for chloroethane.

ii. Non-Target Organic Parameters

The analytical results of additional detected non-target organic parameters are summarized in Table 3. The analytical results obtained for non-target parameters, are provided to preliminary identify those parameters which may need to be continually monitored. If upon continued semiannual data collection, the presence of any non-target parameters are confirmed by repeated analysis, the parameter will be added to the target parameter list.

Additional non-target parameters were detected and/or estimated (detected below the method LOQ and/or CRQL) in five monitoring wells and one surface water sampling location. These non-target parameters and associated sampling points are presented below.

Non-target Parameter(s)	Monitoring Point(s)
trichloroflouromethane	MW-3, 9 & 12
1,2-dichloroethane	MW-3, 12 & 17 and S-2
1,2-dichloropropane	MW-3, 7, 12 & 17
1,4-dichlorobenzene	MW-9
2-butanone	S-2
toluene	S-2
ethylbenzene	S-2
xylene	S-2

All of the detected and/or estimated non-target parameter concentrations were observed at levels below corresponding EPA MCLs and North Carolina groundwater quality standards.

As indicated in Table 6A and 6B (Cumulative Detected Non-target Organic Parameter Analytical Results), the presence of the non-target compounds detected in the second semiannual sampling event are not confirmed by the non-target analytical results obtained from previous assessment sampling events. Confirmation of the presence or absence of these non-target parameters will continue to be evaluated on the following semiannual monitoring events.

6.0. PARAMETER DISTRIBUTION TRENDS

6.1 Inorganic Analytical Results

The inorganic analytical results obtained from the third semiannual assessment monitoring event and associated parameter distribution trends below are similar to the results and trends obtained from the previous assessment events. As a result of three successive assessment sampling events, all the assessment target metal parameters were observed at levels far below EPA MCL and North Carolina groundwater standards. Draper Aden Associates recommends herein the withdrawal of the metal target assessment parameters from routine groundwater monitoring.

Barium (total)

Barium distribution trends, indicated by the analytical results of the third sampling event, are inconclusive. Although barium was detected at every point sampled, over half of the barium detected in the groundwater at the site was reported at concentrations less than 150 μg/l. The EPA MCL and the NCS for barium is 2000 μg/l.

Barium was observed above 150 μg/l in five monitoring wells. In two of the monitoring wells located near the waste disposal area (MW-7 and MW-9), barium was observed at concentrations above 500 μg/l. Barium was also observed at elevated levels above 150 μg/l for MW-8 (259 μg/l), located adjacent and west of the waste disposal area; and MW-2 (219 μg/l), located within the bedrock aquifer in the drainage below the waste disposal area.

Elevated concentrations of barium above 150 μg/l were also detected in three surface water monitoring locations; i.e. S-2 (732 μg/l), S-3 (253 μg/l), and S-5 (11,500 μg/l).

Iron (total)

Iron distribution trends are inconclusive due to many of the analytical results being at concentrations less than 5 times the method blank concentration. The monitoring wells for which iron was observed at concentrations greater than 5 times the method blank concentration, MW-1 (8760 μg/L), MW-3 (1830 μg/L), MW-7 (10,300 μg/L), and MW-8 (11,500 μg/l), are located adjacent and west of the waste disposal area.

Elevated concentrations of iron above 1000 μg/l were also observed in four surface water monitoring locations; i.e. S-1 (7480 μg/l), S-2 (29,100 μg/l), S-3 (5,300 μg/l), and S-5 (2,000,000 μg/l).

Chromium (total)

Chromium distribution trends also indicate a relationship between chromium distribution and proximity to the waste disposal area. The two monitoring wells for which chromium was detected at the highest levels, MW-1 (8.2 μg/L) and MW-8 (24.2 μg/L), are located adjacent and west of the waste disposal area. The EPA MCL for chromium is 100 μg/l and the NCS is 50 μg/l.

Chromium was detected in only one surface water monitoring location, S-5 (41.9 μg/l).

Cobalt (total)

Cobalt distribution trends reveal no significant distribution trends. The monitoring wells for which concentrations of cobalt were estimated at the highest concentrations, MW-11 (5.0 μg/L), MW-17 (5.8 μg/L), MW-8 (13.7 μg/L) and MW-9 (21.2 μg/l), are located at disparate loctions. The low levels of Cobalt detected in other wells also reveal no significant distribution trends. No EPA MCL or NCS exists for cobalt.

Concentrations of cobalt between 3.7 μg/l and 13.8 μg/l were also detected in five of six surface water monitoring locations.

Nickel (total)

Nickel distribution trends are inconclusive due to most of the analytical results being at concentrations less than 5 times the method blank concentration. The one monitoring well for which iron was observed at concentrations greater than 5 times the method blank concentration, MW-8 (45.5 μg/l), is located adjacent and west of the waste disposal area. The EPA MCL and NCS for nickel is 100 μg/l.

Nickel was detected in only one surface water monitoring location, S-5 (31.0 μg/l).

Vanadium (total)

Vanadium distribution trends indicate a relationship between vanadium distribution and proximity to the waste disposal area. The two monitoring wells for which vanadium was estimated at the highest concentrations, MW-1 (12.0 μg/L) and MW-8 (35.1 μg/l), are located adjacent of the waste disposal area. No EPA MCL or NCS exists for vanadium.

Vanadium was detected in only one surface water monitoring location, S-5 (104 μg/l).

6.2 Organic Analytical Results

The organic analytical results obtained from the third semiannual assessment monitoring event and associated parameter distribution trends presented below are similar to the results and trends obtained from the previous assessment events.

i. Target Organic Parameters

1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane (1,1-DCA) distribution trends, as indicated by the analytical results of the third semiannual sampling event, reveal 1,1-DCA was observed at elevated concentrations in more monitoring wells and occurs more pervasively throughout the site than any other target parameter. No established EPA MCL or NCS exists for 1,1-DCA. > 700 ppb

1,1-DCA was observed at concentrations above 50 μg/l (although below the ~~proposed~~ North Carolina groundwater quality standard of 700 μg/l) in various locations; the nested well pair, shallow well MW-3 (90 μg/l) and deep well MW-17 (76 μg/l), located at the downgradient property boundary of the Bolick site; the deep well MW-2 (84 μg/l), located in the north drainage below the waste disposal area; MW-8 (52 μg/l), located between the landfill and the Bolick site, and MW-12 (82 μg/l), located downgradient of the Bolick site.

Lower concentrations of 1,1-DCA were observed at three surface water monitoring locations; i.e. S-2 (14 μg/l), S-4 (12 μg/l) and S-6 (14 μg/l).

Tetrachloroethene (PCE)

Tetrachloroethene (PCE) distribution trends show that with few exceptions, PCE was detected primarily along the west drainage basin adjacent to the landfill, located within and below the "Bolick" site.

PCE was detected at concentrations above the EPA MCL (5 μg/l) in the nested well pair located at the downgradient property boundary of the Bolick site; i.e. shallow well MW-3 (21 μg/l) and deep well MW-17 (21 μg/l). PCE was also detected downgradient of the Bolick site at concentrations above the EPA MCL in the nested well pair located below the Boone-Nissan septic field; i.e. shallow well MW-11 (11 μg/l) and the deep well MW-12 (23 μg/l). PCE was similarly detected above the EPA MCL in MW-8 (13 μg/l), located within the Bolick site.

PCE was also detected at concentrations above the EPA MCL in well MW-2 (11 μg/l), located within the bedrock aquifer in the north drainage below the waste disposal area.

PCE was also estimated at concentrations below the EPA MCL (5 μg/l) in the surface water sampling location situated in the west drainage, S-4 (4 J μg/l).

Trichloroethene (TCE)

Trichloroethene (TCE) distribution trends are similar to PCE distribution trends. With few exceptions, TCE was detected primarily along the west drainage basin adjacent to the landfill, located within and below the "Bolick" site.

TCE was detected at the highest concentrations in the nested well pair located at the downgradient property boundary of the Bolick site; i.e. shallow well MW-3 (12 μg/l) and deep well MW-17 (16 μg/l), and downgradient of the Bolick site in well MW-12 (14 μg/l), located below the Boone-Nissan septic field. Elevated TCE concentrations above the EPA MCL of 5 μg/l were also observed in monitoring well MW-8 (11 μg/l), located adjacent to the landfill, within the Bolick site. Elevated concentrations above the EPA MCL for TCE were also observed in MW-9 (5.1 μg/l), located between the landfill and the Rocky Mountain Heights Subdivision.

TCE was also estimated at concentrations below the EPA MCL (5 μg/l) in three surface water monitoring locations; i.e. S-2 (1 J μg/l), S-3 (3 J μg/l), and S-5 (3 J μg/l).

cis-1,2-Dichloroethene (cis-1,2-DCE)

As previously discussed in Section III, CLP-SOW analytical results for cis-1,2-dichloroethane (utilized with surface water samples only) are reported as part of a total concentration of cis- and trans- isomers of the parameter.

Cis-1,2-Dichloroethene (cis-1,2-DCE) distribution trends are similar to PCE, TCE, and dichlorodiflouromethane distribution trends. With one exception (MW-9), 1,2-DCE was only detected along the west drainage basin adjacent to the landfill, located within and below the Bolick site.

Cis-1,2-DCE was observed at the highest concentration (above the EPA MCL and NCS of 70 μg/l) in deep well MW-17 (100 μg/l), located at the downgradient property boundary of the Bolick site. Elevated concentrations of 1,2-DCE (below the EPA MCL and NCS) were also observed in MW-8 (34 μg/l), located adjacent to the landfill and the Bolick site, and shallow well MW-3 (58 μg/l), located at the downgradient property boundary of the Bolick site, and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (17 μg/l) and deep well MW-12 (60 μg/l).

Lower level detections of cis-1,2-DCE were observed at the two monitoring wells, MW-7 (4.4 μg/l), located south of the Bolick site, and MW-9 (13 μg/l), located along the southern saddle above the landfill.

1,2-DCE was not detected at any surface water sampling locations.

Dichlorodifluoromethane

Dichlorodifluoromethane distribution trends are similar to PCE, TCE, and cis-1,2-DCE distribution trends. Concentrations of dichlorodifluoromethane were observed in the west drainage in MW-3 (6.4 μg/l), MW-8 (17 μg/l), MW-11 (3.0 μg/l) and MW-12 (10 μg/l), and between the landfill and the Rocky Mountain Heights Subdivision in MW-9 (11 μg/l). All of these dichlorodifluoromethane concentrations are above the NCS of 0.19 μg/l. No EPA MCL exists for dichlorodifluoromethane.

Dichlorodifluoromethane was not detected at any surface water sampling locations.

1,1,1-Trichloroethane (1,1,1-TCA)

1,1,1-Trichloroethane (1,1,1-TCA) distribution trends show that 1,1,1-TCA, although occurring throughout the core of the site, was observed at the highest concentrations in the bedrock of the northern drainage basin below the landfill. 1,1,1-TCA was observed above the EPA MCL and NCS of 200 μg/l in the bedrock wells, MW-2 (770 μg/l) and MW-10 (570 μg/l), located in the northern drainage below the landfill.

1,1,1-TCA was also observed at lower concentrations, below the EPA MCL and NCS, in both the deep and shallow wells of the two nested pairs located in the west drainage basin; shallow MW-3 (8.2 μg/l) and deep MW-17 (2.9 μg/l), and shallow MW-11 (6.1 μg/l) and deep MW-12 (11 μg/l), located along and downgradient of the Bolick Site property boundary, respectively, and in MW-8 (4.5 μg/l), located upgradient of these two nested pairs of wells in the west drainage basin.

1,1,1-TCA was additionally estimated in MW-9 (1.5 μg/l), located adjacent to the Carroll property and MW-15 (4.1 μg/l), located adjacent to Rocky Branch.

An estimated 1,1,1-TCA concentration was also observed at one surface water sampling location, S-6 (1 J μg/l).

1,1-Dichloroethene (1,1-DCE)

1,1-Dichloroethene (1,1-DCE) distribution trends show that 1,1-DCE was observed at the highest concentrations in the bedrock of the northern drainage basin below the landfill. Concentrations for 1,1-DCE above the EPA MCL and NCS of 7 μg/l were observed in the deep bedrock well MW-2 (180 μg/l), located in northern drainage basin below the landfill and in the bedrock well MW-10 (84.4 μg/l), located in the northern drainage directly below the fill areas.

Monitoring wells located in the west drainage basin reveal either low level, estimated concentrations or the non-detection of 1,1-DCE; i.e. MW-3 (1.9 μg/l), MW-8 (4.9 μg/l), MW-11 (1.1 μg/l), MW-12 (2.7 μg/l), and MW-17 (1.2 μg/l).

Concentrations of 1,1-DCE were additionally estimated in MW-9 (0.546 J μg/l), located adjacent to the Carroll property, and MW-15 (0.77 J μg/l), located adjacent to Rocky Branch.

1,1-DCE was not detected at any surface water sampling locations.

Benzene

Benzene distribution trends suggest a relationship between benzene distribution and proximity to the waste disposal area.

Benzene concentrations between the lower NCS (1 μg/l) and the higher EPA MCL (5 μg/l) were observed distributed about the waste disposal area in six wells; MW-3 (2.0 μg/L), MW-7 (4.8 μg/L), MW-8 (2.3 μg/l), MW-9 (3.9 μg/L), MW-12 (1.4 μg/L) and MW-17 (1.0 μg/L),

Benzene was also estimated at a concentration between the EPA MCL (5 μg/l) and NCS (1 μg/l) in the landfill spring capture outfall, S-2 (2 J μg/L).

Vinyl Chloride

Vinyl chloride distribution trends are similar to PCE, TCE, and cis-1,2-DCE distribution trends. Vinyl chloride concentrations were estimated (due to coelution) above the EPA MCL (2 μg/l) and NCS (0.015 μg/l) in the west drainage adjacent to the landfill in MW-8 (3 J μg/l), located within the Bolick site, and in the two deep wells, MW-17 (4.0 J μg/l), located at the downgradient property boundary of the Bolick site, and MW-12 (2.8 J μg/l), located downgradient of the Bolick site.

An estimated level of vinyl chloride was also detected above the NCS (0.015 μg/l) in MW-3 (0.979 J μg/l), located in the west drainage at the downgradient property boundary of the Bolick site.

Methylene Chloride

Simliar to previous assessment monitoring events, methylene chloride distribution trends reveal anomalous methylene chloride concentrations at MW-9 (100 μg/l), located adjacent to the Carroll Residence, between the landfill and the Rocky Mountain Heights Subdivision. This methylene chloride concentration is twenty times the EPA MCL and North Carolina groundwater standard (NCS) of 5 μg/l. Lower concentrations of methylene chloride were observed in the west drainage in MW-7 (1.4 μg/l), MW-8 (1.6 μg/l) and MW-12 (1.1 μg/l). Estimated concentrations of methylene chloride (below the LOQ) were observed in the west drainage in MW-3 (0.710 J μg/l), MW-11 (0.697 J μg/l) and MW-17 (0.624 J μg/l).

Chloroethane

Chloroethane distribution trends indicate that chloroethane was observed at the highest concentration in MW-9 (110 μg/l), located adjacent to the Carroll property, and well MW-7 (58 μg/l), located south of the Bolick site, adjacent to the disposal area.

Lower concentrations of chloroethane were also observed in five monitoring wells located in the west drainage; shallow well MW-3 (46 μg/l), located adjacent to deep well MW-17 (30 μg/l), deep well MW-12 (40 μg/l), located adjacent to shallow well MW-11 (12 μg/l), and in MW-8 (38 μg/l), located within the Bolick site.

ii. Non-target Organic Parameters

As previously discussed in Section IV.B.ii, additional non-target parameters were detected in five monitoring wells and two surface water sampling locations (Table 3, Appendix I). A combined total of four non-target parameters were detected in the five monitoring wells (MW-3, MW-7, MW-9, MW-12, and MW-17) These monitoring wells are preferentially located along the N55°W lineament, both adjacent to the waste disposal area and within the west drainage. A combined total of five non-target compounds were detected in the two surface water monitoring locations (S-2 and S-5). These five non-target parameters were only detected in one of these surface water sampling locations, S-2, although again at concentrations below the corresponding CLP method CRQL.

Non-target parameter distribution trends will continue to be evaluated. These non-target compounds have not been repeatedly detected in these wells as a result of previous background analyses (Table 6A, Appendix A). The isolated detection of these non-target compounds in these wells is not indicative of a pervasive, persistent occurrence.

7.0. POTABLE WELL SAMPLING AND ANALYSIS PROGRAM

The initial domestic and commercial use potable well sampling event was developed and conducted by Draper Aden Associates on March 5, 1993 at the direction of Watauga county and approval of State officials to protect public health and welfare. The ongoing potable water well sampling and analysis program is currently being jointly conducted by the Appalachian District Health Department (ADHD) and the North Carolina State Laboratory of Public Health.

The objective of the potable well sampling and analysis program is to investigate and evaluate the potential influence and associated risks of the landfill on neighboring groundwater resources. Potable well water samples collected by the ADHD are analyzed for volatile organic compounds by the State Laboratory utilizing EPA Method 502.2. Potable water well locations with accompanying sampled well reference number can be found on the Site Map (Figure 1). A summary of the analytical results of the potable well testing program collected to date are presented in Appendix IV.

The analytical results of the domestic and commercial use potable water well sampling and analysis program previously indicated that two (2) of the forty-one (41) sampled potable wells neighboring the landfill are significantly impacted by volatile organic compounds. These two (2) significant impacted wells are the Carroll residence (well reference no. 12) and the Nissan-Mazda Dealership well (well reference no. 4). These analytical results are from testing conducted in March 1993, and have been included in earlier reports.

At this time the cause or source of all the organics detected in the potable well sampling program cannot be determined. It should be noted that eight (8) of twenty-one (21) compounds detected in the Carroll residence potable well have not been detected in the landfill monitoring well network. The differences in parameter "fingerprints" in groundwater beneath these sites compared to "fingerprints" for landfill wells tends to indicate potential impacts resulting from activities specifically undertaken on these sites and/or immediately around the private well heads and/or components of the well systems.

Review of the analytical results from all the potable well sampling conducted recently, performed by the NC Department of Epidemiology, indicate that the sampled well waters are acceptable for all uses due to either non-detection or low level detection of organic analytes. The two (2) potable water wells previously identified as significantly impacted have been replaced by alternative water sources and have not been resampled during the past year. Individual potable well analytical results obtained recently are discussed below. Discussions of individual potable well analytical results obtained previously can be found in earlier Assessment reports

A routine potable well sampling schedule has been proposed to the NCDEHNR that involves the semiannual sampling of a minimum of six residences.

The proposed semiannual potable well sampling schedule will continue to concentrate on sampling those potable wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring well network. This will be accomplished by routine, semiannual sampling of the three potable wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring well network, as discussed in the recent Remedial Investigation and Alternatives Report [e.g. BREMCO (well reference no. 5), Ward Residence (well reference no. 24), and Shared Well #2 (well reference no. 14)].

The proposed semiannual schedule will also continue to incorporate periodic confirmational sampling on potable wells that have previously shown nondetection of target organic analytes, or have shown detections of organics dissimilar to those detected in the landfill groundwater monitoring well network. This will be accomplished by including the sampling of three (or more as appropriate) additional potable wells during each semiannual sampling event. The decision criteria for inclusion of additional wells in the potable well sampling program should continue to be based both on previous sampling results as well as public input or requests.

The semiannual potable well program sampling events are anticipated to be performed in the spring (e.g. April) and fall (e.g. October) months and will roughly coincide with the semiannual monitoring of the landfill's monitoring program. The second and third routine, regularly scheduled semiannual potable well sampling events from fall, 1996 and spring, 1997 are described herein.

7.1 October 9, 1996 Sampling Event

Six potable wells were resampled on October 9, 1996: the Blue Ridge Electric Membership Company (well reference no. 5), the Bolick rental house (well reference no. 2), Millsaps residence; shared well #2 (well reference no. 14), the Ward Residence (well reference no. 24), the Simko residence (well reference no. 20), the Perry residence (well reference no. 11) and the Taylor residence (well reference no. 18).

Blue Ridge Electric Membership Company, BREMCO (well reference no. 5)

Six (6) chlorinated volatile organic solvent compounds were detected in the October 9, 1996 sampling of the BREMCO potable well (1,1-dichloroethane, 1-1-dichloroethene, cis-1,2-dichloroethene, 1,1,1,-trichloroethane, trichloroethene, and tetrachloroethene). The only compounds detected at quantifiable levels was 1,1-dichloroethane (1,1-DCA), which was detected just above the detection limit of 1 ppb at 1.5 ppb. No EPA Maximum Contaminant Level exists for 1,1-DCA. The other detected organic compounds were observed at unquantifiable levels below 1 ppb.

The same six (6) chlorinated volatile organic solvent compounds detected as a result of the recent sampling event have also been detected in previous sampling events conducted on the BREMCO potable well. All six (6) compounds had been detected in the past five (5) sampling events. Three of these compounds (1,1-dichloroethane, 1,1,1-trichloroethane, and trichloroethene) had been detected in all seven (7) previous sampling events.

Bolick rental residence (well reference no. 2)

The Bolick rental residence potable well, located directly to the southwest of the BREMCO business, was also resampled and analyzed during this sampling event. The Bolick rental residence potable well had been sampled four previous times. Trace levels (less than 1.0 ppb) of two common chlorinated volatile organic compounds (1,1-dichloroethane and 1,1-dichloroethene) and significant levels of methyl ethyl ketone (MEK) and tetrahydrofuran were detected as a result of the previous two sampling events. MEK and tetrahydrofuran have not been detected in the landfill monitoring well network to date. Coincidentally, three of the four compounds detected in the initial Bolick rental residence potable well sampling event conducted on March 5, 1993 (benzene derivative compounds) were also not detected in the landfill monitoring well network.

The October 9, 1996 resampling and analysis of the Bolick rental residence well resulted in the repeated detection of the same two common chlorinated volatile organic compounds: trace levels of 1,1-dichloroethane and 1,1-dichloroethene at an unquantifiable level below 1 ppb.

Shared Well #2 (well reference no. 14)

Shared well #2 serves four residences. Shared well #2 was originally sampled from the Cone residence on March 18, 1993. Subsequent resampling of shared well #2 was performed on the adjacent Edwards residence. The recent resampling of shared well #2 was performed on the Milsap's residence.

The initial March 18, 1993 sampling detected only low levels of 1,4-deichlorobenzene, which is a compound that has not been detected in the landfill monitoring well network.

The second March 30, 1994 sampling detected trace levels of chloroform, which is a common transformation product resulting from the chlorination of well systems, and also detected two (2) common chlorinated organic compounds (1,1-dichloroethene and 1,1,1-trichloroethane) at unquantifiable levels below 1 ppb.

The third January 12, 1995 sampling only detected 1,1-dichloroethene at unquantifiable levels below 1 ppb.

Shared well #2 was drilled deeper in the fall of 1995 in order to provide needed water production. Resampling was performed to investigate the effect of drilling the well deeper on the concentrations of organic compounds found in this potable well. The fourth resampling, performed on October 24, 1995, detected 1,1-dichloroethane (not 1,1-dichloroethene) at unquantifiable levels below 1 ppb, trace levels of tetrachloroethene and 1,1,1-trichloroethane, and chloroform at 9 ppb. Chloroform is likely a transformation product resulting from the recent chlorination of the well system. A variety of additional compounds that due not appear related to the organic constituents found in the landfill's monitoring well network were also detected. These compounds include the following: bromodichloromethane, dibromochloromethane, 2-chlorotoluene, 4-chlorotoluene, methyl ethyl ketone, and tetrahydrofuran. The presence of these compounds were likely a byproduct resulting from the overdrilling of the well bore.

The fifth resampling only detected 1,1-dichloroethene at unquantifiable levels below 1 ppb.

The October 9, 1996 resampling (sixth) again detected 1,1-dichloroethene at unquantifiable levels below 1 ppb and trace levels of tetrachloroethene .

Ward Residence (well reference no. 24)

The recent October 9, 1996 resampling and analysis of the Ward residence potable well only detected trace levels of tetrachloroethene.

Prior to this sampling event, eight sampling events had been conducted on the Ward residence potable well. The combined analyses from the previous sampling events conducted on the Ward residence potable well had detected trace and/or unquantifiable levels below 1 ppb of five (5) chlorinated organic compounds (carbon tetrachloride, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene, and tetrachloroethene).

Three of a total nine Ward residence sampling events also detected trace levels of chloroform. Chloroform is a common transformation product result from the chlorination of well systems.

The initial Ward residence sampling event also detected methylene chloride at 3.2 ppb. the next eight consecutive sampling events at the Ward residence have resulted in the nondetection of methylene chloride. Methylene Chloride is also a known laboratory contaminant.

Only one of eight Ward residence sampling events, the fourth sampling event, resulted in no detected volatile organic compounds.

Simko residence (well reference no. 20)

The potable well water from the Simko residence was resampled on October 9, 1996 to confirm the results from the previous sampling events conducted on March 23, 1993 and May 20-21, 1996. The October 9, 1996 sampling event detected 1,2-dichloroethane at trace levels. The previous two sampling event also detected 1,2-dichloroethane at trace levels and additionally chloroform at unquantifiable levels below 1 ppb. Chloroform is a common transformation product resulting from the chlorination of well systems.

Perry residence (well reference no. 11)

The Perry residence, located on the southern saddle adjacent to the landfill, was resampled for the four time on October 9, 1996. The recent and second sampling events resulted in no detected volatile organic compounds. The third sampling event only detected chloroform at unquantifiable levels below 1 ppb. Chloroform is a common transformation product resulting from the chlorination of well systems.

Taylor residence (well reference no. 18)

The Taylor residence, located northwest of shared well #2, was resampled for the second time on October 9, 1996. Both sampling events resulted in no detected volatile organic compounds.

7.2 June 4, 1997 Sampling Event

The June 4, 1997 sampling event involved BREMCO (well reference no. 5) and the Bolick rental residence (well reference no. 2). The Bolick rental residence potable well is located directly to the southwest of the BREMCO business.

Blue Ridge Electric Membership Company, BREMCO (well reference no. 5)

Six (6) chlorinated volatile organic solvent compounds were detected in the June 4, 1997 sampling of the BREMCO potable well (1,1-dichloroethane, 1-1-dichloroethene, cis-1,2-dichloroethene, 1,1,1,-trichloroethane, trichloroethene, and tetrachloroethene). The only compounds detected at quantifiable levels were 1,1-dichloroethane (1,1-DCA) and 1-1-dichloroethene (1,1-DCE), which were detected just above the detection limit of 1 ppb at 2.0 and 1.7 ppb, respectively. No EPA MCL exists for 1,1-DCA. The EPA MCL for 1,1-DCE is 7 ppb. The other detected organic compounds were observed at unquantifiable levels below 1 ppb.

The same six (6) chlorinated volatile organic solvent compounds detected as a result of the recent sampling event have also been detected in previous sampling events conducted on the

BREMCO potable well. All six (6) compounds have been detected in the past sex (6) sampling events. Three of these compounds (1,1-dichloroethane, 1,1,1-trichloroethane, and trichloroethene) have been detected in all eight (8) previous sampling events.

Bolick rental residence (well reference no. 2)

The Bolick rental residence potable well, located directly to the southwest of the BREMCO business, was also resampled and analyzed during this sampling event. The Bolick rental residence potable well has been sampled five previous times. The recent resampling and analysis of the Bolick rental residence well only resulted in the detection of trace levels of 1,1-dichloroethane

Trace levels (less than 1.0 ppb) of two common chlorinated volatile organic compounds (1,1-dichloroethane and 1,1-dichloroethene) and significant levels of methyl ethyl ketone (MEK) and tetrahydrofuran had been detected as a result of previous sampling events. MEK and tetrahydrofuran have not been detected in the landfill monitoring well network to date. Coincidentally, three of the four compounds detected in the initial Bolick rental residence potable well sampling event conducted on March 5, 1993 (benzene derivative compounds) were also not detected in the landfill monitoring well network.

7.3 June __, 1997 Sampling Event

Pending event...part of spring,97 domestic sampling program. John Alley will report ASAP.

7.4 Pending Potable Well Sampling

The semiannual potable well sampling schedule involves the semiannual sampling of a minimum of six residences. The sampling program will continue to concentrate on sampling those few wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring well network. Duplicate sampling will indicate whether the organics detected are a persistent occurrence or uncommon event.

The proposed semiannual potable well sampling schedule will continue to concentrate on sampling those potable wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring well network. This will be accomplished by routine, semiannual sampling of the three potable wells that have previously shown trace level detections of organics similar to those detected in the landfill groundwater monitoring well network [e.g. BREMCO (well reference no. 5), Ward Residence (well reference no. 24), and Shared Well #2 (well reference no. 14)].

The proposed semiannual schedule will also continue to incorporate periodic confirmational sampling on potable wells that have previously shown nondetection of target organic analytes, or have shown detections of organics dissimilar to those detected in the landfill groundwater monitoring well network. This will be accomplished by including the sampling of three (or more as appropriate) additional potable wells during each semiannual sampling event. The decision criteria for inclusion of additional wells in the potable well sampling program should continue to be based both on previous sampling results as well as public input or requests.

The Health Department will also continue attempt to sample the seasonally occupied McClintock residence (well reference no. 33) during the next October sampling event. The two previous sampling events performed on this well were also performed during the months of August and October.

In summary, review of the analytical results from all the potable well sampling conducted recently, performed by the NC Department of Epidemiology, indicate that the recently sampled well waters are acceptable for all uses due to either nondetection or very low level detection of the organic analytes. At this time the cause or source of all the low level detected organics can not be determined.

8.0. CONCLUSIONS

8.1 Parameter Distribution

The analytical results obtained from the third semiannual assessment monitoring event are similar to the results obtained from the previous assessment events. The analytical results indicate the northern edge of the occurrence of assessment target parameters in the groundwater primarily exists within the construction right-of-way for the proposed Route 421 bypass. South of the proposed bypass, the detection of assessment target parameters was concentrated between the saddle, located between the landfill and the Rocky Mountain Heights Subdivision, and the west and north drainages below the landfill.

West Drainage

In the west drainage, the detection of target parameters above groundwater standards was observed in both the soil and bedrock groundwater, extending from the landfill to the proposed bypass. All eleven target organic parameters were detected above the method LOQ in MW-12, located south of the proposed bypass. Previous organic analyses performed on the piezometer network on November 16-18, 1992, indicates the target parameters are confined to the trough of the west drainage.

Five target organic parameters were detected in the surface water sampling location, S-4, located in the west drainage (two parameters at concentrations above the method CRQL and three parameters below the method CRQL). No concentrations of these five organic compounds observed in the west drainage were above surface water standards at S-4. Sampling and analysis performed on surface water sampling location, S-6, located approximately 150 feet downstream from S-4, indicates levels observed in S-4 do not dissipate quickly. The organic compounds and relative levels detected in the surface water sampling locations in the west drainage are consistent with the those detected in adjacent groundwater monitoring wells, although at lower concentrations, and indicate that organic impacts to surface water are entirely due to local groundwater discharge at this location.

North Drainage

In the north drainage, the detection of target parameters is confined to the bedrock aquifer medium. The elevated levels of the target parameters detected in the two monitoring wells accessing the bedrock groundwater in the north drainage indicate the parameters have preferentially migrated to deeper fracture zones within the bedrock. Downgradient of the northern drainage, the bedrock aquifer system enters the central watershed of Rocky Branch and is likely significantly diluted. Groundwater entering the Rocky Branch watershed from the northern drainage may be exhibiting lateral stratification. Rather than continuing to follow the northern drainage orientation, groundwater may flow N55°W, parallel to Rocky Branch, within the area between the nested well pair, MW-14 and MW-15, and the Chevrolet Dealership, before reaching the apex of the watershed.. Note, the absence of similar volatile organic parameters detected at the Chevrolet Dealership's potable well suggests non-impact at the dealership's well location.

Southern Saddle

Several organic compounds detected in the monitoring well located along the southern saddle between the landfill and the Rocky Mountain Heights subdivision, particularly Methylene Chloride, were observed at markedly different concentrations than the levels of the organic compounds detected in the remainder of the monitoring well network. The analytical results obtained from the monitoring well installed along the saddle between the landfill and the Rocky Mountain Heights Subdivision (MW-9) indicates the organic parameters observed in the Carroll residence potable well are not confined to the Carroll property.

8.2 Target Parameter Summary

As discussed previously throughout this report, the analytical results obtained from the third semiannual assessment monitoring event are similar to the results obtained from the previous six assessment events (comprised of four quarterly background and two previous semiannual events) .

The detection of five target parameters, benzene, cis-1,2-DCE, chloroethane dichlorodifluoromethane and vinyl chloride, was only reported within the west drainage and southern saddle.

The detection of 1,1,1-TCA and 1,1-DCE was observed in both the west and the north drainages, although these parameters were observed at significantly higher elevated levels in the north drainage, particularly at the deep bedrock well MW-2. The detection of 1,1,1-TCA was also observed along the southern saddle.

The detection of PCE and TCE was observed in both the west and the north drainages, although at significantly higher elevated levels in the west drainage.

The detection of 1,1-DCA was observed at elevated concentrations in more monitoring wells throughout the site than any other target parameter.

Methylene Chloride was observed in MW-9, located along the southern saddle between the landfill and the Rocky Mountain Heights subdivision, at concentrations twenty times the EPA MCL. Although methylene chloride was observed in seven other monitoring wells, the concentrations (often estimated) were observed at levels less than one/fiftieth the concentration observed in MW-9.

As a result of three successive assessment sampling events, all the assessment target metal parameters were observed at levels far below EPA MCL and North Carolina groundwater standards. Draper Aden Associates recommends herein the withdrawal of the metal target assessment parameters from routine groundwater monitoring.

8.3 Closing

Next Assessment Monitoring Event

The eighth assessment monitoring event is tentatively scheduled to be performed in October, 1997. **Based on an evaluation of risk, combined with the steady state conditions observed in the third semiannual assessment monitoring event and six previous assessment events, Draper Aden recommends herein the initiation of annual rather than semiannual monitoring, withdrawal of the metal target assessment parameters, and continued withdrawal of select non-impacted assessment monitoring wells from routine groundwater monitoring for NCDEHNR approval.** Upon approval, the eighth assessment monitoring event will be scheduled to be performed in April, 1998.

Additional Assessment Monitoring Well

As proposed in the Remedial Investigation and Alternatives (RIA) Report for the Watauga County Landfill, dated January 12, 1996, an additional assessment monitoring well, MW-19, was installed in the west drainage. This additional assessment monitoring well was installed in response to trace level detections observed in the Blue Ridge Electric Company's (BREMCO) potable well (Potable Well Analysis Summary Table, Appendix IV). These trace level detections suggest groundwater flow within the west drainage may follow a N55°W lineament set within the west drainage. The objective of the additional monitoring well was to provide additional information to evaluate the transport, migration, and fate of the organic parameters, and evaluate aquifer equilibrium conditions existing within the west drainge. The County obtained an agreement with BREMCO for the property easement necessary for the installation of the additional well and installed the well approximately fifty feet north-northwest of BREMCO's potable well (well reference no. 5, see Figure 1), along the N55°W lineament set trace.

Review of the BREMCO potable well record indicates that the well was drilled to a total depth of 425 feet. The driller of the BREMCO potable well (Dewey Wright Well and Pump) has been unable to locate a detailed well record specifying groundwater production zones. Therefore, since the primary groundwater production zone observed during the drilling of BREMCO's potable well is not documented, the depth of the screened interval of the proposed monitoring well was proposed to coincide with the the first portion of the aquifer encountered most likely to be impacted. The actual depth of the monitoring well screen interval was proposed to be chosen in the field in response to groundwater production conditions encountered during drilling.

Geologic formations encountered during the drilling of the additional assessment well generally agree with expected formations as depicted on the geologic map compiled by Bryant and Reed (1970) and presented on Figure 5 of the Watauga County Landfill Assessment Plan (dated September 3, 1993), and the revised Vicinity Geology Map provided as Figure 4 in the Watauga County Landfill Activity Report (dated July 8, 1994). The revised mapping incorporated information obtained from assessment drilling and site reconnaissance with information obtained from Bryant and Reed (1970) and the Watauga County Soil Survey (1944).

The initial 55 feet of bedrock encountered during the drilling of the additional assessment well was the rock assemblage referenced by Bryant and Reed as Lower Precambrian "mixed rocks" (pm). The "mixed rocks" assemblage is a narrow band, less than one half mile wide, existing between a low grade layered cataclastic schist and gneiss and a tectonically overlying medium grade amphibolite and hornblende gneiss. The "mixed rocks" unit, as described by Bryant and Reed, consists of interlayered and intergrading amphibolite calc-silicate granofels, biotite-hornblende gneiss, hornblende-epidote-biotite gneiss, biotite-hornblende-plagioclase schist and

gneiss, epidote-biotite-plagioclase schist and gneiss, and granitic gneiss ranging from quartz diorite to quartz monzonite.

At 55 feet in depth, the drilling encountered the Lower Precambrian amphibolite and hornblende gneiss (pa). These rocks tectonically overly the "mixed rock" assemblage. At this location in the west drainage, this geologic contact between the "mixed rocks" unit and the amphibolite and hornblende gneiss coincides with the N55°W lineament set trace. The geologic contact coinciding with the N55°W lineament set trace represents a core fracture zone within the bedrock fracture system. Abundant groundwater was observed at this depth and the monitoring well was completed at 70 feet in depth and screened over the geologic contact.

Monitoring well MW-19 was installed, developed, and equipped with a dedicated stainless steel and TEFLON electrical submersible pump prior to the seventh assessment monitoring event. The subsequent sampling of MW-19 resulted in no detected volatile organic compounds.

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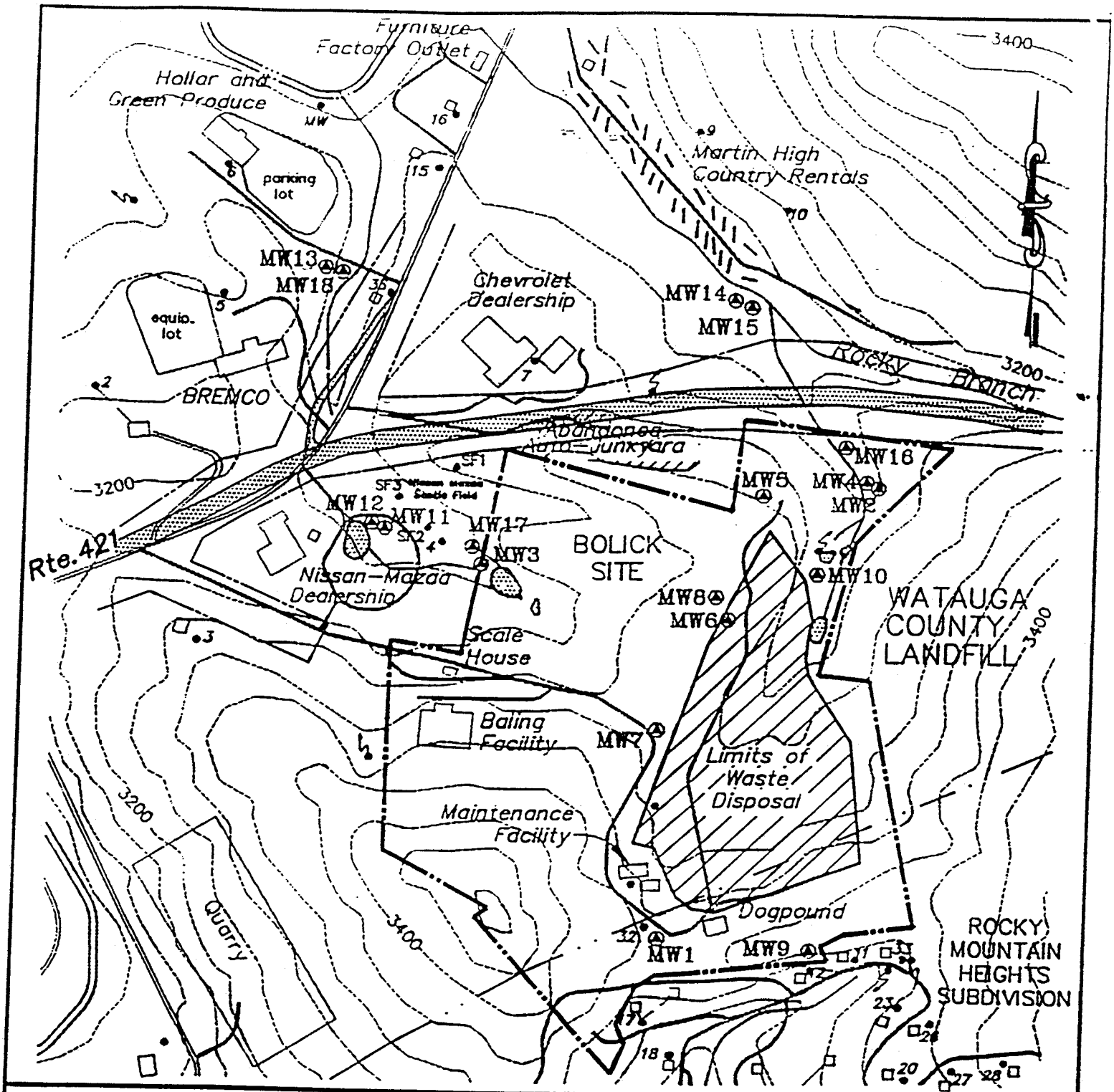
gneiss, epidote-biotite-plagioclase schist and gneiss, and granitic gneiss ranging from quartz diorite to quartz monzonite.

At 55 feet in depth, the drilling encountered the Lower Precambrian amphibolite and hornblende gneiss (pa). These rocks tectonically overly the "mixed rock" assemblage. At this location in the west drainage, this geologic contact between the "mixed rocks" unit and the amphibolite and hornblende gneiss coincides with the N55°W lineament set trace. The geologic contact coinciding with the N55°W lineament set trace represents a core fracture zone within the bedrock fracture system. Abundant groundwater was observed at this depth and the monitoring well was completed at 70 feet in depth and screened over the geologic contact.

Monitoring well MW-19 was installed, developed, and equipped with a dedicated stainless steel and TEFLON electrical submersible pump prior to the seventh assessment monitoring event. The subsequent sampling of MW-19 resulted in no detected volatile organic compounds.



3200 Existing Ground

Proposed Right-of-Way

Proposed Road Improvements

PROPOSED ROUTE 421 BYPASS MAP

Draper Aden Associates CONSULTING ENGINEERS Blacksburg, Va. – Richmond, Va. – Nashville, Tenn.	JOB No.	DATE:	SCALE:	FIGURE
	6520-14	10 JUN 94	1"=600'±	2

APPENDIX A

TABLES AND FIGURES

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Table 1

Watauga County Landfill
Groundwater and Surface Water
Assessment Monitoring Schedule

GROUNDWATER MONITORING	1st Year Quarterly Sampling Events				Alternating Subsequent Sampling Events*	
"CORE" ASSESSMENT WELLS						
Target Parameter Monitoring Parameters	CLP Methods	CLP Methods	CLP Methods	CLP Methods	Low Level Risk Assessment Screening Methods	CLP Methods
"BOUNDARY" ASSESSMENT WELLS**						
Target Parameter Monitoring Parameters	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods	LLRA Methods*	-
SURFACE WATER MONITORING						
Target Parameter Monitoring Parameters	CLP Methods	-	CLP Methods	-	CLP Methods	CLP Methods

CLP - EPA Contract Laboratory Program Methods
LLRA - Low Level Risk Assessment Screening Methods (EPA SW-846)
* - proposed initiation of annual rather than semiannual monitoring
** - monitoring frequency for the non-impacted wells based on temporal contaminant distribution trends observed from subsequent monitoring events.

Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
06/03/97

Table 2A
Third Semi-Annual Monitoring Event
Assessment Target Parameter Analytical Results
Core Groundwater Monitoring Wells - Inorganic and Organic Analyses

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Parameters	Event	Results ug/L(ppb)																									
		MW-1		MW-2		MW-3		MW-7		MW-8		MW-9		MW-10		MW-11		MW-12		MW-15		MW-17		MW-19		NCS (ug/L)	MCL (ug/L)
METALS, TOTAL																											
Barium, Total	4/8/97	171		219		97.0		615		259		659		83.0		137		145		77.3		106		36.8		2000	2000
Chromium, Total	4/8/97	8.2		1.0		3.7		4.2		24.2		1.1		3.7		1.2		0.90	U	2.8		0.90	U	1.9		50	100
Cobalt, Total	4/8/97	3.2		0.90	U	1.7		3.5		13.7		21.2		0.90	U	5.0		0.90	U	0.90	U	5.8		1.2		-	-
Iron, Total	4/8/97	8760		U*		1830		10300		11500		U*		U*		U*		U*		U*		U*		U*		300*	300*
Nickel, Total	4/8/97	U*		U*		U*		U*		45.5		U*		U*		U*		U*		U*		U*		U*		100	100
Vanadium, Total	4/8/97	12.0		1.6		4.6		8.4		35.1		0.80	U	2.2		0.80	U	0.80	U	3.4		0.80	U	0.80	U	-	-
ORGANICS																											
Benzene	4/8/97	1.00	U	100	U	2.0		4.8		2.3		3.9		100	U	1.00	U	1.4		1.00	U	1.0		1.00	U	1	5
Chloroethane	4/8/97	1.00	U	1.00	U	46		58		38		110		1.00	U	12		40		1.00	U	30		1.00	U	-	-
Dichlorodifluoromethane	4/8/97	1.00	U	1.00	U	6.4		1.00	U	17		11		1.00	U	3.0		10		1.00	U	1.00	U	1.00	U	0.19	-
1,1-Dichloroethane	4/8/97	1.00	U	84		90		9.4		52		28		27		26		82		1.00	U	76		1.00	U	700**	-
1,1-Dichloroethene	4/8/97	1.00	U	180		1.9		1.00	U	4.9		0.546	J	84.4		1.1		2.7		0.77	J	1.2		1.00	U	7	7
1,2-Dichloroethene (cis)	4/8/97	1.00	U	1.00	U	58		4.4		34		13		1.00	U	17		60		1.00	U	100		1.00	U	70	70
1,2-Dichloroethene (trans)	4/8/97	1.00	U	1.00	U	1.00	U	3.4		1.00	U	0.963	J	1.00	U	1.00	U	1.00	U	1.00	U	0.624	J	1.00	U	70	70
Methylene Chloride	4/8/97	1.00	U	1.00	U	0.710	J	1.4		1.6		100		1.00	U	0.697	J	1.1		0.656	J	0.631	J	1.00	U	5	5
Tetrachloroethene	4/8/97	1.00	U	11		21		1.00	U	13		3.4		4.4		11		23		1.00	U	21		1.00	U	0.7	5
Trichloroethene	4/8/97	1.00	U	1.9		12		0.533	J	11		5.1		1.2		6.0		14		1.00	U	16		1.00	U	2.8	5
1,1,1-Trichloroethane	4/8/97	1.00	U	770		8.2		1.00	U	4.5		1.5		570		6.1		11		4.1		2.9		1.00	U	200	200
Vinyl Chloride	4/8/97	1.00	U	1.00	U	0.979	J	1.00	U	3	J	1.00	U	1.00	U	1.00	U	2.8	J	1.00	U	4.0	J	1.00	U	0.015	2

Notes:
NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Level (IDL) for Inorganics and not detected above Limit of Quantitation (LOQ) for Organics
U* Denotes result less than 5X method blank concentration.
J Denotes an estimated value
* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
** Denotes a proposed NCS
\- Denotes Not Avaliable or Not Sampled
Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.

(1) Metal parameters were analyzed in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0.
CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method for metal analysis
(2) Organic parameters were analyzed in accordance with EPA SW-846 Method #8021.

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Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1

06/19/97

Table 2B
Third Semi-Annual Monitoring Event
Assessment Target Parameter Analytical Results
Surface Water Monitoring Locations - Inorganic and Organic Analysis
Contract Laboratory Program (CLP) Statements of Work (SOW)

Parameters	Sampling Date	Results ug/L(ppb)													
		S-1		S-2		S-3		S-4		S-5		S-6		NCS (ug/L)	MCL (ug/L)
METALS, TOTAL															
Barium, Total	4/8/97	122		732		253		72		11500		54.9		2000	2000
Chromium, Total	4/8/97	0.90	U	0.90	U	0.90	U	0.90	U	41.9		0.90	U	50	100
Cobalt, Total	4/8/97	8.8		13.8		8.6		4.8		0.90	U	3.7		-	-
Iron, Total	4/8/97	7480		29100		5300		529		2E+06		962		300*	300*
Nickel, Total	4/8/97	U*		U*		U*		U*		31.0		U*		100	100
Vanadium, Total	4/8/97	0.80	U	0.80	U	0.80	U	0.80	U	104		0.80	U	-	-
ORGANICS															
Benzene	4/8/97	10	U	2	J	10	U	10	U	10	U	10	U	1	5
Chloroethane	4/8/97	10	U	50		10	U	1	J	23		10	U	-	-
Dichlorodifluoromethane	4/8/97	10	U	10	U	10	U	10	U	10	U	10	U	0.19	-
1,1-Dichloroethane	4/8/97	10	U	14		10	U	12		10	U	14		700**	-
1,1-Dichloroethene	4/8/97	10	U	10	U	10	U	10	U	10	U	10	U	7	7
1,2-Dichloroethene (total)	4/8/97	10	U	6	J	10	U	15		10	U	16		70	70
Methylene Chloride	4/8/97	10	U	3	J	1	J	10	U	10	U	10	U	5	5
Tetrachloroethene	4/8/97	10	U	10	U	10	U	4	J	10	U	4	J	0.7	5
Trichloroethene	4/8/97	10	U	1	J	10	U	3	J	10	U	3	J	2.8	5
1,1,1-Trichloroethane	4/8/97	10	U	10	U	10	U	10	U	10	U	1	J	200	200
Vinyl Chloride	4/8/97	10	U	2	J	10	U	10	U	10	U	10	U	0.015	2

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Detection Limit (IDL) for Inorganics,
and not detected above Contract Required Quantification Limit (CRQL) for Organics.
U* Denotes result less than 5X method blank concentration.
J Denotes an estimated value
* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
** Denotes a proposed NCS
\- Denotes Not Available or Not Sampled

Note: CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0 for metal analysis. Organic parameters were analyzed in accordance with USEPA CLP SOW OLMO3.2.

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Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
06/19/97

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Table 3
Third Semi-Annual Assessment Monitoring Event
Detected Non-Target Organic Parameters

CLP Methods

Parameter	Event	S-1		S-2		S-3		S-4		S-5		S-6		NCS (ug/L)	MCL (ug/L)
2-Butanone	4/8/97	~		3	J	~		~		~		~		-	-
1,2-Dichloroethane	4/8/97	~		1	J	~		~		~		~			
Ethylbenzene	4/8/97	~		2	J	~		~		~		~		29	700
Toluene	4/8/97	~		2	J	~		~		~		~		1000	1000
Xylene (total)	4/8/97	~		6	J	~		~		~		~		530	10000

SW-846 Methods

Parameter	Event	MW-3		MW-7		MW-9		MW-12		MW-17				NCS (ug/L)	MCL (ug/L)
1,2-Dichloroethane	4/8/97	1.5		~		~		1.1		1.8				-	-
1,2-Dichloropropane	4/8/97	0.689	J	2.6		~		0.657	J	0.972	J			-	-
1,4-Dichlorobenzene	4/8/97	~		~		0.547	J	~		~					
Trichlorofluoromethane	4/8/97	1.0		~		1.4		1.3		~				-	-

Notes:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
~ Denotes Not Detected
- Denotes Not Available
J Denotes an estimated value
Organic parameters were analyzed in accordance with USEPA CLP SOW OLMO1.9 (3/90) and EPA SW-846 Method #8021..

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Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1

16-Jun-97

TABLE 4
GROUNDWATER LEVEL DATA
MONITORING WELLS

	REFERENCE ELEVATION								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
GROUND	3339.03	3151.24	3182.25	3150.06	3263.81	3262.55	3270.56	3235.39	3356.65
MEASURING POINT	3341.80	3152.94	3183.12	3152.52	3267.69	3266.04	3273.53	3239.77	3359.23
DATE	STATIC WATER LEVEL								
6/20/94	38.00	7.88	18.43	13.48	NM	44.12	23.03	17.68	59.35
9/27/94	39.69	7.51	17.42	10.45	NM	43.99	30.73	17.38	57.79
2/6/95	37.57	5.58	16.20	8.18	50.39	42.85	45.88	15.41	59.54
4/11/95	37.94	6.46	16.85	9.22	48.95	42.81	49.11	16.05	59.30
7/10/95	41.20	6.60	17.43	8.94	50.29	43.73	48.98	17.42	80.17
4/9/96	38.71	5.85	7.01	8.40	49.87	42.87	44.32	16.80	61.28
4/8/97	38.30	5.59	16.35	NM	NM	NM	40.50	17.43	62.47
DATE	GROUNDWATER ELEVATION								
6/20/94	3303.80	3145.06	3164.69	3139.04	NM	3221.92	3250.50	3222.09	3299.88
9/27/94	3302.11	3145.43	3165.70	3142.07	NM	3222.05	3242.80	3222.39	3301.44
2/6/95	3304.23	3147.36	3166.92	3144.34	3217.30	3223.19	3227.65	3224.36	3299.69
4/11/95	3303.86	3146.48	3166.27	3143.30	3218.74	3223.23	3224.42	3223.72	3299.93
7/10/95	3300.60	3146.34	3165.69	3143.58	3217.40	3222.31	3224.55	3222.35	3279.06
4/9/96	3303.09	3147.09	3176.11	3144.12	3217.82	3223.17	3229.21	3222.97	3297.95
4/8/97	3303.50	3147.35	3166.77	NM	NM	NM	3233.03	3222.34	3296.76

	REFERENCE ELEVATION								
	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18
GROUND	3202.18	3156.44	3156.82	3117.39	3117	3117.15	3141.42	3181.14	3117.12
MEASURING POINT	3203.87	3159.6	3159.15	3119.72	3120	3120.65	3142.72	3183.62	3119.63
DATE	STATIC WATER LEVEL								
6/20/94	8.18	13.35	11.04	19.66	7.94	11.92	5.32	17.93	17.93
9/27/94	8.09	13.22	10.78	19.57	7.89	11.82	5.68	17.83	17.86
2/6/95	7.73	13.22	10.61	19.39	7.52	11.55	4.61	17.05	17.58
4/11/95	7.90	13.00	10.58	19.53	7.75	11.87	5.11	17.48	17.65
7/10/95	7.91	12.53	10.48	19.62	7.74	11.96	4.54	18.11	17.94
4/9/96	7.67	12.73	10.38	19.56	7.59	11.85	4.67	17.78	17.81
4/8/97	7.67	12.28	9.48	NM	NM	11.91	NM	17.17	NM
DATE	GROUNDWATER ELEVATION								
6/20/94	3195.69	3146.25	3148.11	3100.06	3112.06	3108.73	3137.40	3165.69	3101.70
9/27/94	3195.78	3146.38	3148.37	3100.15	3112.11	3108.83	3137.04	3165.79	3101.77
2/6/95	3196.14	3146.38	3148.54	3100.33	3112.48	3109.10	3138.11	3166.57	3102.05
4/11/95	3195.97	3146.60	3148.57	3100.19	3112.25	3108.78	3137.61	3166.14	3101.98
7/10/95	3195.96	3147.07	3148.67	3100.10	3112.26	3108.69	3138.18	3165.51	3101.69
4/9/96	3196.20	3146.87	3148.77	3100.16	3112.41	3108.80	3138.05	3165.84	3101.82
4/8/97	3196.20	3147.32	3149.67	NM	NM	3108.74	NM	3166.45	NM

1) ALL MEASUREMENTS IN FEET.
2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.
4) NM - NOT MEASURED
5) ESTIMATED ELEVATION OF MW-19 IS 3125.0.
STATIC WATER LEVEL FOR MW-19 ON 4/8/97 IS 4.85 FT.
CORESPONDING GROUNDWATER ELEVATION FOR MW-19 ON 4/8/97 IS 3120.15 FT.

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Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
06/13/97

Table 5A
Background Assessment Organic Target Parameter Analytical Results
Core Groundwater Monitoring Wells and Septic Field Wells

Parameter	Event	MW-1		MW-2		MW-3		MW-6		MW-7		MW-8		MW-9		MW-10		MW-11		MW-12		MW-17		SFW-1		SFW-2		SFW-3		Analysis Type	NCS ug/L	MCL (ug/L)
		Results ug/l(ppb)																														
		Organics																														
Benzene	6/20/94	10	U	120	U	10	U	9	J	0.42	J	0.72	J	0.40	J	5.30	U	5.30	U	5.30	U	5.30	U	-		-		-		CLP/8021	1	5
	9/27/94	10	U	9	J	2	J	12	J	3	J	5	J	4	J	10	U	10	U	10	U	2	J	-		-		-		CLP	1	5
	2/06/95	10	U	150	U	2	J	12	J	3.6		5	J	2	J	50	U	10	U	10	U	10	U	10	U	10	U	10	U	CLP	1	5
	4/11/95	10	U	200	U	1	J	10	J	3	J	6	J	3	J	71	U	10	U	10	U	10	U	10	U	10	U	10	U	CLP	1	5
	7/10/95	2.0	U	2.0	U	2.3		14		2.2		6.2		4.0		2.0	U	2.0	U	2.0	U	2.0	U	-		-		-		8021	1	5
	7/10/95	5	U	5	U	2.6	J	13		2.7	J	3.3		3.8	J	5	U	5	U	5	U	5	U	-		-		-		8260	1	5
Chloroethane	6/20/94	10	U	120	U	6	J	8	J	7.33	J	9.44		56.78	J	9.29	U	1.16	J	20.23		28.21		-		-		-		CLP/8021	-	-
	9/27/94	10	U	170	U	8	J	10	J	16		7	J	18		10	U	10	U	5	J	7	J	-		-		-		CLP	-	-
	2/06/95	10	U	150	U	7	J	11	J	28		7	J	17		50	U	10	U	4	J	5	J	10	U	10	U	10	U	CLP	-	-
	4/11/95	10	U	200	U	6	J	8	J	16		7	J	15		71	U	10	U	2	J	4	J	10	U	10	U	10	U	CLP	-	-
	7/10/95	2.0	U	2.0	U	10	U	15	U	9.2		10	U	20	U	2.0	U	2.0	U	3.0	U	5.0	U	-		-		-		8021	-	-
	7/10/95	5	U	5	U	8.7		16		22		9.3		21		5	U	5	U	6.4		4.9	J	-		-		-		8260	-	-
Dichlorodifluoromethane	6/20/94	10	U	120	U	7	J	25	U	46.64	U	2.26	J	13.92	J	46.64	U	1.88	J	9.83	J	1.44	J	-		-		-		CLP/8021	0.19	-
	9/27/94	10	U	10	J	4	J	25	U	10	U	2	J	9	J	10	U	10	U	4	J	4	J	-		-		-		CLP	0.19	-
	2/06/95	10	U	150	U	10	U	25	U	1.0	U	14		27		50	U	2	J	10	U	12		10	U	10	U	10	U	CLP	0.19	-
	4/11/95	10	U	200	U	10	U	25	U	10	U	7	J	9	J	71	U	10	U	4	J	3	J	10	U	10	U	10	U	CLP	0.19	-
	7/10/95	2.0	UJ	2.0	UJ	6.9	J	2.0	UJ	2.0	UJ	16	J	2.0	UJ	2.0	UJ	2.0	UJ	5.7	J	5.3	J	-		-		-		8021	0.19	-
	7/10/95	5	U	5	U	7.2		2.2	J	5	U	6.7		2.8	J	5	U	1.7	J	4.0	J	4.2	J	-		-		-		8260	0.19	-
1,1-Dichloroethane	6/20/94	10	U	75	J	160		97		10.42	J	35.33	J	13.63	J	28.62	J	25.23	J	82.77	J	105.03	J	-		-		-		CLP/8021	700**	-
	9/27/94	10	U	110	J	200		110		1	J	70		23		84		27		130		230		-		-		-		CLP	700**	-
	2/06/95	10	U	160		180		140		2.9		74		30		37	J	28		120		170		10	U	18		11		CLP	700**	-
	4/11/95	10	U	98	J	130		94		4	J	58		35		67	J	18		77		130		-		-		-		CLP	700**	-
	7/10/95	2.0	U	81		130		100	J	4.8		60	J	36		58	J	22		100		102	J	-		-		-		8021	700**	-
	7/10/95	5	U	94		160		130		6.8		71		40		55		26		120		130		-		-		-		8260	700**	-
1,1-Dichloroethene	6/20/94	10	U	360		5	J	25	U	9.75	U	0.30	J	9.75	U	32.29		9.75	U	1.15	J	1.09	J	-		-		-		CLP/8021	7	7
	9/27/94	10	U	330		6	J	25	U	10	U	4	J	10	U	160		10	U	5	J	3	J	-		-		-		CLP	7	7
	2/06/95	10	U	340		6	J	25	U	1.0	U	6	J	10	U	100		10	U	4	J	3	J	10	U	10	U	10	U	CLP	7	7
	4/11/95	10	U	190	J	3	J	25	U	10	U	3	J	10	U	120		10	U	2	J	1	J	-		-		-		CLP	7	7
	7/10/95	2.0	U	170		4.0		2.0	U	2.0	U	5.7		2.0	U	160	J	0.86	J	3.9		1.8	J	-		-		-		8021	7	7
	7/10/95	5	U	179	J	3.7	J	1.3	J	5	U	4.1	J	5	U	88		5	U	3.6	J	1.6	J	-		-		-		8260	7	7
cis 1,2-Dichloroethene(3)	6/20/94	10	U	120	U	37		330		0.97	J	28.90		0.95	J	9.49	U	5.05	J	28.13		60.79	J	-		-		-		CLP/8021	70	70
	9/27/94	10	U	170	U	61		380		3	J	94		2	J	10	U	8	J	47		130		-		-		-		CLP	70	70
	2/06/95	10	U	150	U	54		370		7.2		97		2	J	50	U	8	J	37		80		10	U	6	J	3	J	CLP	70	70
	4/11/95	10	U	200	U	44		330		9	J	100		4	J	71	U	6	J	30		70		-		-		-		CLP	70	70
	7/10/95	2.0	U	2.0	U	65		440	J	4.4		110	J	7.4		2.0	U	11		37		72	J	-		-		-		8021	70	70
	7/10/95	5	U	5	U	50		430		7.9		89		6.2		5	U	7.6		42		63		-		-		-		8260	70	70
trans-1,3-Dichloropropene	6/20/94	10	U	120	U	10	U	25	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	-		-		-		CLP/8021	-	-
	9/27/94	10	U	170	U	10	U	25	U	10	U	10	U	10	U	10	U	10	U	10	U	14	U	-		-		-		CLP	-	-
	2/06/95	10	U	150	U	10	U	25	U	1.0	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	CLP	-	-
	4/11/95	10	U	200	U	10	U	25	U	10	U	10	U	10	U	71	U	10	U	10	U	10	U	-		-		-		CLP	-	-
	7/10/95	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	-		-		-		8021	-	-
	7/10/95	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	-		-		-		8260	-	-
Methylene Chloride	6/20/94	8	J	120	U	6	J	11	J	36.20	UJ	36.20	UJ	140.1	J	36.20	UJ	36.20	UJ	8.58	J	36.20	UJ	-		-		-		CLP/8021	5	5
	9/27/94	10	U	190		14	U	25	U	10	U	4	J	73		180		10	U	28	U	58	U	-		-		-		CLP	5	5
	2/06/95	10	U	150	U	10	U	25	U	1.5		10	U	93		50	U	10	U	10	U	10	U	2	J	10	U	2	J	CLP	5	5
	4/11/95	10	U	200	U	10	U	25	U	10	U	10	U	120		71	U	10	U	10	U	10	U	-		-		-		CLP	5	5
	7/10/95	2.0	U	2.0	U	2.4		1.2	J	2.0	U	4.7		49		2.0	U	2.9		3.3		2.2		-		-		-		8021	5	5
	7/10/95	5	U	5	U	5	U	5	U	5	U	5	U	160		5	U	5	U	5.9	U	5	U	-		-		-		8260	5	5
Tetrachloroethene	6/20/94	10	U	120	U	44		6	J	0.88	J	7.55	J	2.15	J	1.30	J	7.47	J	22.78		37.43		-		-		-		CLP/8021	0.7	5
	9/27/94	10	U	170	U	53		26		10	U	33		5	J	12	J	9	J	36		64		-		-		-		CLP	0.7	5
	2/06/95	10	U	18	J	46		38		1.0	U	31		4	J	6	J	8	J	32		48		10	U	8	J	7	J	CLP	0.7	5
	4/11/95	10	U	200	U	33		13	J	10	U	33		5	J	10	J	7	J	28		43		-		-		-		CLP	0.7	5
	7/10/95	2.0	U	12		31		13		2.0	U	42	J	5.0		12		10		37		40		-		-		-		8021	0.7	5
	7/10/95	5	U	8.9		37		14		5	U	34		3.6	J	5.9		8.1		31		34		0.7		-		-		8260	0.7	5
Trichloroethene	6/20/94	10	U	120	U	18		21	J	21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	5.74	J	15.70	J	-		-		-		CLP/8021	2.8	5
	9/27/94	10	U	170	U	23		71		10	U	13		6	J	10	U	3	J	14		34		-		-		-		CLP	2.8	5
	2/06/95	10	U	150	U	39		88		2.5	U	14		6	J	50	U	3	J	13		34		10	U	2	J	2	J	CLP	2.8	5
	4/11/95	10	U	200	U	42		63		1	J	13		6	J	71	U	2	J	10		32		-		-		-		CLP	2.8	5
	7/10/95	2.0	U	1.2	J	30		60	J	1.6	J	38		8.6		2.0	U	5.8		16		31	J	-		-		-		8021	2.8	5
	7/10/95	5	U	5	U	16		37		1.2	J	13		6		5	U	3.1	J	13		17		-		-		-		8260	2.8	5
1,1,1-Trichloroethane	6/20/94	10	U	1800		31		25	U	30.11	U	2.42	J	11.89	J	130.14	J	4.83	J	16.79	J	13.39	J	-		-		-		CLP/8021	200	200
	9/27/94	10	U	1900		35		25	U	10	U	6	J	18		1830		5	J	24		16		-		-		-		CLP	200	200
	2/06/95	10	U	2200		31		25	U	1.0	U	6	J	14		650		5	J	18		14		10	U	6	J	3	J	CLP	200	200
	4/11/95	10	U	2000		21		25	U	10	U	5	J	16		1300		5	J	17		10		-		-		-		CLP	200	200
	7/10/95	2.0	U	1600		26		2.0	U	2.0	U	6.0		12		900		5.9		17		7.8		-		-		-		8021	200	200
	7/10/95	5	U	1600		21		5	U	5	U	4.9	J	9.8		740		4.8	J	16		7		-		-		-		8260	200	200
Vinyl Chloride	6/20/94	10	U	120	U	10	U	10	J	6.60	UJ	6.60	UJ	6.60	UJ	6.60	UJ	6.60	UJ	6.60	UJ	6.60	UJ	-		-		-		CLP/8021	0.15	2
	9/27/94	10	U	170	U	3	J	10	J	10	U	5	J	10	U	10	U	10	U	10	U	14	U	-		-		-		CLP	0.15	2
	2/06/95	10	U	150	U	2	J	20	J	2.6		6	J	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	CLP	0.15	2
	4/11/95	10	U	200	U	10	U	10	J	2	J	6	J	10	UJ	71	U	10	U	10	UJ	10	U	-		-		-		CLP	0.15	2
	7/10/95	2.0	U	2.0	U	2.9	J	12	J	2.0	U	11	J	2.0	U	2.0	U	2.0	U	3.3		0.94	J	-		-		-		8021	0.15	2
	7/10/95	5	U	5	U	3.1	J	13		5	U	7.2		5	U	5	U	5	U	5	U	5	U	-		-		-		8260	0.15	2

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TABLE 5A NOTES:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Level (IDL) for Inorganics and not detected above CRQL/LOQ for Organics.
J Denotes an estimated value
CRQL Contract Required Quantification Limit (CLP Methods)
LOQ Limit of Quantitation (SW-846 Methods)
** Denotes a proposed NCS
- Denotes Not Avaliable or Not Sampled
Shading - denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.

H/Eteam/6520-20/Table5A2.xls

ANALYSIS TYPE NOTES:

1) Organic parameters were analyzed utilizing CLP Statement of Work OLMO1.9(3/90), SW-846 Method #8260 and/or #8021, as noted.
2) For CLP, 1,2-Dichloroethene was reported as total concentration; for 8021/8260 concentration was reported for cis-isomer.
3) For the 6/20/94 event, monitoring wells MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17, analyses were performed by using SW-846 anlytical method #8021. Other monitoring locations were analyzed using CLP analytical methods.

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Watauga County, North Carolina
Upgradient Well: MW-1
06/13/97

Table 5B
Background Assessment Organic Target Parameter Analytical Results
Boundary Groundwater Monitoring Wells and
Surface Water Sampling Locations

Parameter	Event	MW-4		MW-5		MW-13		MW-14		MW-15		MW-16		MW-18		S1		S2		S3		S4		S5		L1		Mt. Spring		Analysis Type	NCS (ug/L)	MCL (ug/L)
																ORGANICS																
Benzene	6/20/94	10	U	-		5.30	U	5.30	U	5.30	U	5.30	U	5.30	U	10	U	3	J	10	U	1	J	10	U	-		-		CLP/8021	1	5
	9/27/94	2	J	-		10	U	10	U	10	U	2	J	1	J	-		-		-		-		-		10	U	10	U	CLP	1	5
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	10	U	10	U	10	U	-		CLP/8021	1	5
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	1	5
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	1	5
Chloroethane	6/20/94	10	U	-		9.29	U	9.29	U	9.29	U	9.29	U	9.29	U	10	U	56		10	U	10	U	11		-		-		CLP/8021	-	-
	9/27/94	18		-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		13		10	U	CLP	-	-
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	26		10	U	2	J	7	J	6	J	-		CLP/8021	-	-
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	-	-
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	15		10	U	10	U	4	J	10	U	-		-		CLP/8021	-	-
Dichlorodifluoromethane	6/20/94	10	U	-		46.64	U	46.64	U	46.64	U	46.64	U	46.64	U	10	U	4	J	10	U	10	U	10	U	-		-		CLP/8021	0.19	-
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	0.19	-
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	10	U	10	U	10	U	-		CLP/8021	0.19	-
	4/11/95	10	U	10	U	10	U	10	UJ	10	UJ	10	UJ	10	UJ	-		-		-		-		-		-		-		CLP	0.19	-
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	-		-		CLP/8021	0.19	-
1,1-Dichloroethane	6/20/94	10	U	-		0.99	J	43.10	U	0.26	J	43.10	U	43.10	U	1	J	23		10	U	59		2	J	-		-		CLP/8021	700**	-
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	700**	-
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	45		10	U	10	U	-		CLP/8021	700**	-
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	700**	-
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	6	J	20		10	U	41		2	J	-		-		CLP/8021	700**	-
1,1-Dichloroethene	6/20/94	10	U	-		9.75	U	9.75	U	9.75	U	9.75	U	9.75	U	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	7	7
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	7	7
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	10	U	10	U	10	U	-		CLP/8021	7	7
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	7	7
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	7	7
cis-1,2-Dichloroethene(3)	6/20/94	10	U	-		9.49	U	9.49	U	9.49	U	9.49	U	9.49	U	10	U	4	J	10	U	58		10	U	-		-		CLP/8021	70	70
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	70	70
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	42		10	U	10	U	-		CLP/8021	70	70
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	70	70
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	1	J	3	J	10	U	42		10	U	-		-		CLP/8021	70	70
trans-1,3-Dichloropropene	6/20/94	10	U	-		24.49	U	24.49	U	24.49	U	24.49	U	24.49	U	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	-	-
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	-	-
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	10	U	10	U	10	U	-		CLP/8021	-	-
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	-	-
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	-	-
Methylene Chloride	6/20/94	10	U	-		36.20	UJ	36.20	UJ	36.20	UJ	36.20	UJ	36.20	UJ	6		9		3	J	1	J	8		-		-		CLP/8021	5	5
	9/27/94	13	U	-		10	U	10	U	10	U	32		42		-		-		-		-		-		10	U	10	U	CLP	5	5
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	2	J	3	J	1	J	10	U	10	U	-		CLP/8021	5	5
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	5	5
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	5	5
Tetrachloroethene	6/20/94	10	U	-		7.84	U	0.24	J	7.84	U	7.84	U	7.84	U	10	U	10	U	10	U	16		10	U	-		-		CLP/8021	0.7	5
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	0.7	5
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	32		10	U	10	U	-		CLP/8021	0.7	5
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	0.7	5
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	11		10	U	-		-		CLP/8021	0.7	5
Trichloroethene	6/20/94	10	U	-		21.20	U	21.20	U	21.20	U	21.20	U	21.20	U	10	U	1	J	10	U	13		10	U	-		-		CLP/8021	2.8	5
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	2.8	5
	2/06/95	10	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	10	U	10	U	10	U	8		10	U	10	U	-		CLP/8021	2.8	5
	4/11/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		-		-		CLP	2.8	5
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	1	J	10	U	8		10	U	-	-	-	-	CLP/8021	2.8	5
1,1,1-Trichloroethane	6/20/94	10	U	-		30.11	U	30.11	U	0.08	J	30.11	U	30.11	U	10	U	2	J	10	U	3	J	10	U	-		-		CLP/8021	200	200
	9/27/94	10	U	-		10	U	10	U	5	J	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	200	200
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	2.5		1.0	U	1.0	U	10	U	10	U	10	U	2	J	10	U	10	U	-		CLP/8021	200	200
	4/11/95	10	U	10	U	10	U	1	J	3	J	10	U	10	U	-		-		-		-		-		-		-		CLP	200	200
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	1	J	10	U	2	J	10	U	-		-		CLP/8021	200	200
Vinyl Chloride	6/20/94	10	U	-		6.60	UJ	6.60	UJ	6.60	UJ	6.60	UJ	6.60	UJ	10	U	10	U	10	U	10	U	10	U	-		-		CLP/8021	0.015	2
	9/27/94	10	U	-		10	U	10	U	10	U	10	U	10	U	-		-		-		-		-		10	U	10	U	CLP	0.015	2
	2/06/95	10	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10	U	10	U	10	U	2	J	10	U	10	U	-		CLP/8021	0.015	2
	4/11/95	10	UJ	10	U	10	U	10	UJ	10	UJ	10	UJ	10	UJ	-		-		-		-		-		-		-		CLP	0.015	2
	7/10/95	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	3		10	U	-		-		CLP/8021	0.015	2

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TABLE 5B NOTES:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Level (IDL) for Inorganics and not detected above CRQL/LOQ for Organics.
J Denotes an estimated value
CRQL Contract Required Quantification Limit (CLP methods)
LOQ Limit of Quantification (SW-846 methods)
- Denotes Not Avaliable or Not Sampled
Shading - denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.

H/Eteam/6520-21/Table5B2.xls

ANALYSIS TYPE NOTES:

1) Organic parameters were analyzed utilizing CLP Statement of Work OLMO1.9(3/90), SW-846 Method #8260 and/or #8021, as noted.
2) For CLP, 1,2-Dichloroethene was reported as total concentration; for 8021/8260 concentration was reported for cis-isomer.
3) For the 6/20/94, 2/6/95, and 7/10/95 events, boundry monitoring well analyses were performed utilizing SW-846 Method #8021. Surface water sampling locations analyses were performed by using CLP analytical methods.

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Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
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Table 5C
Background Assessment Metal Target Parameter Analytical Results, Core Groundwater Monitoring Wells and Septic Field Monitoring Wells

Parameter	Event	Results ug/l(ppb)																																							
		MW-1		MW-2		MW-3		MW-4		MW-6		MW-8		MW-9		MW-10		MW-11		MW-12		MW-17		SFW-1		SFW-2		SFW-3		Analysis Type	NCS (ug/L)	MCL (ug/L)
METALS, TOTAL																																									
Barium, Total	6/20/94	203		199		123		24.2		652		281		710		109		117		101		117		-		-		-		CLP	2000	2000
	9/27/94	149		204		119		23.5		502		86.9		632		113		153		101		90.4		-		-		-		CLP	2000	2000
	2/06/95	157		192		109		27.2		418		70.4		615		94.8		176		104		87.2		69.7	J	1050	J	143	J	CLP	2000	2000
	4/11/95	143		212	J	82		23.2	J	477		65		628	J	93.1		295		97.7	J	77.3		-		-		-		CLP	2000	2000
	7/10/95	125		210	J	94.5		23.8		499		70.6		612		103		199		110		79		-		-		-		CLP	2000	2000
	4/10/96	144		178		142		-		570		63.5		507		105		268		119		75.7		-		-		-		CLP	2000	2000
	4/8/97	171		219		97		-		-		259		659		83		137		145		106		-		-		-		CLP	2000	2000
Iron, Total	6/20/94	409		24.4	U	9950		24.4	U	24900		16100	J	7060		5460		337	J	1800	J	3220		-		-		-		CLP	300	300*
	9/27/94	1390		140		9320		71.8		9170		418		42		3100		3.8	U	16		149		-		-		-		CLP	300	300*
	2/06/95	2830		46		6610		552		5930		368		735		2240		296		61.3		260		123	J	56600	J	7240	J	CLP	300	300*
	4/11/95	2490	J	245	J	3600	J	54.4	UJ	8300	J	149	J	81.7	UJ	234	J	15.7	U	54.4	UJ	63.7	J	-		-		-		CLP	300*	300*
	7/10/95	646		U*		4480		U*		7980		455		U*		508		9.7	U	U*		48.5		-		-		-		CLP	300*	300*
	4/10/96	1660		257		8550		-		9760	J	334		348	J	3340		13.3	U	13.3	U	53.5		-		-		-		CLP	300*	300*
	4/8/97	8760		U*		4480		-		-		11500		U*		U*		U*		U*		U*		-		-		-		CLP	300*	300*
Cadmium, Total	6/20/94	6.0		4.5	UJ	5.5		4.5	UJ	4.5	UJ	4.6	UJ	4.5	UJ	4.5	UJ	4.6	UJ	4.6	UJ	4.5	UJ	-		-		-		CLP	5	5
	9/27/94	4.3	U	4.6	U	4.6	U	4.6	U	4.3	U	4.3	U	4.6	U	4.6	U	4.3	U	4.6	U	4.6	U	-		-		-		CLP	5	5
	2/06/95	0.5	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	CLP	5	5
	4/11/95	0.3	U	4.4	UJ	0.3	U	4.4	UJ	0.3	U	0.3	U	4.4	UJ	0.3	U	0.3	U	4.4	UJ	0.3	U	-		-		-		CLP	5	5
	7/10/95	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	-		-		-		CLP	5	5
	4/10/96	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	5	5
	4/8/97	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	5	5
Mercury, Total	6/20/94	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		-		CLP	1.1	2
	9/27/94	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		-		CLP	1.1	2
	2/06/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	CLP	1.1	2
	4/11/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		-		CLP	1.1	2
	7/10/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		-		CLP	1.1	2
	4/10/96	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	1.1	2
	4/8/97	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	1.1	2

Table 5C Notes:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Limit (IDL) for Inorganics (CLP SOW only)
U* Denotes result less than 5X method blank concentration.
J Denotes an estimated value
* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron
\- Denotes Not Avaliable or Not Sampled
Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0 for metal analysis.

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Watauga County Landfill
Watauga County, North Carolina
Upgradient Well: MW-1
06/13/97

Table 5D
Background Assessment Metal Target Parameter Analytical Results
Boundary Groundwater Monitoring Wells and Surface Water Sampling Locations

Parameter	Event	Results ug/l(ppb)																																							
		MW-5		MW-7		MW-13		MW-14		MW-15		MW-16		MW-18		S1		S2		S3		S4		S5		L1		Mt. Spring		Analysis Type	NCS (ug/L)	MCL (ug/L)
METALS, TOTAL																																									
Barium, Total	6/20/94	-		439		54.2		18.4		94.9		66.8		73.6		133		755		366		94.1		197		-		-		CLP	2000	2000
	9/27/94	-		698		59.7		17.4		79		70.6		78.7		-		-		-		-		-		-		5.5		CLP	2000	2000
	2/06/95	710		743		79.4		16.3		82.3		72.5		67.9		86.8	J	350	J	235	J	82.5	J	472	J	2240	J	-		CLP	2000	2000
	4/11/95	591		426		54.4		16.4	J	78.4	J	70.3	J	83	J	-		-		-		-		-		-		-		CLP	2000	2000
	7/10/95	700		-		116		19.5		73.6		67		90		502		592		277		861		310		-	-	-		CLP	2000	2000
	4/10/96	-		612		-		-		56.3	J	-		-		346	J	427	J	182	J	68.5	J	113	J	-		-		CLP	2000	2000
	4/8/97	-		10300		-		-		77.3		-		-		122		732		253		72		11500		-		-		CLP	2000	2000
Iron, Total	6/20/94	-		15200		283		100	U	2110		78.6		24.4		11300		30800		8600		1040		26400		-		-		CLP	300	300*
	9/27/94	-		19200		450		3.8		554		117		12.2		-		-		-		-		-		-		31.4		CLP	300	300*
	2/06/95	475		26400		2370		61.3		975		490		61.3		13200	J	42000	J	8790	J	3110	J	90300	J	255000	J	-		CLP	300	300*
	4/11/95	15.7	U	5180	J	131	J	40.8	UJ	490	J	331	J	40.8	UJ	-		-		-		-		-		-		-		CLP	300*	300*
	7/10/95	9.7	U	-		3960		9.7	U	21.2		9.7	U*	9.7	U*	19400		36100		5740		1290		87900		-	-	-		CLP	300*	300*
	4/10/96	-		12000	J	-		-		194	J	-		-		503	J	4390	J	1260	J	285	J	688	J	-		-		CLP	300*	300*
	4/8/97	-		10300		-		-		U*		-		-		7480		29100		5300		529		2E+06		-		-		CLP	300*	300*
Cadmium, Total	6/20/94	-		4.5	UJ	4.5	UJ	4.5	UJ	4.5	UJ	4.5	UJ	4.5	UJ	4.5	U	4.5	U	4.5	U	4.5	U	4.5	U	-		-		CLP	5	5
	9/27/94	-		4.3	U	4.3	U	4.3	U	4.6	U	4.6	U	4.6	U	-		-		-		-		-		-		4.3	U	CLP	5	5
	2/06/95	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	4.4	U	-		CLP	5	5
	4/11/95	0.3	U	23		0.3	U	4.4	UJ	4.4	UJ	4.4	UJ	4.4	UJ	-		-		-		-		-		-		-		CLP	5	5
	7/10/95	0.5	U	-		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	4.2	U	4.2	U	4.2	U	4.2	U	4.2	U	-	-	-		CLP	5	5
	4/10/96	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	5	5
	4/8/97	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	5	5
Mercury, Total	6/20/94	-		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		CLP	1.1	2
	9/27/94	-		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		-		-		-		-		0.2	U	CLP	1.1	2
	2/06/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		CLP	1.1	2
	4/11/95	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-		-		-		-		-		-		-		CLP	1.1	2
	7/10/95	0.2	U	-		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	-	-	-		CLP	1.1	2
	4/10/96	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	1.1	2
	4/8/97	-		-		-		-		-		-		-		-		-		-		-		-		-		-		CLP	1.1	2

Table 5C Notes:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
U Denotes not detected above Instrument Detection Limit (IDL) for Inorganics (CLP SOW only)
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Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.
CLP analytical methods utilize relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0 for metal analysis.

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Watauga County Landfill

Watauga County, North Carolina
Upgradient Well: MW-1
06/19/97

Table 6A

Cumulative Detected Non-Target Organic Parameter Analytical Results

Contract Laboratory Program (CLP) Statement of Work (SOW) - Organics

Parameter	Event	Results ug/L(ppb)																												NCS (ug/L)	MCL (ug/L)
		MW-1		MW-3		MW-4		MW-7		MW-8		MW-9		MW-10		MW-11		MW-12		MW-17		S1		S2		S3		S5			
Acetone	6/20/94	61		~		~		-		-		-		-		~		-		-		~		~		~		~		700	-
	9/27/94	~		~		~		~		~		~		40	J	~		~		~		~		~		~		~		700	-
	4/11/95	~		~		~		15	J	~		~		~		~		~		~		~		~		~		~		700	-
	4/8/97	-		-		-		-		-		-		-		-		-		-		~		~		9	J	~		700	-
2-Butanone	9/27/94	~		~		~		19		~		~		~		~		~		~		~		~		~		~		-	-
	7/10/95	~		~		~		~		~		~		~		~		~		~		~		5	J	~		~		-	-
	4/8/97	-		-		-		-		-		-		-		-		-		-		~		3	J	~		~		-	-
Carbon Tetrachloride	4/11/95	~		~		2	J	~		~		~		~		~		1	J	2	J	~		-		-		~		0.3	5
1,2-Dichloroethane	4/8/97	-		-		-		-		-		-		-		-		-		-		~		1	J	~		~		-	-
1,2-Dichloropropane	4/11/95	~		~		~		~		1	J	~		~		~		~		2	J	~		~		~		~		0.56	5
	2/6/95	~		1	J	~		~		1	J	~		~		~		~		1	J	~		~		~		~		0.56	5
	4/8/97	-		-		-		-		-		-		-		-		-		-		~		~		~		~		0.56	5
2-methyl-2-pentanone	6/20/94	24		~		~		-		-		-		-		~		-		-		~		6		~		~		-	-
1,1,2,2-Tetrachloroethane	6/20/94	2	J	~		~		-		-		-		-		~		-		-		~		-		-		~		-	-
Ethylbenzene	6/20/94	10		~		~		-		-		-		-		~		-		-		~		6		~		~		29	700
	7/10/95	~		~		~		-		-		-		-		~		-		-		~		3	J	~		~		29	700
	4/8/97	-		-		-		-		-		-		-		-		-		-		~		2	J	~		~		29	700
Toluene	6/20/94	2	J	~		~		-		-		-		-		~		-		-		~		7		~		~		1000	1000
	4/11/95	~		~		2	J	~		~		~		~		~		1	J	4	J	~		-		~		~		1000	1000
	7/10/95	~		~		~		~		~		~		~		~		~		~		~		2	J	~		~		1000	1000
	4/8/97	-		-		-		-		-		-		-		-		-		-		~		2	J	~		~		1000	1000
Xylene (total)	6/20/94	64		~		~		-		-		-		-		~		-		-		~		20		~		~		530	10000
	9/27/94	~		~		~		1	J	~		3	J	~		~		~		~		~		~		~		~		530	10000
	4/11/95	~		~		~		~		~		3	J	~		~		~		~		~		~		~		~		530	10000
	7/10/95	~		~		~		~		~		~		~		~		~		~		1	J	6	J	~		2	J	530	10000
	4/8/97	-		-		-		-		-		-		-		-		-		-		~		6	J	~		~		530	10000

Tentatively Identified Compounds

Parameter	Event	Results ug/L(ppb)											
		MW-6		MW-9		MW-11		MW-16		MW-17		MW-18	
Hexane	4/11/95	~		~		~		7	NJ	~		~	
Trichlorofluoromethane	4/11/95	~		200	NJ	~		~		~		~	
Unknown Alkane	4/11/95	~		~		6	NJ	~		~		~	
	4/11/95	~		~		9	NJ	~		~		~	
	4/11/95	~		~		6	NJ	~		~		~	
Unknown Cycloalkane	4/11/95	~		~		12	NJ	~		~		~	
	4/11/95	~		~		28	NJ	~		~		~	
Unknown Hydrocarbon	4/11/95	~		~		10	NJ	10	NJ	7	NJ	7	NJ
	4/11/95	~		~		5	NJ	7	NJ	37	NJ	~	
	4/11/95	~		~		13	NJ	18	NJ	9	NJ	~	
	4/11/95	~		~		~		9	NJ	~		~	
Unknown Unsaturated Hydrocarbon	4/11/95	~		~		7	NJ	~		~		~	
	7/10/95	~		~		~		~		~		~	
Unknown Ketone	4/11/95	50	NJ	~		8	NJ	~		~		~	

Notes:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
~ Denotes Not Detected
- Denotes Not Available
J Denotes an estimated value
N Denotes tentatively identified
Organic parameters were analyzed in accordance with USEPA CLP SOW OLMO1.9 (3/90).

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Watauga County Landfill

Watauga County, North Carolina
Upgradient Well: MW-1
11/27/95

Table 6B

Cumulative Detected Non-Target Organic Parameter Analytical Results

Low Level Risk Assessment (LLRA) Analytical Methods

Parameter	Event	Method	Results ug/L (ppb)																											
			MW-3		MW-6		MW-7		MW-8		MW-9		MW-10		MW-12		MW-13		MW-14		MW-16		MW-17		MW-18		Trip Blank		NCS (ug/L)	MCL (ug/L)
1,2,3-Trichlorobenzene	6/20/94	8021	~		~		~		~		~		~		0.32	J	0.47	J	~		~		~		~		~		-	-
1,4-Dichlorobenzene	7/10/95	8260	~		~		~		1.1	J	~		~		~		~		~		~		~		~		~		-	100
	4/8/97	8021	~		-		2.6		~		~		~		~		~		~		~		~		~		~		-	100
1,3,5-Trimethylbenzene	6/20/94	8021	~		~		~		~		0.17	J	~		~		~		~		~		~		~		~		-	-
Isopropylbenzene	6/20/94	8021	~		~		~		~		0.41	JB	~		1.06	JB	~		~		1.67	JB	~	JB	0.50	JB	0.36	JB	-	-
n-Propylbenzene	6/20/94	8021	~		~		~		~		0.50	J	~		0.33	J	~		~		0.66	J	~		~		~		-	-
Trichlorofluoromethane	6/20/94	8021	~		~		~		~		20.50	J	~		~		~		~		~		~		~		~		2,100	-
	7/10/95	8260	1.1	J	~		~		~		~		~		~		~		~		~		~		~		~		2100	-
	4/8/97	8021	1.02		-		~		~		1.38		~		1.29		~		~		~		~		~		~		2100	-
Styrene	6/20/94	8021	~		~		~		~		0.94	J	~		0.65	J	~		~		~		~		~		~		100	100
Napthylene	6/20/94	8021	~		~		0.33	J	~		0.69	J	~		0.74	J	7.07	J	~		0.62	J	~		~		~		-	-
o-Xylene	6/20/94	8021	~		~		0.83	J	~		~		~		~		~		~		~		~		~		~		530	10,000
	2/6/95	8021	~		~		0.6		~		~		~		~		~		~		~		~		~		~		530	10,000
	7/10/95	8260	~		~		~		~		3.0	J	~		~		~		~		-		~		~		~		530	10000
t-bb+tmb+s-bb	6/20/94	8021	~		~		44.97	J	8.91	J	~		~		0.83		~		~		~		~		~		~		-	-
trans-1,2-Dichloroethene	6/20/94	8021	~		~		1.53	J	2.03	J	~		~		1.47	J	~		~		~		1.31		~		~		70	100
	2/6/95	8021	~		~		2.6		~		~		~		~		~		~		~		~		~		~		70	100
	7/10/95	8260	1.6	J	5.7		1.6	J	1.4	J	~		~		~		~		~		~		~		~		~		70	100
1,2,-Dichloroethane	7/10/95	8260	1.8	J	~		~		~		~		~		~		~		~		~		1.8	J	~		~		-	-
	7/10/95	8021	1.8	J	~		~		0.89	J	~		~		~		~		~		~		1.7	J	~		~		-	-
	4/8/97	8021	1.52		-		~		0.89	J	~		~		1.09		~		~		-		1.76		~		~		-	-
Dibromochloromethane	2/6/95	8021	~		~		~		~		~		~		~		~		0.6	J	~		~		~		~		-	100
Bromomethane	2/6/95	8021	~		~		5.8		~		~		~		~		~		~		~		~		~		~		0.30	-
	7/10/95	8260	2.4	J	~		~		~		~		~		~		~		~		~		~		~		~		0.30	-
1,2-Dichloropropane	2/6/95	8021	~		~		1.6	J	~		~		~		~		~		~		~		~		~		~		0.56	5
	7/10/95	8260	1	J	1	J	1.6	J	~		~		~		~		~		~		~		~		~		~		0.56	5
	7/10/95	8021	~		~		1.4	J	0.87	J	~		~		~		~		~		~		0.80		~		~		0.56	5
	4/8/97	8021	0.689	J	-		1.4	J	0.87	J	~		~		0.657	J	~		~		-		0.97	J	~		~		0.56	5
2-Butanone	7/10/95	8021	~		~		15		4.9	J	~		3.1	J	~		~		~		~		~		~		~		-	-

Notes:

NCS Denotes North Carolina Groundwater Quality Standard (T15A: 02L .0200)
MCL Denotes EPA Maximum Contaminant Level (EPA 822-R-94-001)
~ Denotes not detected
- Denotes Not Available
J Denotes an estimated value
B Denotes present in blank
Shading Denotes Parameter results that meet or exceed U.S. EPA Maximum Contaminant Levels
t-bb+tmb+s-bb: tert-Butylbenzene + 1,2,4-Trimethylbenzene + sec-Butylbenzene

H:6520-21\TABLE6B3.xls

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Solid Waste
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MARK

You noted that the last two pages of the report and the analytical data summary tables were inadvertently omitted from your copy of the referenced report (Preliminary summary analytical data tables for this event were sent to you on June 3, 1997). We apologize for this omission. Please find enclosed a copy of the omitted pages.

THANKS. JEFF SMITH

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APPENDIX B

FIELD NOTES

STANDARD FIELD PROTOCOL - INITIAL ACTIVITIES

Project Watauga County Landfill Permit #95-02 Date 04-10-97
Sampling Sequence See Below * Weather/Temperature 55-65°F
Samplers CGF / DLL
Static Water Level measurement equipment Solinst
procedure decon prior to each well with deionized water

Well evacuation equipment dedicated grunfos pumps
procedure Purge 3 well vol sample. pH, temp. & Specific conductivity for stabilization

Sample withdrawal equipment dedicated grunfos pumps
procedure

Sample filtration equipment N/A
procedure

Types of sample containers and method of preservation used for required analysis (in order of sequence of filling containers)

40mL VOA Amber or clear glass (HCL)
mL Plastic (HNO3)

Internal temperature of shipping containers at outset of sampling

4°C

Temperature equipment
calibration procedure None
measurement procedure measure at standard intervals during purging

pH equipment
calibration procedure 7.0 & 4.0 buffers
measurement procedure measured at standard intervals during purging

Conductivity equipment
calibration procedure
measurement procedure measured at standard intervals during purging

Conductivity calibration measurements/time

Sampler signatures (date/time)
Donna Lancaster

* MW-19, MW-12, MW-11, MW-17, MW-3, MW-7, MW-8, MW-10, S-3, MW-2, S-1, S-5, S-2, MW-1, MW-9, S-11, S-6

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-1 Date 4-7-97 Time 1728 Sampler's Initials CGF/DW

Condition of well/pad: good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 38.30 (in feet)

Total Depth of well = TD = 76.65 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 38.35 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.\cancel{163}$ .66 gal/ft. (4" well) = 12.50

Minimum Purge Volume (gallons) = 3 * V_c = ~~37.50~~ 75

Measurements collected during purging:

1731 : Purge start time Description of Initial Purge Water:(e.g. silty?)

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1738	11.7	7.47	-29.1	162 µS	~ 2 GPM	~ 2 gals
	1743	11.9	6.49	16.8	112 µS	~ 2 GPM	~ 12
	1751	12	6.16	32	101 µS	~ 3	~ 50
	1800	11.8	6.15	36	093 µS	~ 3	~ 75

NA : Dial down time Reduced Flow Rate Time NA min. for 15 sec/ft. of total well depth.

Total volume of water purged + 75 gals

Description of final purge water (e.g. silty? NAPLs?)

Field pH Adjustments:

Total and Dissolved Metals: pH	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 4-8-97 1800

Misc. Field Observations

Sampler signatures (date/time) CFaley 4-8-97 1750

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-2 → 6" well Date 4-8-97 Time 1553 Sampler's Initials CGF/OU

Condition of well/pad: Good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 5.59 (in feet)

Total Depth of well = TD = 177.50 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 171.91 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * \cancel{0.163}$ .66 gal/ft. = 113

Minimum Purge Volume (gallons) ~~= 3 * V_c~~ = 113

Measurements collected during purging:

1601 : Purge start time Description of Initial Purge Water:(e.g. silty?) Clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1602	14.1	7.70	-43.8	276 uS	~ 3 GPM	~ 4 gals
	1610	13.6	7.78	-47.7	284 uS	"	25
	1618	13.3	7.83	-50.2	283 uS	"	50
	1626	14.0	7.87	-52.1	280 uS	"	75
	1634	13.1	7.92	-54.8	279 uS	"	100
	1639	13.9	7.93	-55	279 uS	"	115

1640 : Dial down time Reduced Flow Rate Time 44 min. for 15 sec/ft. of total well depth.

Total volume of water purged + 115 gals

Description of final purge water (e.g. silty? NAPLs?)

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1710

Misc. Field Observations

Sampler signatures (date/time) C Fenley 4-8-97 1650

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-3 Date 4-7-97 Time 1555 Sampler's Initials _____

Condition of well/pad: good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05

Reference Point - Top of Well Casing:

Depth To Water = DTW = 16.35 (in feet)

Total Depth of well = TD = 39.60 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 23.25 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 3.78

Minimum Purge Volume (gallons) = 3 * V_c = 11.34

Measurements collected during purging:

1555 : Purge start time Description of Initial Purge Water:(e.g. silty?) cloudy, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1556	14.3	6.10	35.6	214 µS	~ 2 GPM	~4 gals
	1558	13.9	6.21	28.1	209 µS	"	~ 8 gals
	1559	13.5	6.21	32.4	210 µS	"	~ 11 gals
	1602	13.4	6.24	28.8	209 µS	"	~ 17 gals

NA : Dial down time Reduced Flow Rate Time NA min. for 15 sec/ft. of total well depth.

Total volume of water purged + 17 gals

Description of final purge water (e.g. silty? NAPLs?) silty, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 4-8-97 1125

Misc. Field Observations _____

Sampler signatures (date/time) Charley 4-8-97 1102

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-7 Date 4-7-97 Time 1249 Sampler's Initials CGF / DLL

Condition of well/pad: good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.04.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 40.50 (in feet)

Total Depth of well = TD = 50.00 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 9.50 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 1.54

Minimum Purge Volume (gallons) = 3 * V_c = 4.64

Measurements collected during purging:

1300 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, mineral debris, slight odor

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1300	11.7	6.53	12.8	700 uS	1 bail	
	1302	11.9	6.69	5.9	742	5	
	1307	11.8	6.81	0.7	818	10	
	1312	11.2	6.80	1.1	863	15	
	1316	11.2	6.82	0.4	884	20	

NA : Dial down time Reduced Flow Rate Time NA min. for 15 sec/ft. of total well depth.

Total volume of water purged + 5 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1300 4-8-97

Misc. Field Observations

Sampler signatures (date/time) [signature] 4-8-97 1300

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-8 Date 4-7-97 Time 1331 Sampler's Initials CGF/DCC

Condition of well/pad: Good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH _____ and _____.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 17.43 (in feet)

Total Depth of well = TD = 67.00 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 49.57 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 8.08

Minimum Purge Volume (gallons) = 3 * V_c = 24.24

Measurements collected during purging:

1337 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1338	15.1	7.41	-30.6	565 µS	~ 1.5	~ 3
	1340	16.1	7.11	-14.2	536 µS	~ 1	~ 5
	1345	16.9	7.14	-15.6	537 µS	~ 1	10
	1350	17.4	7.06	-11.8	533 µS		15
	1355	17.5	7.04	-10.9	535 µS		20
	1400						25

_____: Dial down time Reduced Flow Rate Time 17 min. for 15 sec/ft. of total well depth.

Total volume of water purged ≈ 25 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
____ ml of HNO3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1330 4-8-97

Misc. Field Observations

Sampler signatures (date/time) [signature] 4-8-97 1325

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-9 Date 4-9-97 Time 0928 Sampler's Initials CGF/DLL

Condition of well/pad: good, access road could use some clearing up

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05

Reference Point - Top of Well Casing:

Depth To Water = DTW = 62.47 (in feet)

Total Depth of well = TD = 86.40 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 23.93 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 3.80

86.40
62.47
23.93
.163
7179
143580
239300
3.90059

Minimum Purge Volume (gallons) = 3 * V_c = 11.70

Measurements collected during purging:

0948 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, unid. organic smell

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	0948	12.1	6.53	16.3	588 µS	~ 1 GPM	~ 2 gal
	0952	13.1	6.41	22.3	538	"	6
	0956	13.8	6.26	27.6	567	"	10
	0958	14.1	6.27	27.6	578	"	12
	1001	13.4	6.27	27.4	575		15

1002 : Dial down time Reduced Flow Rate Time 22 min. for 15 sec/ft. of total well depth.

Total volume of water purged + 16 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odor

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1025

Misc. Field Observations

Sampler signatures (date/time) CFCulley 4-9-97 1005

3
86
15
430
86
1290

21
60 | 1260
120
60
60
0

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-10 Date 4-7-97 Time 14..21 Sampler's Initials DLL/KGF

Condition of well/pad: Good, some erosion around edges of pad. gs signif. below cp.

pH Calibration: _____ and _____ Standard solutions Meter Calibrated to pH _____ and _____.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 7.67 (in feet)

Total Depth of well = TD = 70.03 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 62.36 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 10.16

Minimum Purge Volume (gallons) = 3 * V_c = 30.49

Measurements collected during purging:

1423 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1425	13.9	7.67	-41.7	197 µS	~ 1 GPM	~ 3 gals
	1432	15	7.17	-17.2	152 µS		10
	1442	15.1	7.27	-21.2	143 µS		20
	1452	15.7	7.39	-27.7	151 µS		30

_____: Dial down time Reduced Flow Rate Time _____min. for 15 sec/ft. of total well depth.

Total volume of water purged ≈ 30 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
____ ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1345 4-8-97

Misc. Field Observations _____

Sampler signatures (date/time) [signature] 4-8-97 1335

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-11 Date 4-7-97 Time 1634 Sampler's Initials CGF/OLL

Condition of well/pad: good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 12.28 (in feet)

Total Depth of well = TD = 25.80 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 13.52 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 2.20

Minimum Purge Volume (gallons) = 3 * V_c = 6.60

Measurements collected during purging:

1634 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1636	11.7	6.16	32.3	130 µS	~ 1 GPM	~ 2 gals
	1638	12.8	6.13	34.7	126 µS	"	~ 4
	1640	12.2	6.06	37.0	126 µS	"	~ 6
	1642	12.4	6.13	34.9	126 µS		~ 8

NA : Dial down time Reduced Flow Rate Time NA min. for 15 sec/ft. of total well depth.

Total volume of water purged + 8 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 4-8-97 1055

Misc. Field Observations

Sampler signatures (date/time) [signature] 4-8-97 1050

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-12 Date 4-7-97 Time 1611 Sampler's Initials CGF/DCL

Condition of well/pad: good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05.

Reference Point - Top of Well Casing:

Depth To Water = DTW = 9.48 (in feet)

Total Depth of well = TD = 72.75 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 63.27 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 10.38

Minimum Purge Volume (gallons) = 3 * V_c = 30.93

Measurements collected during purging:

1618 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1619	12.9	6.55	12.0	223 µS	~ 2 GPM	~ 2 gals
	1623	13.5	6.46	18.2	223 µS	"	10
	1628	13.5	6.38	21.7	221 µS	"	20
	1633	13.0	6.41	20.8	218 µS	"	30

NA : Dial down time Reduced Flow Rate Time NA min. for 15 sec/ft. of total well depth.

Total volume of water purged + 30 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 4-8-97 1045

Misc. Field Observations

Sampler signatures (date/time) [signature] 4-8-97 1100

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-15 Date 4-8-97 Time 1405 Sampler's Initials CGF/OLL

Condition of well/pad: good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05

Reference Point - Top of Well Casing:

Depth To Water = DTW = 11.91 (in feet)

Total Depth of well = TD = 178.00 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 166.09 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 27.07

Minimum Purge Volume (gallons) = 3 * V_c = 81.22

Measurements collected during purging:

1415 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1416	16.7	7.33	-26.6	143 µS	~ 2 GPM	~ 2 gals
	1426	15.5	7.74	-45.7	142 µS	"	20
	1436	17.0	7.57	-37.5	145 µS	"	40
	1446	20.1	7.50	-34.5	145 µS	"	60
	1456	18	7.52	-35.4	148 µS	"	80

1456 : Dial down time Reduced Flow Rate Time 45 min. for 15 sec/ft. of total well depth.

Total volume of water purged + 81 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH <2	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of HNO_3 Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1540

Misc. Field Observations

Sampler signatures (date/time) CFoster 4-8-97 1454

SAMPLE COLLECTION FORM

Project: Watauga County Landfill Permit No. 95-02

Well # MW-17 Date 4-7-97 Time 1524 Sampler's Initials CGF/DLL

Condition of well/pad: Good

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05

Reference Point - Top of Well Casing:

Depth To Water = DTW = 17.17 (in feet)

Total Depth of well = TD = 94.54 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 77.37 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 12.611

Minimum Purge Volume (gallons) = 3 * V_c = 37.83

Measurements collected during purging:

1532 : Purge start time Description of Initial Purge Water:(e.g. silty?) clear, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	1533	13.3	6.84	-3.8	308 µS	~ 2 GPM	~ 3 gals
	1538	13.8	6.66	8.2	340 µS	"	~ 13
	1543	14.9	6.65	10.4	363 µS	"	~ 23
	1548	14.8	6.42	20.4	292 µS	"	~ 33
	1551	14.5	6.35	23.6	268 µS	"	~ 39

NA : Dial down time Reduced Flow Rate Time NA min. for 15 sec/ft. of total well depth.

Total volume of water purged + 38 gals

Description of final purge water (e.g. silty? NAPLs?) clear, no odors

Field pH Adjustments:

Total and Dissolved Metals: pH	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 4-8-97 1115

Misc. Field Observations purged on 4-7-97, let recover overnite before sampling

Sampler signatures (date/time) Charley 4-8-97 1102

Compucham CLP VOA bottle lid broke, used one of CTE 8021 as replacement

3x8021 for CTE

SAMPLE COLLECTION FORM

Project: WATAUGA CO. LANDFILL

Well # MW-19 Date 4-8-97 Time 0852 Sampler's Initials CGF/DCL

Condition of well/pad: well is good, 57' Grundfos pump installed

pH Calibration: 4 and 7 Standard solutions Meter Calibrated to pH 4.00 and 7.05.

Reference Point - Top of Well Casing: TopPVC

Depth To Water = DTW = 4.85 (in feet)

Total Depth of well = TD = 69.60 (in feet)

Water column length = $L_{c(ft.)}$ = (TD-DTW) = 64.75 (in feet)

Volume of water in well casing = $V_{c(gal.)} = L_{c(ft.)} * 0.163$ gal/ft. = 10.55

Minimum Purge Volume (gallons) = 3 * V_c = 32

* purged 5 well volumes ~53 gal

Measurements collected during purging:

0928 : Purge start time Description of Initial Purge Water:(e.g. silty?) slightly silty, no odors

#	Time	Temp. (C)	pH	mV	Specific Conductivity	Purge Rate(GPM) or # of bails	Estimated volume purged
	0929	11.2	7.32	-25	98 µS	2	~ 2 gals
	0938	12.6	7.40	-28.8	99 µS	"	~ 26 gals
	0942	12.9	7.33	-25.1	94 µS	"	~ 28 gals
	0948	13.2	7.09	-13.1	88 µS	"	~ 40
	0958	13.3	7.02	-9.3	85 µS	"	~ 50

0958 : Dial down time Reduced Flow Rate Time 18 min. for 15 sec/ft. of total well depth.

Total volume of water purged ~ 50 gals

Description of final purge water (e.g. silty? NAPLs?)

Field pH Adjustments:

Total and Dissolved Metals: pH	Acrylonitrile Adjustment: pH	Field VOA pH Blank: pH
ml of Preservative	# of drops of N HCl	# of drops of N HCl

Sample Collection Time 1020

Misc. Field Observations need 9/16" socket to remove well cover, no way to lock up well; well is good producer

Sampler signatures (date/time) 4-8-97 1020

Specs TOC – 6" from top of manhole

TOP of manhole 4" from top of concrete pad

STANDARD FIELD PROTOCOL - FINAL ACTIVITIES

Project: Watauga County Landfill Permit #95-02 Date: 04-10-97

Internal temperature of shipping containers at completion of sampling: 4°C

Sample destination Compuchem / CT&E

Method of transportation Fed Ex

Sampler signatures (date/time)

Verna Lancaster 4-10-97

Wabauga
3rd annual
Sampling event

4-07-97
6520.21

8:15 @ office

Dawn Lancaster

12:25 on site wabauga

-No Key to gate to get to mw-13
mw-9

6:30pm finish for day

4-8-97

8-8:44 Wilson pump for use
in mw-19

8:44 on site

mw-19
SWL 4.85
TD 69.60
64.75 x .163 = 10.55
10.55 x 5 = 52.77

Top of pvc casing 0.5 ft from top of
manhole

04.08-97 6520.21

Top of manhole 0.33 from top of concrete pad

9:05 begin development.
- use bailer to remove heavy sediments first
- install 56' grundfos for purging & sampling

9:30 no coarse sediment load detected.

14:40 Search for MW-2
- Well at end of road (past MW-10) grouted up. Concrete visable in well pipe. Well had 3x3 ? pad w/ black 4" steel protective casing (lift and Twist)
MW-16 ?

Donna Lancaster

04-08-97
6520.21

- Map slightly wrong wells MW-2, MW-4 & MW-16 fenceline runs parallel approx to wells. property boundary doesn't

18:30 off site

18:45 finish for day

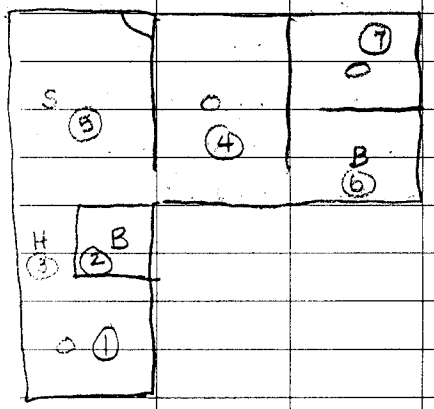
4-9-97

8- Check out
8:30 on site
- finish samples
- prep coolers for shipment
- do gas monitoring

Donna Lancaster

4-9-97 6520.21

SCALE HOUSE



O office
B bathroom
H hallway
S secretarys office

1 office rear of scale house
no methane

2 Bathroom
toilet no methane
cabinet no methane

3 hallway no methane

Donna Lancaster

4-9-97 6520.21

4 office
-newly painted
-check 4 electrical outlets
(had no covers) no methane

5 Secretarys office
No methane
Check vents near desk
no methane

6 Bathroom
toilet no methane
sink connection to wall
no methane

7 office (small) front of building
No methane

3:15 off site

6pm @ office

Doug Lancaster

APPENDIX C

Previous Landfill Groundwater Organic Analysis
Summary Table

W.....UGA COUNT LANDFILL GROUNDWATER
ORGANIC CONSTITUENTS DETECTED
December 11, 1990, November 16-18, 1992 and March 3, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Trichloroethene	December 11, 1990	SW846 Method 8240	5			9		---	2.8	5	
(TCE)	November 16-18, 1992	SW846 Method 8010	1			23		110	2.8	5	
	March 5, 1993	EPA Method 502.2	0.2	0.4	2.4	18.1	0.7		2.8	5	
	March 5, 1993	SW846 Method 8021	0.2		2.1	15.7	0.8	79.5	2.8	5	
1,1,1-Trichloroethane	December 11, 1990	SW846 Method 8240	5		394	102			200	200	
(1,1,1-TCA)	November 16-18, 1992	SW846 Method 8010	1		980	68	6		200	200	
	March 5, 1993	EPA Method 502.2	0.4		1646	19.0	10.5		200	200	
	March 5, 1993	SW846 Method 8021	0.4		1212	19.0	22.5	1.4	200	200	
Tetrachloroethene	December 11, 1990	SW846 Method 8240	5		7	25			0.7	5	
(PCE)	November 16-18, 1992	SW846 Method 8010	1		5	39		4	0.7	5	
	March 5, 1993	EPA Method 502.2	0.5	0.5	11.2		1.6		0.7	5	
	March 5, 1993	SW846 Method 8021	0.5		11.8	24.9	1.6	12.5	0.7	5	
1,1,-Dichloroethane	December 11, 1990	SW846 Method 8240	5		52	178			700[1]	---	
(1,1-DCA)	November 16-18, 1992	SW846 Method 8010	1		41	250		81	700[1]	---	
	March 5, 1993	EPA Method 502.2	0.7		96	173.3	1.2	77	700[1]	---	
	March 5, 1993	SW846 Method 8021	0.7		82	161	1.1	43.7	700[1]	---	
1,1-Dichloroethene	December 11, 1990	SW846 Method 8240	5		80	7			7	7	
(1,1-DCE)	November 16-18, 1992	SW846 Method 8010	1		110	14			7	7	
	March 5, 1993	EPA Method 502.2	0.7		232	10.3	5.1	0.9	7	7	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.3)		143.6	9	4.5	*	7	7	
cis-1,2-Dichloroethene	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4	36.4		225	70	70	
(cis-1,2-DCE)	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)		1	26.6	*	87.8	70	70	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WATAUGA COUNTY LANDFILL GROUNDWATER
ORGANIC CONSTITUENTS DETECTED
DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Methylene Chloride	December 11, 1990	SW846 Method 8240	5			23		---	5	5	
	November 16-18, 1992	SW846 Method 8010	1			16		15	5	5	
	March 5, 1993	EPA Method 502.2	0.6		4.2	9.4			5	5	
	March 5, 1993	SW846 Method 8021	0.6						5	5	
Vinyl Chloride	December 11, 1990	SW846 Method 8240	10					---	.015	2	
	November 16-18, 1992	SW846 Method 8010	1			3		12	.015	2	
	March 5, 1993	EPA Method 502.2	0.4			3.4		18.3	.015	2	2.6
	March 5, 1993	SW846 Method 8021 and *(8240)	0.4 *(1.0)			*		*	.015	2	
Dichlorodifluoromethane	December 11, 1990	SW846 8240	5			21		---	0.19	---	
	November 16-18, 1992	SW846 Method 8010	1						0.19	---	
	March 5, 1993	EPA Method 502.2	0.8			11.8		6.9	0.19	---	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.8 *(0.8)			*			0.19	---	
Chloroethane	December 11, 1990	SW846 Method 8240	10					---	---	---	
	November 16-18, 1992	SW846 8010	1			5		8	---	---	
	March 5, 1993	EPA Method 502.2	1.4		2.6				---	---	
	March 5, 1993	SW846 method 8021 and *(8240)	1.4 *(10)			*		*	---	---	
Trans-1,3-Dichloropropene	December 11, 1990	SW846 Method 8240	5			9-J		---	70	100	
	November 16-18, 1992	SW846 Method 8010	1					3	70	100	
	March 5, 1993	EPA Method 502.2	0.7			0.9		5.5	70	100	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)			*			70	100	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WATAUGA COUNTY LANDFILL GROUNDWATER
ORGANIC CONSTITUENTS DETECTED
DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Benzene	December 11, 1990	SW846 Method 8240	5					---	1.0	5	
	March 5, 1993	EPA Method 502.2	0.1			1.5	0.5	6.3	1.0	5	
	March 5, 1993	SW846 Method 8021	0.1			1.3		6.3	1.0	5	
1,4-Dichlorobenzene	November 15-18, 1992	SW846 Method 8010	0.3			0.5			0.19	75	
	March 5, 1993	EPA Method 502.2	0.5		0.8				1.8	75	
	March 5, 1993	SW846 Method 8021	0.5						1.8	75	
Chloroform	December 11, 1990	SW846 Method 8240	5					---	0.19	100	
	November 16-18, 1992	SW846 Method 8010	1				2	1	0.19	100	3
	March 5, 1993	EPA Method 502.2	0.3						0.19	100	
	March 5, 1993	SW846 Method 8021	0.3			0.5			0.19	100	
1,2-Dichloropropane	December 11, 1990	SW846 Method 8240	5					---	0.56	5	
	November 16-18, 1992	SW846 Method 8010	1						0.56	5	
	March 5, 1993	EPA Method 502.2	0.3		0.3	0.3			0.56	5	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.3 *(0.3)			*	*	*	0.56	5	
2,2-Dichloropropane	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4				---	---	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.7 *(0.7)		*	*	*	*	---	---	
1,1-Dichloropropene	March 5, 1993	SW846 Method 8240	0.5	3.8					---	---	
Bis(2-ethylhexyl)phthalate	March 5,1993	SW846 Method 8270	2		20				---	---	
Xylenes, Total	March 5, 1993	SW846 Method 8021	0.4					1	0.4	10	
4,4'-DDD	March 5, 1993	SW846 Method 8080	0.1					0.1	---	---	

Note: All Concentrations are in ppb (ug/L) (other footnotes located on page 4)

WATAUGA COUNTY LANDFILL GROUNDWATER
ORGANIC CONSTITUENTS DETECTED
DECEMBER 11, 1990, NOVEMBER 16-18, 1992 AND MARCH 5, 1993 SAMPLING EVENTS

Analyte	Date Sampled	Analytical Method	MDL	MW-1	MW-2	MW-3	MW-4	PZ-24	NCS	MCL	TRIP
Bromodichloromethane	December 11, 1990	SW846 Method 8240	5					---	---	100	
	November 16-18, 1992	SW846 Method 8010	1						---	100	
	March 5, 1993	EPA Method 502.2	0.3		0.6				---	100	
Carbon Tetrachloride	December 11, 1990	SW846 Method 8240	5					---	0.3	5	
	November 16-18, 1992	SW846 Method 8010	1						0.3	5	
	March 5, 1993	EPA Method 502.2	0.1			0.2	0.2	0.3	0.3	5	
	March 5, 1993	SW846 Method 8021	0.1						0.3	5	
	March 5, 1993	SW846 Method 8021	0.3						0.38	5	
1,2-Dichloroethane	December 11, 1990	SW846 Method 8240	5					---	0.38	5	
	November 16-18, 1992	SW846 Method 8010	1			1			0.38	5	
	March 5,1993	EPA Method 502.2	0.3		0.3				0.38	5	
	March 5, 1993	SW846 Method 8021 and *(8240)	0.3 *(0.3)		*	*		*	0.38	5	

PA SW-846 Methods 8011, 8030, 8040, 8090, 8120, 8150, and 8310 were Also Performed on Samples Collected on March 5, 1993, Resulting in No Analytes Detected.

MDL Analytical Method Detection Limit
NCS North Carolina Water Quality Standard (DEHNR: 15A NCAC 2L .0202)
MCL EPA Primary Drinking Water Standard Maximum Contaminant Level

December 11, 1990 Sampling Event - Conducted by Engineering Tectonics and split-sampled with the NCDEHNR Solid Waste Section - Analysis performed by the North Carolina State Laboratory of Public Health.
November 16-18, 1993 and March 5, 1993 Sampling Event - Conducted by Draper Aden Associates - Analysis performed by Central Virginia Laboratories and Consultants, Inc. (CVLC).
EPA Metho 502.2 Co-elutes compounds cis-1,2-Dichloroethene and 2,2-Dichloropropane

denotes estimated result
denotes proposed NCS
denotes *(method) utilized and analyte not detected

Note: All Concentrations are in ppb (ug/L)

APPENDIX D

Potable Well Organic Analysis Summary Table

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	MARCH 5, 1993*	MARCH 18, 1993*	MARCH 24, 1993*	JUNE 23, 1993**	JULY 13, 1994**	NCS	MCL
Carroll Residence (12)							
Benzene	2.1	1.7		1.9		1.0	5
Chloroethane	173.4	74.5		**ND**		---	---
Chloromethane	**ND**	14.8		**ND**		---	---
Dichlorodifluoromethane	30.6	**ND**		**ND**		0.19	---
1,1-Dichloroethane	20.9	17.4		**ND**		700	---
1,1-Dichloroethene	4.1	1.5		**ND**		7	7
cis-1,2-Dichloroethene#	1.2	0.9		<1.0		70	70
2,2-Dichloropropane#	1.2	0.9		**ND**		---	---
4-Isopropyltoluene	**ND**	0.2	NS	**ND**	NS	---	---
Isopropylbenzene	0.6	**ND**		**ND**		---	---
Methylene Chloride	**ND**	43.0(XT)		138.2		5	5
Styrene	2.8	0.5		**ND**		0.014	100
Tert-Butyl Methyl Ether	**ND**	**ND**		2.4		200	---
Tetrachloroethene	5.4(X)	4.7		4.2		0.7	5
Toluene	**ND**	0.6(T)		**ND**		1000	1000
1,1,1-Trichloroethane	19.7	15.7		29.4		200	200
Trichloroethene	7.0(X)	5.5(X)		7.0		2.8	5
Trichlorofluoromethane	37.1	20.2		**ND**		2100	---
Vinyl Chloride	1.7(T)	**ND**		**ND**		0.015	2
p and m-Xylene	**ND**	**ND**		<1.0		400	10,000
o-Xylene	**ND**	3.4		2.9		400	10,000
Nissan-Mazda Dealership (4)							
Carbon Tetrachloride	0.2		**ND**		**ND**	0.3	5
Chloroethane	19.1		**ND**		**ND**	---	---
Dichlorodifluoromethane	8.2		8.7		**ND**	0.19	---
1,1-Dichloroethane	98.5		63.1		104.3	700	---
1,2-Dichloroethane	**ND**		0.5		**ND**	0.38	---
1,1-Dichloroethene	5.4		3.7		4.7	7	7
cis-1,2-Dichloroethene#	22.2		13.0		23.7	70	70
1,2-Dichloropropane	0.5		0.3		**ND**	0.56	5
2,2-Dichloropropane#	22.2	NS	13.0	NS	**ND**	---	---
Tetrachloroethene	21.8(X)		28.1(X)		30.9	0.7	5
Toluene	**ND**		0.8(T)		**ND**	1000	1000
1,1,1-Trichloroethane	14.7		19.3		22.9	200	200
Trichloroethene	11.2(X)		9.1(X)		12.6	2.8	5
Trichlorofluoromethane	0.4		ND		**ND**	2100	---
o-Xylene	0.4		0.5(T)		**ND**	400	10,000

NOTE: All Concentrations are in ppb (ug/L).

(Other footnotes located on page 4)

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June 19, 1997

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	3/5/93*	3/18/93*	5/11/93**	6/23/93**	3/30/94**	4/6/94**	8/2/94**	12/7/94**	4/26/95**	10/24/95**	4/9/1996**	5/20/1996**	10/9/96**	6/4/96**	NCS	MCL
Blue Ridge Electric Membership Company - (BREMCO) (5)																
1.1-Dichloroethane	0.7					<1.0	1.4	1.0	1.2	1.8	1.5		1.5	2.0	700	---
Naphthalene	0.6					ND	ND	ND	ND	ND	ND		ND	ND	---	---
1,1,1-Trichlorothane	0.2					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	200	200
Trichloroethene	0.5	NS	NS	NS	NS	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NS	<1.0	<1.0	2.8	5
1,1-Dichloroethene	ND					1.0	1.9	<1.0	1.1	1.7	1.0		<1.0	1.7	7	7
cis-1,2-Dichloroethene	ND					<1.0	ND	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	70	70
Tetrachloroethene	ND					<1.0	<1.0	trace	<1.0	<1.0	<1.0		<1.0	<1.0	0.7	5
Bolick rental resident (2)																
tert-Butylbenzene	1.1					ND				ND	ND		ND	ND	---	---
Isopropylbenzene	0.7					ND				ND	ND		ND	ND	---	---
Trichloroethene	0.5					ND				ND	ND		ND	ND	2.8	5
1,3,5-Trimethylbenzene	0.7	NS	NS	NS	NS	ND	NS	NS	NS	ND	ND	NS	ND	ND	---	---
1,1-Dichloroethane	ND					trace				<1.0	trace		<1.0	trace	700	---
1,1-Dichloroethene	ND					trace				trace	ND		trace	ND	7	7
Methyl Ethyl Ketone	ND					trace				35.3	ND		ND	ND	170	---
Tetrahydrofuran	ND					ND				42.3	ND		ND	ND	---	---
Perry Residence (11)																
Dichlorodiflurometh an	2.5			ND	ND								ND		0.19	---
Naphthalene	0.7			ND	ND								ND		---	---
Chloromethane	<9	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	ND	NS	---	---
Methylene Chloride	<0.6			ND	ND								ND		5	5
Chloroform				ND	<1.0								NDT		0.19	100
Greer residence (15)																
Benzene		ND				<1.0		ND							1.0	5
Toluene		ND				6.4		ND							1000	1000
Tetrachloroethene	NS	ND	NS	NS	NS	trace	NS	ND	NS	NS	NS	NS	NS	NS	0.7	5
Ethylbenzene		ND				trace		ND							29	700
p and m - Xylene		ND				<1.0		ND							400	10,000
Styrene		ND				trace		ND							0.14	100
Ward residence (24)																
Methylene Chloride			3.2	ND	ND		ND	ND	ND	ND		ND	ND		5	5
1,1,1-Trichloroethane			<1.0	<1.0	<1.0		ND	ND	ND	ND		ND	ND		200	200
Trichloroethene			trace	trace	<1.0		ND	trace	ND	ND		ND	ND		2.8	5
Tetrachloroethene	NS	NS	ND	trace	<1.0	NS	ND	trace	trace	<1.0	NS	<1.0	trace	NS	0.7	5
Carbon Tetrachloride			ND	ND	<1.0		ND	ND	ND	ND		ND	ND		0.3	5
1,1-Dichloroethane			ND	ND	<1.0		ND	<1.0	<1.0	trace		<1.0	ND		700	---
Chloroform			ND	ND	trace		ND	ND	trace	trace		ND	ND		0.19	100
1,2-Dibromoethane (EDB)			ND	ND	ND		ND	ND	ND	trace		ND	ND		0.0004	0.05

NOTE: All Concentrations are in ppb (ug/L). (Other footnotes located on page 4)

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June 19, 1998

POTABLE WELL TESTING - WATAUGA COUNTY, NC
RESULTS OF VOLATILE AND SEMI-VOLATILE ANALYSIS

CONSTITUENT	3/18/93*	5/11/93**	9/21/93**	3/30/94**	1/12/95**	10/24/95**	4/9/96**	10/9/96**	6/12/13**	MCL	NCS
Shared Well #1 (8 Houses) (13)											
sec-Butylbenzene	0.2	ND	ND							---	---
Carbon Tetrachloride	0.1	ND	ND							5	0.3
Methylene Chloride	1.5	ND	ND	NS	NS	NS	NS	NS	NS	5	5
alpha-Chlordane	0.4	ND	ND							2	0.27
gamma-Chlordane	0.3	ND	ND							2	0.27
Shared Well #2 (4 Houses) (14)											
1,4-Dichlorobenzene	0.5			ND	ND	ND	ND	ND	ND	---	---
1,1-Dichloroethane	ND			ND	ND	<1.0	<1.0	<1.0	ND	---	700
1,1-Dichloroethene	ND			<1.0	<1.0	ND	ND	ND	ND	7	7
Tetrachloroethene	ND			ND	ND	trace	ND	trace	ND	5	0.7
1,1,1-Trichoroethane	ND	NS	NS	<1.0	ND	trace	ND	ND	ND	200	200
Chloroform	ND			trace	ND	9.0	ND	ND	ND	100	0.19
Bromodichloromethane	ND			ND	ND	1.4	ND	ND	ND	100	---
Dibromochloromethane	ND			ND	ND	<1.0	ND	ND	ND	---	---
2-Chlorotoluene	ND			ND	ND	1.2	ND	ND	ND	---	---
4-Chlorotoluene	ND			ND	ND	1.0	ND	ND	ND	---	---
Methyl Ethyl Ketone	ND			ND	ND	24.6	ND	ND	ND	---	170
Tetrahydrofuran	ND			ND	ND	13.4	ND	ND	ND	---	---

CONSTITUENT	3/5/93**	4/26/95**	4/9/96**	NCS	MCL
Chevrolet dealership (7)					
t-butyl methyl ether	ND	24.4	2.5	200	---

CONSTITUENT	3/23/93**	3/23/93**	5/11/93**	6/23/93**	8/3/93**	8/9/93**	10/20/93**	3/30/94**	9/21/94**	1/12/95**	4/26/95**	2/21/96**	5/20/96**	10/9/96**	6/12/97**	NCS	MCL
Simko residence (20)																	
1,1,1-Trichloroethane		trace											trace	trace	trace	---	200
Chloroform		<1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<1.0	NDT	ND	0.19	100
Johnson residence (23)																	
Chloroform	NS	NS	trace	NS	NS	NS	NS	NS	NS	NS	NS	NS	<1.0	NS	<1.0	0.19	100
McLean residence (26)																	
Chloroform	NS	NS	NS	<1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.0	100
Yates residence (30)																	
Chloroform	NS	NS	NS	NS	<1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.19	100
McClintock residence (33)																	
1,2-Dichloroethane	NS	NS	NS	NS	NS	<1.0	<1.0	NS	ND	NS	NS	NS	NS	NS	NS	700	---
Chloroform						<1.0	ND		<1.0							0.19	100
Meadowridge condominiums (38)																	
Chloroform							<1.0					ND				0.19	100
trans-1,2-Dichloroethene							<1.0					ND					
1,1,1-Trichloroethane	NS	NS	NS	NS	NS	NS	trace	NS	NS	NS	NS	ND	NS	NS	NS	200	200
Trichloroethene							trace					ND				2.8	5
Austin residence (40)																	
Chloroform	NS	NS	NS	NS	NS	NS	NS	NS	NS	trace	NS	NS	NS	NS	NS	0.19	100

NOTE: All Concentrations are in ppb (ug/L)

(Other footnotes located on page 4)

POTABLE WELL TESTING - WATAUGA COUNTY, NC
WELLS SHOWING NO DETECTED ORGANIC COMPOUNDS

SAMPLING LOCATION	SAMPLING DATES
Colene Bolick residence (1)	March 5, 1993* and February 21, 1996**
Roten residence (3)	March 5, 1993* and July 3, 1994**
Hollar and Green Produce (6)	March 5, 1993*
Vannoy residence (8)	March 5, 1993*
Martin High County Rentals #1 (9)	March 5, 1993*
Martin High Country Rentals #2 (10)	March 5, 1993*
Williamson residence (16)	March 18, 1993*
Suddreth residence (17)	March 18, 1993*, September 21, 1993**, and July 3, 1994**
Taylor residence (18)	March 18, 1993*, October 9, 1996**
Hodges residence (19)	March 18, 1993*
Findt residence (21)	March 18, 1993*
Rusher residence (22)	March 23, 1993**
Younce residence (25)	May 11, 1993**
Medlin residence (27)	June 23, 1993**
Rector residence (28)	June 23, 1993**
Robinson residence (29)	June 23, 1993**
Cook residence (31)	August 3, 1993**
Animal Control Office (32)	August 3, 1993**
Brook Hollow Trailer Park (37)	October 11, 1993**
Green residence (34)	October 20, 1993**
Shared well #3 (35)	October 20, 1993**
BREMCO residence (36)	September 21, 1993**
Isaacs residence (39)	November 16, 1994**
Norris residence (41)	January 12, 1995**

TABLE 5A AND 5B NOTES:

The sampled well reference number as presented on the Vicinity Map (Figure 3) is denoted in parentheses following the sampling locations name

* Laboratory analysis performed by Central Virginia Laboratories and Constultants (CVLC) utilizing EPA Methods 502.2 (Volatiles) and 525.1 (Semi-Volatiles)

**Laboratory Analysis performed by NCDEHNR Division of Laboratory Services utilizing EPA Method 502.2 (Volatiles)

# denotes compound co-elutes

ND denotes no compounds detected for entire analytical scan

NDT denotes compound detected in trip blank at same concentration as well sample

NS denotes not sampled on that date

NA denotes compound not analyzed on that date

(T) denotes found in Trip Blank

(E) denotes estimated result

(X) denotes above MCL

NSC-North Carolina Water Qualtiy Standard (DEHNR-15A NCAC 2L.0202)

MCL-EPA Primary Drinking Water Standard Maximum Contaminant Level

APPENDIX E

Laboratory Analytical Data Reports
And Associated Data Validation Forms (on CD-ROM)

Drawing Under Seperate Cover