

Carmen Johnson 95-02

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**VOLUME I OF II**

**Groundwater and Surface Water  
Assessment Monitoring Results Report  
Initial Background Data Set  
Second Quarter 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:

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DAA Job No. 6520-20

February 17, 1995



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February 17, 1994

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

Re: Watauga County Landfill, Second Quarter Assessment Monitoring Background Report,  
DAA Job No. 6520-20

Dear Mr. Poindexter:

Please find enclosed a copy of the second quarter background data set report for Assessment Monitoring at the Watauga County Landfill, for your review. The enclosed report presents the findings of the second background Assessment Monitoring groundwater and surface water sampling event conducted on September 27-30, 1994 by Draper Aden Associates.

Volume I of the report discusses sampling procedures, analytical results, and overall conclusions of the first quarter event. Volume II, comprised of one separately bound section, contains copies of all associated laboratory data. Volume II also contains Data Validation Forms summarizing the guidelines and results of data validation procedures utilized for evaluating the data discussed in this report.

The enclosed Second Quarter Assessment Monitoring Background Report will be available to the public on February 21, 1995.

The third quarter Assessment Monitoring sampling event was recently conducted on February 6-10, 1995. Draper Aden Associates will prepare and submit a Quarterly Assessment Report for the third event upon receipt and review of the analytical data.

Mr. Mark Poindexter  
November 11, 1994  
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If you should have any questions concerning the enclosed report or the second assessment groundwater and surface water sampling event, please do not hesitate to contact me.

Sincerely,  
Draper Aden Associates



Jeffrey E. Smith  
Project Geologist

JES:kr

cc: Mr. James S. Ratchford, Watauga County manager  
Mr. Richard M. DiSalvo, Jr., P.E., Director of Engineering Services, DAA  
Mr. Justin E. Babendreier, Environmental Project Manager, DAA

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## **I. Introduction**

This report presents the results of the second quarter background sampling event for Assessment Groundwater and Surface Water Monitoring at the Watauga County Landfill, NCDEHNR Permit No. 95-02, Watauga County, North Carolina, performed on September 27-30, 1994 by Draper Aden Associates. Assessment monitoring was performed in accordance with the Watauga County Landfill Assessment Plan (DAA, September 3, 1993), approved by the NCDEHNR on September 30, 1993. 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.

Volume I of this report (herein) discusses sampling procedures, analytical results, and overall conclusions of the initial Assessment background sampling event. Volume II of the report (separate cover) contains copies of all associated laboratory data. Volume II of this report also contains Data Validation Forms summarizing the guidelines and results of the preliminary data validation procedures utilized for evaluating the data discussed in this report.

### **A. Groundwater Monitoring Well Network**

Eighteen (18) 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.

The decision criteria utilized for the selection of core assessment wells is the exceedance of the groundwater protection standard for an individual parameter. The groundwater protection standard is based on an individual parameter's North Carolina Groundwater Quality Standard (NCS) or EPA Maximum Contaminant Level (MCL).

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 wells. The presence of target parameters above the analytical method limit of detection shall be evaluated with respect to repeated sampling events prior to confirmation.

Eleven (11) of the eighteen (18) groundwater monitoring wells were recently installed in January and February of 1994. For the first quarter background event, four (4) of the previous seven (7) monitoring wells, MW-2, MW-3, MW-4, and MW-6, were denoted as core assessment wells based on the decision criteria and 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 decision criteria and the analytical data obtained from the first quarter background event, the assessment monitoring well network was restratified for the second quarter background monitoring event. Revisions to the network of core and boundary assessment wells resulted in the upgrading of six of the eleven recently installed monitoring wells to "core" status (MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17).

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

<u>CORE WELLS</u>	<u>BOUNDARY WELLS</u>
MW-1	MW-5
MW-2	MW-7
MW-3	MW-13
MW-4	MW-14
MW-6	MW-15
MW-8	MW-16
MW-9	MW-18
MW-10	
MW-11	
MW-12	
MW-17	

As outlined in the Assessment Monitoring schedule (Table 1, Appendix 1), both core and boundary assessment wells were analyzed using CLP statements of work for the second assessment background monitoring event.

## **B. Surface Water Sampling**

Surface water sampling is conducted on a semi-annual basis. Therefore, no routine surface water sampling was performed during the second quarter background monitoring event.

As per recommendations by the NCDEHNR, a spring located along the base of Rocky Knob, adjacent to the landfill, observed flowing during the second quarter background sampling event, was sampled. This spring, located at the head of the drainage adjacent to the Carroll residence well (well reference no. 12), was not observed to be flowing during the first background sampling event.

The decision criteria for subsequent sampling of the springs located in the Rocky Mountain Heights subdivision will be based on the results of the initial spring sampling outlined above, as well as additional monitoring well and potable well sampling and analyses results. Springs located in other areas of the site, as designated on Figure 1, will also be considered for sampling based on evaluations of future sampling events.

Although not required by the Assessment Monitoring schedule (Table 1, Appendix I), leachate production observed during the second quarter background sampling event was also sampled. A grid field screening inspection of the landfill was conducted concurrent with the second quarter background event to verify the presence or absence of leachate production occurring within the fill. Observations resulting from the inspection are documented in the enclosed field notes (Appendix II).

A leachate sample (L1) was collected from surface flow observed approximately 15 feet west of MW-10, located downgradient and below all the sanitary and debris waste disposal areas. The leachate was observed to be flowing very slowly and described as odorless, with an oily sheen. The volume of leachate production was insufficient to allow the collection of a sample for metal analysis. Two 40 ml samples were collected for volatile organic analysis. As documented in the enclosed field notes (Appendix II), no other leachate production was observed during the second quarter background sampling event.

No leachate production was observed at the landfill during the initial background sampling event (June 20-23, 1994).

## C. Sampling and Analysis Schedule

### Groundwater

During the first year of Assessment groundwater monitoring, four (4) quarterly background sampling events will be conducted on each groundwater monitoring well. Semi-annual sampling events will be conducted after the first year. The groundwater assessment monitoring schedule is outlined in Table 1.

The analytical scans performed on each monitoring well during the first year of assessment groundwater monitoring are designed to analyze for all the target parameters detected and tentatively confirmed as a result of the first 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 North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) requirements for Municipal Solid Waste Landfills (15A NCAC 13B Section .1600). A summary and evaluation of the results of the initial March 5, 1993 sampling event are contained in Appendix III of this report and detailed in Sections II and III of the Assessment Plan (DAA, September 3, 1993).

After completion of the four (4) quarterly Assessment background groundwater monitoring events and on an annual basis thereafter, the complete EPA Appendix II analysis will be repeated on the network of core assessment wells. If any additional parameters are detected, and verified through QA/QC validation as being present, that were not identified in prior Assessment monitoring events, amendments to the existing target parameter list will be evaluated and reviewed with the NCDEHNR. For amended target parameters, four (4) independent samples will be collected and analyzed for those additional parameters during the following four (4) semi-annual sampling events at all core and boundary assessment wells to establish background.

Groundwater monitoring events will also continue to be conducted on all wells on a semi-annual basis for the 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 follows 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 preliminarily identify low levels of parameters that may be present. The groundwater analysis schedule, indicating methods designated for the core and boundary wells, is outlined in Table 1.

During the first year of Assessment Monitoring, analyses of the core assessment monitoring wells utilize CLP SOWs for all four (4) quarterly events. Analyses of the boundary assessment monitoring wells alternate between CLP and LLRA analytical methods for each quarterly event.

After the first year of quarterly sampling events, the core assessment monitoring wells will be monitored on a semi-annual basis. The first semi-annual core sampling event will analyze 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. The second semi-annual core sampling event will also analyze for the target parameter assessment monitoring parameters using CLP-SOWs.

After the first year of quarterly sampling events, boundary assessment wells will also be monitored on a semi-annual basis for the target parameter assessment monitoring parameters. Analysis of semi-annual boundary well monitoring events will continue to alternate between CLP and LLRA methods for each semi-annual event.

### **Surface Water**

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

## **II. 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 II, document groundwater sample collection procedures.

### **A. 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 from the September 27-30, 1994 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 was 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 II, summarize and document well purging calculations and results.

Monitoring well MW-5 was observed to be dry during both the June 20-23, 1994 sampling event and the September 27-30, 1994 sampling event. Static water level data collected since the installation of MW-5 in October 1992 indicate the lowering of the potentiometric surface in this area is a recent phenomenon. The potentiometric surface was observed to be seasonally low during the two recent events. The potentiometric surface inferred from static water level elevations obtained from nearby wells during the recent September sampling event is presented on the enclosed Groundwater and Surface Water Monitoring Program Site Map (Figure 1, Appendix I).

#### **B. 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 II document field meter calibration methods for each sampling event.

#### **C. 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.

#### **D. 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.

#### **E. Chain of Custody Documentation**

Chain of Custody documentation and analysis requests are contained within each laboratory report for each event. Laboratory analytical data sheets are found in Volume II.

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 Chain of Custody 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 were also attached along with the COC forms. Analysis request forms included lists of parameters and respective required analytical methods. 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.

### **III. LABORATORY ANALYSIS AND DATA VALIDATION**

#### **A. List of Laboratories**

Volatile analysis and Total Metal analysis by EPA Contract Laboratory Program (CLP) statements of work (SOW) were performed by Compuchem Environmental Corporation of Research Triangle Park, North Carolina.

## **B. 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.

## **C. 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 - 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 - 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 - The degree to which a sample represents the character of the population being measured. Representativeness is controlled by defining sample collection protocols and adhering to them throughout the evaluation.
- Completeness - The ratio of validated data points to the total samples collected. Completeness is achieved through duplicate sampling and resampling, when necessary.
- Comparability - 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. Estimated 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 second quarter background assessment monitoring event are provided in Tables 2 and 3 (Summary Tables - Assessment Monitoring Results; Appendix I).

### **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
- surrogate parameters
- instrument adjustment
- calibration
- additional QC requirements (organic and inorganic)
- quantification
- raw data
- chromatograms

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

#### IV. DATA VALIDATION

The analyses for organic as well as inorganic parameters were performed in adherence to the relevant Contract Laboratory Program-Statement of Work (CLP-SOW). 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.

##### A. 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 are recommended. In addition to the **laboratory reporting qualifiers** defined in volume II, project specifications required the laboratory performing the analytical services to utilize the following additional data qualifiers and definitions:

##### Qualifiers

- 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.

## B. 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 either the sample quantitation limit or 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 value is an estimate and may be inaccurate or imprecise.

### **C. Inorganic Data Review**

Inorganic analysis was performed by relevant Atomic Adsorption technique and Inductively Coupled Plasma (ICP) method, in accordance with EPA Contract Laboratory Program (CLP) Statement of Work ILMO 3.0. The samples were analyzed for total concentrations of 4 metal parameters, Barium, Cadmium, Iron and Mercury. Barium, Cadmium, and Iron were analyzed by ICP techniques. Mercury was analyzed for by Cold Vapor Atomic Adsorption technique. Compuchem Environmental Corporation of Research Triangle Park, North Carolina performed these analyses.

The results of preliminary data validation presented herein are based upon an extensive review of holding times, preservation procedures and standards, spike analysis on sample matrix, laboratory control samples, post digestion spike results, blank results (method, trip, equipment, and continuing calibration blanks), duplicate sample results, ICP serial dilution results, and interference check sample results.

A brief summary of important data validation results is presented below. Detailed validation notes are presented in Section 2, Volume II of this report.

As noted in the previous sections, a total of 18 samples, including 17 groundwater samples, and 1 surface water sample was collected and analyzed for the metal parameters previously stated. The samples were analyzed in two batches, in order to adhere to the Groundwater Monitoring Program analysis batch size specifications. Samples MW-1, MW-6, MW-7, MW-8, MW-11, MW-13, MW-14, and the Spring in the Rocky Mountain Heights subdivision were analyzed as the first batch, and samples MW-2, MW-3, MW-4, MW-9, MW-10, MW-12, MW-15, MW-16, MW-17, and MW-18 were analyzed as the second batch. The Limits of Detection for ICP parameters were different between the two batches, due to difference in ICP instrumentation used for the two sample batches.

Two Trip Blanks were supplied by the laboratory and are representative of samples from each respective batch. However, the Mt. Spring sample was collected on September 29, 1994 and was delivered to the laboratory with the second batch of samples on October 3, 1994. Hence, the Trip Blank representative of Mt. Spring Sample is the Trip Blank analyzed with the second batch of samples.

Iron was detected in the Trip Blank analyzed with the first batch of samples at 10.5 µg/l. This necessitated the validation of all relevant sample results less than 53 µg/l as "U".

Samples from MW1, MW9 were spiked with standards to identify any possible matrix interferences in their recoveries. Spike recoveries were within acceptable ranges for all parameters.

The sample matrix spike recoveries for MW1S and MW9S were found to be inside control limits for the requested parameters. CLP control limits for matrix spike recoveries are set at 75% to 125% of the parameter quantity added unless original sample concentrations exceed the true values of these "spikes" by a factor of four or more; in this case affected parameters are not flagged even if recoveries fall outside percentage recovery control limits.

The sample matrix duplicates, MW1D and MW9D, were within CLP control limits for all requested parameters. CLP control limits for duplicate determinations are +/- 20% Relative Percent Difference (RPD) for concentrations greater than or equal to five times the CRDL in both the original and duplicate samples, and +/- the CRDL for concentrations less than five times the CRDL. The RPD is not calculated if both the original and duplicate values fall below the IDL.

A five-fold serial dilution of samples MW1L and MW9L were performed in accordance with CLP requirements for ICP analysis. The adjusted sample concentrations were inside CLP control limits for all requested parameters. CLP control limits for serial dilution are defined as a deviation less than or equal to 10% in the dilution-adjusted concentrations from the original values for all parameter concentrations with values greater than fifty (50) times their respective Instrument Detection Limit (IDL) in the original sample.

It should be noted that data less than IDLs for the parameters have been validated as "U", and samples results greater than IDLs have been reported unchanged. The CRDLs for the target parameters are presented on Form 2B (Form II [Part 2] - IN) of the laboratory Certificate of Analysis.

#### D. Organic Data Review

Organic data review for the September 27-30, 1994 sampling event was conducted on a total of 34 volatile organic parameters (CLP SOW VOA list and Dichlorodifluoromethane) analyzed using CLP Statement of Work (3/90) OLMO1.9. Samples were collected from monitoring wells MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, leachate sample L1 and surface water sample MT.SPRING located within the Rocky Mountain Heights subdivision. The data package submitted by CompuChem Environmental Corporation contained two separate data sets; one containing analytical results for L1, MW-1, MW-11, MW-13, MW-14, MW-6, MW-7, MW-8, and MT.SPRING (Case# 29369 SDG# 00001) and the second containing analytical results for monitoring wells MW-10, MW-12, MW-15, MW-16, MW-17, MW-18, MW-2, MW-3, MW-4, and MW-9 (Case# 29369 SDG# 00018).

The Contract Required Quantitation Limit (CRQL) for both SDG# 00001 and SDG# 00018 was 10  $\mu\text{g/L}$ . However, some samples required dilution prior to analysis which resulted in the elevation of corresponding quantitation limits. In SDG# 00001, sample MW-6 was diluted at a ratio of 2.5:1 resulting in a CRQL of 25  $\mu\text{g/L}$ . For SDG# 00018, four samples required dilutions. Sample MW-10 was diluted 8.3:1 resulting in a CRQL of 83  $\mu\text{g/L}$ . Samples MW-14 and MW-3 were diluted 1.4:1 resulting in CRQL values of 14  $\mu\text{g/L}$ . Sample MW-2 required a 16.7:1 dilution which resulted in a CRQL value of 170  $\mu\text{g/L}$ .

Batch specific Quality Control (QC) samples were employed for the second assessment event. For SDG# 00001, monitoring well MW-1 was chosen to have matrix spike and matrix spike duplicate analyses performed. For SDG# 00018, monitoring well MW-9 was chosen for matrix spike and matrix spike duplicate analyses. The associated Trip Blank for SDG# 00018 also applied to samples L1 and MT.SPRING contained in SDG# 00001. The two aforementioned samples were shipped to the laboratory as part of the second sample batch but analyzed as part of the first sample batch. Therefore, the analytical results for the Trip Blank presented in SDG# 00018 applied to all samples in the SDG in addition to L1 and MT.SPRING in SDG# 00001.

The analytical data set prepared by CompuChem was accompanied by a CLP Quality Assurance/Quality Control (QA/QC) package containing instrument calibration and internal standard results, raw data from all analyses and accompanying chromatographic and spectral results. Draper Aden Associates reviewed the volatile organic packages presented by CompuChem by reviewing technical holding times, preservation requirements, performance checks, initial calibrations, continuing calibrations, blank analyses, surrogate spike results, matrix spike and duplicate analyses, internal standards criteria and Tentatively Identified Compound (TIC) results. The review of this data package is considered preliminary, and did not account for data transcription or calculation errors.

A brief summary of data validation results is presented below. Detailed data validation notes are presented in Section 2, Volume II of this report.

*SDG# 00001*

Analytical data for SDG# 00001 displayed minor complications with the quality control blanks. Both laboratory quality control blanks, or Method Blanks, contained low level concentrations of common laboratory contaminants. Method Blank VBLKVE contained Methylene Chloride at 2 µg/L and Acetone at 3 µg/L. Method Blank VBLKWV contained Acetone at 4 µg/L. The associated Trip Blank contained Methylene Chloride at 1 µg/L and Acetone at 4 µg/L. According to the Contract Laboratory Program (CLP), "Functional Guidelines for Organic Data Review," all blanks should be free from contamination. Since the Method Blank is a laboratory-derived sample, the contamination shown in the analytical results for VBLKVE and VBLKWV was considered to be laboratory artifact. Therefore, all samples containing Methylene Chloride and Acetone associated with VBLKVE and VBLKWV were validated based on the Method Blank concentrations of the laboratory contaminants. For samples associated with VBLKWV, Methylene Chloride concentrations were validated using the Trip Blank since Methylene Chloride was not detected in the Method Blank. Methylene Chloride was detected at levels below the Contract Required Quantitation Limit (CRQL) in each of the nine sample locations comprising SDG# 00001. Acetone was found at low levels in all samples except MW-1, MW-8, MW-13, and MW-14. For samples MW-7 and MW-11, Acetone levels were higher than the CRQL but lower than the VBLKWV concentration multiplied by a factor of ten. Therefore the sample results were validated as "U" and the CRQL values were elevated to the original sample result. All contaminant sample results below the CRQL were validated as less than the CRQL and labeled "U."

*SDG# 00018*

Analytical results for SDG# 00018 displayed complications with one of the two Continuing Calibrations and with the quality control blanks. The data set contained two Continuing Calibrations (CCAL), CCAL CS and CCAL CT. CCAL CT, also included in SDG# 00001, contained no data review abnormalities. CCAL CS, which applied to VBLKJ1, MW-4, MW-12, MW-17, TRIP, MW-9MSD, and MW-3, contained four parameters with percent differences (%D) outside the  $\pm 25\%$  range. Therefore, all sample results associated with CCAL CT for Acetone, Carbon Disulfide, 2-Butanone, and 2-Hexanone were validated as estimated and labeled "J."

Both Method Blanks and the accompanying Trip Blank contained both Methylene Chloride and Acetone at low concentrations. VBLKVE contained Methylene Chloride at 2 µg/L and Acetone at 3 µg/L. VBLKJ1 contained Methylene Chloride at 11 µg/L and Acetone at 7 µg/L. The Trip Blank contained Methylene Chloride at 2 µg/L and Acetone at 6 µg/L. Methylene Chloride concentrations in samples MW-2, MW-9, MW-10, MW-16 and MW-18 exceeded both the corresponding CRQL values as well as corresponding CLP guidance laboratory contaminant values (Method Blank concentration multiplied by a factor of ten). Therefore, no data qualification was necessary. Acetone concentrations never exceeded respective CRQL values and were therefore validated accordingly.

For each sample location, Tentatively Identified Compounds (TICs) were reported with estimated concentrations. All TICs for SDG# 00001 were listed as unknown and were validated as "NJ," tentatively identified. For SDG# 00018, Hexane was qualified at a concentration of 7 µg/L. Hexane, at a concentration of less than 100 µg/L is considered to be a laboratory artifact or contaminant. Hexane in sample MW-16 could not be validated as such due to the absence of the parameter in all blanks. Dichlorofluoromethane was qualified as a TIC in sample MW-9 at a concentration of 200 µg/L. Both parameters were qualified by the laboratory as tentatively identified, "NJ."

All other sample results (from both data sets) less than the CRQL required no qualification. Analytical results less than the CRQL which displayed a concentration followed by "J" were reported in original laboratory reporting format after final data validation. For SDG# 00001, Chloroethane, 1,1-Dichloroethane, 1,2-Dichloroethene (total), Trichloroethene, Tetrachloroethene, and 2-Butanone were detected at concentrations higher than respective CRQL values. For SDG# 00018, Methylene Chloride, 1,1-Dichloroethene, 1,1-Dichloroethane, 1,2-Dichloroethene (total), Tetrachloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Chloroethane were detected above the CRQL. For these parameters, no data qualification was necessary.

## V. DISCUSSION OF ANALYTICAL RESULTS

Tables 2A and 2B (Assessment Target Parameter Analytical Results; Appendix I) provide a summary of the target parameter analytical results obtained from the second quarter background sampling event for the core and boundary monitoring wells, respectively. These results were validated in-house by Draper Aden Associates according to the discussion provided in Section IV of this report. Tables 2A and 2B 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 Detection Limit (CRQL) for CLP-Organic results, and the analytical method.

Estimated analytical results for the target parameters are provided in Tables 2A and 2B 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 quarter background sampling event for the core and boundary monitoring wells, is provided in tables 3A and 3B, respectively. Non-target parameter data is provided for preliminary assessment purpose only and is not intended for use in determining regulatory compliance issues.

#### **A. Inorganic Analytical Results**

The evaluation of existing inorganic data on twelve (12) metal parameters collected prior to development of the Assessment Plan, indicated the tentative presence of four (4) 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.

The analytical results for the four target metal parameters obtained from the second quarter 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 VI.

Barium and Iron, both common naturally occurring parameters, were detected in almost all monitoring wells as well as the spring sampled in the Rocky Mountain Heights Subdivision. As previously noted in Section I.B., the volume of leachate production was insufficient to allow for collection of a leachate sample for metal analysis. Although observed in all of the monitoring wells, Barium was detected at levels below the EPA MCL and North Carolina groundwater standard of 2,000  $\mu\text{g/l}$ . Iron was also detected above the IDL in all but one of the monitoring wells, and often at levels significantly above associated water quality criteria. No Federal Primary Drinking Water Standard (EPA MCL) exists for Iron.

Review of Tables 2A and 2B indicates the second quarter total Mercury and total Cadmium CLP analysis resulted in the non-detection of Mercury and Cadmium in all seventeen (17) monitoring wells sampled, as well as the spring sampled in the Rocky Mountain Heights Subdivision.

The detection of Cadmium as a result of the first quarter sampling event, although estimated at levels above water quality standards, was observed in only two monitoring wells, MW-1 (the upgradient well) and MW-3 (an original downgradient well), and at no surface water sampling locations. The apparent discrepancy in the first quarter background Cadmium detections may be a result of sample matrix interference problems experienced by the laboratory during analysis of the first quarter samples.

## **B. 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 (12) primary target organic parameters occurring in the groundwater beneath the Watauga County Landfill. The analytical results for the target organic parameters obtained from the second quarter assessment background sampling event are summarized in Tables 2A and 2B. 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 VI.

#### Tetrachloroethene (PCE)

Tetrachloroethene (PCE) was detected at concentrations above the EPA MCL of 5  $\mu\text{g/l}$  and above the North Carolina groundwater standard (NCS) of 0.7  $\mu\text{g/l}$  in five core groundwater monitoring wells (MW-3, MW-6, MW-8, MW-12, and MW-17). Estimated concentrations for PCE (detected below the method CRQL) were also observed at or above the EPA MCL and above the NCS in three additional core groundwater monitoring wells (MW-9, MW-10, and MW-11). PCE was not detected in any of the boundary monitoring wells or the leachate sample and Rocky Mountain Heights Subdivision spring.

#### Trichloroethene (TCE)

Trichloroethene (TCE) was detected above the method CRQL at concentrations above the EPA MCL of 5  $\mu\text{g/l}$  and above the NCS of 2.8  $\mu\text{g/l}$  in five core groundwater monitoring wells (MW-3, MW-6, MW-8, MW-12, and MW-17). An estimated concentration for TCE (detected below the method CRQL) was also observed above the EPA MCL and NCS in one additional core groundwater monitoring well (MW-9). TCE was also estimated (detected below the method CRQL) at concentrations below the EPA MCL but above the NCS in one additional core groundwater monitoring well (MW-11). TCE was not detected in any of the boundary monitoring wells or the leachate sample and Rocky Mountain Heights Subdivision spring.

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

1,1-Dichloroethene (1,1-DCE) was detected above the method CRQL at concentrations above the EPA MCL and NCS of 7  $\mu\text{g/l}$  in two core groundwater monitoring wells (MW-2 and MW-10). 1,1-DCE was also estimated (observed below the method CRQL) at concentrations below applicable water quality standards in four additional core wells (MW-3, MW-8, MW-12, and MW-17). 1,1-DCE was not detected in any of the boundary monitoring wells or the leachate sample and subdivision spring.

### Methylene Chloride

Concentrations for Methylene Chloride were observed above the EPA MCL and NCS of 5  $\mu\text{g/l}$  in three core groundwater monitoring wells (MW-2, MW-9 and MW-10) and two boundary groundwater monitoring wells (MW-16 and MW-18). Although also detected in the method blank, the concentration for Methylene Chloride was 98 times greater than the EPA MCL and NCS for one core well (MW-2), 36 times greater than the EPA MCL and NCS in a second core well (MW-10), and over 15 times the EPA MCL and NCS in a third core well (MW-9). The concentrations for Methylene Chloride were 5 and 6 times greater than the EPA MCL and NCS in the boundary wells MW-16 and MW-18, respectively.

Estimated concentrations for Methylene Chloride (detected below the CRQL) were observed below the EPA MCL and NCS in MW-8 and one of the Trip Blanks.

As discussed in the previous Section IV, the detections of many of the lower concentrations of Methylene Chloride were validated as non-detect ("U") due to laboratory solvent interferences detected in the method blanks. Note that estimated detection for Methylene Chloride observed in the upgradient well MW-1 in the first background sampling event was not confirmed by the second background sampling event. Methylene Chloride was not detected in the upgradient well during the second background sampling event. To date, no volatile organic parameters have been confirmed by repeated sampling at MW-1.

### Dichlorodifluoromethane

Estimated concentrations for Dichlorodifluoromethane (detected below the method CRQL) were observed at concentrations above the North Carolina groundwater standard (NCS) of 0.19  $\mu\text{g/l}$  in six core groundwater monitoring wells (MW-2, MW-3, MW-8, MW-9, MW-12 and MW-17). No EPA MCL exists for Dichlorodifluoromethane. Dichlorodifluoromethane was not detected in any of the boundary monitoring wells or the leachate sample and subdivision spring.

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

1,1,1-Trichloroethane (1,1,1-TCA) was detected above the method CRQL at concentrations above the EPA MCL and North Carolina groundwater standard (NCS) of 200  $\mu\text{g/l}$  in two core monitoring wells (MW-2 and MW-10). 1,1,1-TCA was also detected above the method CRQL, but below the EPA MCL and below the NCS, in four core monitoring wells (MW-3, MW-9, MW-12, and MW-17). Estimated concentrations of 1,1,1-TCA (below the CRQL) were also observed below the EPA MCL and NCS in two additional core groundwater monitoring wells (MW-8 and MW-11) and one additional boundary groundwater monitoring well (MW-15).

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

As previously discussed in Section IV, CLP-SOW analytical results for cis-1,2-Dichloroethene are reported as part of a total concentration of cis- and trans- isomers of the parameter.

Total 1,2-Dichloroethene (1,2-DCE) was detected above the method CRQL at concentrations above the EPA MCL and North Carolina groundwater standard (NCS) of 70  $\mu\text{g/l}$  in three core groundwater monitoring wells (MW-6, MW-8, and MW-17). Total 1,2-DCE was also detected above the method CRQL, but below the EPA MCL and below the NCS, in two additional core groundwater monitoring wells (MW-3 and MW-12). Estimated concentrations for total 1,2-DCE were observed in two core groundwater monitoring wells (MW-9 and MW-11) and one boundary monitoring well (MW-7).

### Benzene

No concentrations of Benzene above the method CRQL were observed in any monitoring wells or surface water sampling locations. Estimated concentrations of Benzene (detected below the method CRQL) were observed above the EPA MCL of 5  $\mu\text{g/l}$  and above the NCS of 1  $\mu\text{g/l}$  in three core groundwater monitoring wells (MW-2, MW-6 and MW-8). Benzene was also detected below the method CRQL (estimated) below the EPA MCL but above the NCS in four additional core groundwater monitoring wells (MW-3, MW-4, MW-9 and MW-17) and below the EPA MCL but at or above the NCS in three boundary monitoring wells (MW-7, MW-16, and MW-18).

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

1,1-Dichloroethane (1,1-DCA) was detected at concentrations below the proposed North Carolina groundwater standard (NCS) of 700  $\mu\text{g/l}$  in eight core groundwater monitoring wells (MW-3, MW-6, MW-8, MW-9, MW-10, MW-11, MW-12 and MW-17). No EPA MCL exists for 1,1-DCA. Estimated concentrations of 1,1-DCA were also observed below the NCS in one additional core well (MW-2) and one additional boundary monitoring well (MW-7).

### Chloroethane

Chloroethane was detected at concentrations above the method CRQL in two core groundwater monitoring wells (MW-4 and MW-9) and one boundary monitoring well (MW-7) and the leachate sample (L1). Estimated concentrations of Chloroethane (detected below the method CRQL) were also observed in five additional core wells (MW-3, MW-6, MW-8, MW-12 and MW-17). No EPA MCL or North Carolina groundwater standard (NCS) exists for Chloroethane.

### trans-1,3-Dichloropropene

Trans-1,3-Dichloropropene was not detected above or estimated below the method CRQL in any monitoring wells or surface water sampling locations.

### Vinyl Chloride

Vinyl Chloride was not detected above the method CRQL in any core or boundary monitoring wells or surface water sampling locations, but was estimated (detected below the CRQL) at a concentration above the EPA MCL of 2  $\mu\text{g/l}$  and above the North Carolina groundwater standard (NCS) of 0.015  $\mu\text{g/l}$  in three core groundwater monitoring wells (MW-3, MW-6 and MW-8).

## **ii. Non-Target Organic Compounds**

The analytical results of additional non-target organic parameters detected as a result of utilizing USEPA CLP SOW OLMO1.9 (3/90) are summarized in Table 3. The analytical results obtained for non-target parameters, are provided to preliminarily identify those parameters which may need to be continually monitored. If upon completion of background 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 in seven core monitoring wells and three boundary monitoring wells. The CLP analysis identified a total of six non-target parameters and tentatively identified an additional thirteen non-target parameters. Ten of the nineteen total non-target parameters were tentatively identified compounds observed in the same monitoring well, MW-11. Twelve of the nineteen total non-target parameters were observed in only one monitoring well, although not the same well.

Tentatively identified compounds (TICs) were identified and/or classified based on a mass spectra library search. The thirteen tentatively identified non-target parameters were identified and/or classified as hexane, dichlorofluoromethane, unknown alkanes, unknown cycloalkanes, unknown hydrocarbons, an unknown unsaturated hydrocarbon, and an unknown ketone. The ten TICs detected in MW-11 (located below the Boone-Nissan septic field) were all classified as either unknown alkanes, cycloalkanes, hydrocarbons, unsaturated hydrocarbons, and ketones.

The detection of the tentatively identified Dichlorofluoromethane in MW-9, (estimated at 200 J  $\mu\text{g/l}$ ). The target parameter, Dichlorodifluoromethane, was also detected at the second highest estimated concentration in MW-9 (9 J  $\mu\text{g/l}$ ).

Low level non-target parameter detects were observed in several boundary wells that do not indicate significant impact by the target parameters (ie: MW-7, MW-16, and MW-18). Additional background data collection will be used to confirm the presence of the non-target analytes in these wells.

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

The ten additional non-target parameters detected as result of the first background sampling event utilizing LLRA analytical methods were validated as being estimated, "J", until outstanding QC data could be obtained from the laboratory and the data set could undergo a data validation process. Draper Aden Associates has been notified by the laboratory that the necessary QC information will not be available. The presence of these compounds will be evaluated with respect to the annual LLRA analysis.

## VI. PARAMETER DISTRIBUTION TRENDS

### A. Inorganic Analytical Results

#### Mercury (total)

The ~~presence of Mercury~~ in the groundwater and surface waters at the site is ~~not supported~~ by the analytical results of the first or second quarter assessment background monitoring event. No concentrations of Mercury were observed above the IDL of 0.20  $\mu\text{g/l}$ . If Mercury is confirmed to be absent upon completion of background data collection and the first complete annual EPA Appendix II List sampling event (utilizing LLRA analytical methods), it will be removed from the Target Parameter List.

#### Cadmium (total)

The ~~presence of Cadmium~~ in the groundwater and surface waters at the site is ~~not supported~~ by the analytical results of the second quarter assessment background monitoring event. No concentrations of Cadmium were observed above the IDL of 4.3  $\mu\text{g/l}$  and/or 4.6  $\mu\text{g/l}$ . If Cadmium is confirmed to be absent upon completion of background data collection and the first complete annual EPA Appendix II List sampling event (utilizing LLRA analytical methods), it will be removed from the Target Parameter List.

#### Barium (total)

Barium distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, suggest a relationship between Barium distribution and proximity to the waste disposal areas. Although Barium was detected at every point sampled, a majority of the Barium detected at the site was reported at concentrations less than 120  $\mu\text{g/l}$ . All concentrations for Barium detected at the site were below the EPA MCL and the NCS for Barium of 2000  $\mu\text{g/l}$ .

Barium was observed above 120  $\mu\text{g/l}$  in six monitoring wells. In three of the six monitoring wells located near the waste disposal area (MW-6, MW-7, and MW-9), Barium was observed at concentrations above 500  $\mu\text{g/l}$ . Barium was also observed at elevated levels above 120  $\mu\text{g/l}$  for MW-11 (153  $\mu\text{g/l}$ ), located below the Boone-Nissan septic field, and for MW-2 (204  $\mu\text{g/l}$ ), located below the waste disposal area, and for MW-1 (149  $\mu\text{g/l}$ ), located adjacent and upgradient of the waste disposal area. Notably absent from this group of wells is MW-10, located directly downgradient and adjacent to the waste disposal area. A concentration for Barium was observed for MW-10 at 113  $\mu\text{g/l}$ .

## Iron (total)

Iron distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, also indicate a relationship between Iron distribution and proximity to the waste disposal area. The monitoring well for which Iron was observed at the highest concentration, MW-7 (19,200  $\mu\text{g/l}$ ), is located adjacent and west of the waste disposal area. The following two most elevated Iron concentrations were detected in two other monitoring wells, MW-6 (9170  $\mu\text{g/l}$ ) and MW-3 (9320  $\mu\text{g/l}$ ), also located adjacent and west, respectively, of the waste disposal area.

Elevated concentrations of Iron above 1000  $\mu\text{g/l}$  were also detected in MW-10 (3100  $\mu\text{g/l}$ ), located directly downgradient of the waste disposal area and in MW-1 (1390  $\mu\text{g/l}$ ), directly adjacent yet upgradient of the waste disposal area. Concentrations of Iron above the secondary EPA MCL of 300  $\mu\text{g/l}$  were also observed in two boundary monitoring wells, MW-13 (450  $\mu\text{g/l}$ ) and MW-15 (554  $\mu\text{g/l}$ ), that have not exhibited the presence of significant concentrations of other inorganic or organic compounds to date.

### **B. Organic Analytical Results**

#### **i. Target Organic Parameters**

##### Tetrachloroethene (PCE)

Tetrachloroethene (PCE) distribution trends, indicated by the analytical results of the second quarter assessment monitoring event 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 the highest concentrations in the nested well pair located at the downgradient property boundary of the Bolick site; ie:shallow well MW-3 (53  $\mu\text{g/l}$ ) and deep well MW-17 (64  $\mu\text{g/l}$ ). PCE was also detected downgradient of the Bolick site in the nested well pair located below the Boone-Nissan septic field; ie:shallow well MW-11 (estimated at 9 J  $\mu\text{g/l}$ ) and the deep well MW-12 (36  $\mu\text{g/l}$ ). PCE was similarly detected above the EPA MCL (5  $\mu\text{g/l}$ ) in MW-8 (33  $\mu\text{g/l}$ ), located within the Bolick site and in MW-6 (26  $\mu\text{g/l}$ ), located between the landfill and the Bolick site.

Other PCE detections were observed and concentrations estimated in MW-9 (5 J  $\mu\text{g/l}$ ) and in MW-10 (12 J  $\mu\text{g/l}$ ).

### Trichloroethene (TCE)

Trichloroethene (TCE) distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, are similar to PCE distribution trends. With one exception (MW-9), TCE was only detected along the west drainage basin adjacent to the landfill, located within and below the Bolick site.

TCE was detected at the highest concentration in monitoring well MW-6 (71  $\mu\text{g/l}$ ), located adjacent to the landfill, within the Bolick site. The following two highest concentrations for TCE were observed in the nested well pair located at the downgradient property boundary of the Bolick site; ie:shallow well MW-3 (23  $\mu\text{g/l}$ ) and deep well MW-17 (34  $\mu\text{g/l}$ ). TCE was also detected downgradient of the Bolick site in the nested well pair located below the Boone-Nissan septic field; ie:deep well MW-12 (14  $\mu\text{g/l}$ ) and shallow well MW-11 (estimated at 3 J  $\mu\text{g/l}$ ).

The only TCE observed outside of the west drainage basin was detected below the method CRQL (estimated) in MW-9 (6 J  $\mu\text{g/l}$ ), located between the landfill and the Rocky Mountain Heights Subdivision.

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

1,1-Dichloroethene (1,1-DCE) distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, show that 1,1-DCE was observed at the highest concentrations in the bedrock of the northern drainage basin below the landfill. The highest concentrations for 1,1-DCE were observed in the deep bedrock well MW-2 (210  $\mu\text{g/l}$ ), located in northern drainage basin below the landfill and in the bedrock well MW-10 (160  $\mu\text{g/l}$ ), located in the northern drainage directly below the fill areas. 1,1-DCE was not detected in the shallow soil wells, MW-4 and MW-16, located in the northern drainage basin below the landfill.

Monitoring wells located in the west drainage basin reveal either low level, estimated concentrations or the non-detection of 1,1-DCE. 1,1-DCE was observed below the method CRQL (estimated) for four monitoring wells located in the west drainage basin; i.e: MW-3 (6 J  $\mu\text{g/l}$ ), MW-8 (4 J  $\mu\text{g/l}$ ), MW-12 (5 J  $\mu\text{g/l}$ ), and MW-17 (3 J  $\mu\text{g/l}$ ). 1,1-DCE was not detected in the shallow well MW-11, located adjacent to the deep well MW-12 in this west drainage basin.

### Methylene Chloride

Methylene Chloride distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, show that Methylene Chloride was observed at the highest concentrations in the bedrock of the northern drainage basin below the landfill. Elevated concentrations of Methylene Chloride were observed in the both bedrock wells, MW-2 (490  $\mu\text{g/l}$ ) and MW-10 (120  $\mu\text{g/l}$ ), located below the waste disposal area. Both of these estimated Methylene Chloride concentrations are well above the EPA MCL and North Carolina groundwater standard (NCS) of 5  $\mu\text{g/l}$ . A high concentration of Methylene Chloride was also observed in MW-9 (73  $\mu\text{g/l}$ ) located adjacent to the Carroll Residence.

Elevated concentrations of Methylene Chloride were observed in two boundary monitoring wells, MW-16 (33  $\mu\text{g/l}$ ) and MW-18 (27  $\mu\text{g/l}$ ), that have not demonstrated significant concentrations of other more widespread target parameters. Estimated Concentrations of Methylene Chloride were observed in the deep well MW-18 but not in the adjacent shallow well MW-13 or wells upgradient of MW-18; and estimated Concentrations of Methylene Chloride were observed in the shallow well MW-16 but not in the nearby shallow well MW-4, located upgradient of MW-16.

### Dichlorodifluoromethane

Dichlorodifluoromethane distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, are fairly random. Elevated concentrations of Dichlorodifluoromethane, although estimated (below the method CRQL), were observed in MW-2 at 10 J  $\mu\text{g/l}$  and in MW-9 at 9 J  $\mu\text{g/l}$ . Both of these estimated Dichlorodifluoromethane concentrations are above the North Carolina groundwater standard (NCS) of 0.19  $\mu\text{g/l}$ . No EPA MCL exists for Dichlorodifluoromethane.

Lower estimated concentrations (below the method CRQL) of Dichlorodifluoromethane were also observed in four other monitoring wells located within the west drainage basin adjacent to the landfill; i.e: MW-3 (4 J  $\mu\text{g/l}$ ), MW-8 (2 J  $\mu\text{g/l}$ ), MW-12 (4 J  $\mu\text{g/l}$ ), and MW-17 (4 J  $\mu\text{g/l}$ ). Dichlorodifluoromethane was detected in no other monitoring wells at the site.

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

1,1,1-Trichloroethane (1,1,1-TCA) distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, show that 1,1,1-TCA, although occurring pervasive 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  $\mu\text{g/l}$  in the bedrock wells, MW-2 (1900  $\mu\text{g/l}$ ) and MW-10 (1100  $\mu\text{g/l}$ ), located in the northern drainage below the landfill. 1,1,1-TCA was notably absent from the shallow soil wells, MW-4 and MW-16, located within the same drainage, adjacent to and downgradient, respectively, of MW-2.

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 (35  $\mu\text{g/l}$ ) and deep MW-17 (16  $\mu\text{g/l}$ ), and shallow MW-11 (estimated at 5J  $\mu\text{g/l}$ ) and deep MW-12 (16  $\mu\text{g/l}$ ), at and downgradient of the Bolick Site property boundary, respectively. An estimated concentration (below the CRQL) of 1,1,1-TCA was also observed in MW-8 (6J  $\mu\text{g/l}$ ), located upgradient of these two nested pairs of wells in the west drainage basin.

1,1,1-TCA was additionally detected in MW-9 (18  $\mu\text{g/l}$ ), located adjacent to the Carroll property and estimated (below the CRQL) in the boundary monitoring well MW-15 (5 J  $\mu\text{g/l}$ ), located adjacent to Rocky Branch.

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

As previously discussed in Section III, CLP-SOW analytical results for cis-1,2-Dichloroethene were reported as part of a total concentration of cis- and trans- isomers of the parameter. Total 1,2-Dichloroethene (1,2-DCE) distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, are similar to PCE and TCE distribution trends. With one exception (MW-9), Total 1,2-DCE was only detected along the west drainage basin adjacent to the landfill, located within and below the Bolick site.

Total 1,2-DCE was observed at the highest concentrations (above the EPA MCL and NCS of 70  $\mu\text{g/l}$ ) in MW-6 (380  $\mu\text{g/l}$ ) and MW-8 (93  $\mu\text{g/l}$ ), located adjacent to the landfill and the Bolick site, and at the deep well MW-17 (120  $\mu\text{g/l}$ ), located at the property boundary of the Bolick site. Elevated concentrations of 1,2-DCE (below the EPA MCL and NCS) were also observed at the downgradient property boundary of the Bolick site at the shallow well MW-3 (61  $\mu\text{g/l}$ ) and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (estimated at 8 J  $\mu\text{g/l}$ ) and deep well MW-12 (47  $\mu\text{g/l}$ ).

Lower level detections of cis-1,2-DCE were also estimated at the two monitoring wells, MW-7 (3 J  $\mu\text{g/l}$ ), located south of the Bolick site, and MW-9 (2 J  $\mu\text{g/l}$ ), located along the southern saddle above the landfill.

### Benzene

Benzene distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, are inconclusive since no concentrations of Benzene were observed above the Method CRQL in any monitoring wells or surface water sampling locations.

Estimated Benzene results (below the Method CRQL) indicate parameter levels in MW-6 (12 J  $\mu\text{g/l}$ ) at concentrations above the EPA MCL (5  $\mu\text{g/l}$ ) and NCS (1  $\mu\text{g/l}$ ) similar to levels previously observed at this location. Estimated Benzene results were also observed at or above the EPA MCL (5  $\mu\text{g/l}$ ) and NCS (1  $\mu\text{g/l}$ ) in MW-8 (5 J  $\mu\text{g/l}$ ), the deeper well located adjacent to MW-6, and in the deep well MW-2 (9 J  $\mu\text{g/l}$ ), located below the waste disposal. Estimated Benzene concentrations between the lower North Carolina groundwater quality standard (NCS) and the higher EPA MCL were observed in four other core wells and three boundary wells randomly distributed about the site; MW-3 (2 J  $\mu\text{g/l}$ ), MW-4 (2 J  $\mu\text{g/l}$ ), MW-9 (4 J  $\mu\text{g/l}$ ), and MW-17 (2 J  $\mu\text{g/l}$ ), and MW-7 (3 J  $\mu\text{g/l}$ ), MW-16 (2 J  $\mu\text{g/l}$ ), and MW-18 (1 J  $\mu\text{g/l}$ ), respectively.

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

1,1-Dichloroethane (1,1-DCA) distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, reveals 1,1-DCA was observed 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.

1,1-DCA was observed at the highest concentrations (below the proposed North Carolina groundwater quality standard of 700  $\mu\text{g/l}$ ) in the nested well pair, shallow MW-3 (200  $\mu\text{g/l}$ ) and deep well MW-17 (230  $\mu\text{g/l}$ ), located at the downgradient property boundary of the Bolick site. Elevated concentrations of 1,1-DCA were also observed between the landfill and the Bolick site at MW-6 (110  $\mu\text{g/l}$ ) and within the Bolick site at MW-8 (70  $\mu\text{g/l}$ ), and downgradient of the Bolick site at the nested well pair, shallow well MW-11 (27  $\mu\text{g/l}$ ) and deep well MW-12 (130 E  $\mu\text{g/l}$ ).

Concentrations of 1,1-DCA were also observed in the deep well MW-10 (84  $\mu\text{g/l}$ ), located below the waste disposal area and elevated estimated concentrations (below CRQL) of 1,1-DCA were observed at the deep well MW-2 (110J  $\mu\text{g/l}$ ) located in the drainage below the waste disposal area. 1,1-DCA was not detected in the shallow wells MW-4 and MW-16, located in the northern drainage basin below the landfill.

Lower level concentrations of 1,1-DCA were observed at MW-9 (23  $\mu\text{g/l}$ ), located along the southern saddle above the landfill, and estimated at MW-7 (1J  $\mu\text{g/l}$ ), located south of the Bolick site.

### Chloroethane

Chloroethane distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, show that Chloroethane was observed at the highest concentration in MW-9 (18  $\mu\text{g/l}$ ) located adjacent to the Carroll property, and the shallow well MW-4 (18  $\mu\text{g/l}$ ), located below the waste disposal area. A similar concentration of Chloroethane was observed in the leachate sample, LI (13  $\mu\text{g/l}$ ), collected below the waste disposal area. A concentration of Chloroethane was also observed at the boundary well MW-7 (16  $\mu\text{g/l}$ ), located south of the Bolick site.

Estimated concentrations of Chloroethane (below the Method CRQL) were observed in five core monitoring wells located in the west drainage; shallow well MW-3 (8 J  $\mu\text{g/l}$ ), located adjacent to deep well MW-17 (7 J  $\mu\text{g/l}$ ), deep well MW-12 (5 J  $\mu\text{g/l}$ ), located adjacent to shallow well MW-11 (not detected), MW-6 (10 J  $\mu\text{g/l}$ ), located between the landfill and the Bolick site, and in MW-8 (7 J  $\mu\text{g/l}$ ), located within the Bolick site.

### trans-1,3-Dichloropropene

The presence of trans-1,3-Dichloropropene in the groundwater and surface waters at the site is not supported by the analytical results of the first or second quarter assessment monitoring events. Previous organic analysis results indicated the presence of trans-1,3-Dichloropropene in the west drainage adjacent to the landfill. The recent sampling and analysis, did not confirm the presence of trans-1,3-Dichloropropene.

If upon completion of background data collection and the first annual EPA Appendix II list sampling event (utilizing LLRA analytical methods), the absence of trans-1,3-Dichloropropene in the groundwater and surface waters at the site is confirmed, trans-1,3-Dichloropropene will be removed from the Target Parameter List.

## Vinyl Chloride

Vinyl Chloride distribution trends, indicated by the analytical results of the second quarter assessment monitoring event, are inconclusive since no concentrations of Vinyl Chloride were observed above the Method CRQL in any monitoring wells or surface water sampling locations. The recent analysis results indicate estimated levels of Vinyl Chloride in the west drainage adjacent to the landfill above the EPA MCL (2 µg/l) and NCS (0.015 µg/l) in MW-6 (10 J µg/l) located between the landfill and the Bolick site, MW-8 (5 J µg/l) located within the Bolick site, and MW-3 (3 J µg/l) located at the property boundary of the Bolick site. Additionally, the pervasive presence of Vinyl Chloride in the groundwater and surface waters at the site is not supported by the analytical results of the first quarter assessment monitoring event. As a result of the first background analyses, Vinyl Chloride was only estimated (detected below the CRQL) in one monitoring well, MW-6 (10 J µg/l).

### ii. Non-target Organic Parameters

As previously discussed in Section V.B.ii, ~~over half of all the total non-target parameters detected were observed in MW-11 (located below the Nissan-Mazda septic field).~~ The non-target contaminants detected in MW-11 are significantly different than those observed in other groundwater wells in the assessment monitoring network. The detection of the tentatively identified non-target parameters, comprised of unknown alkanes, cycloalkanes, hydrocarbons, an unsaturated hydrocarbon and a ketone, indicate a significantly different mechanism is involved in the occurrence of these parameters in the groundwater at MW-11.

Other non-target parameter distribution trends that will continue to be evaluated are the detections of Carbon Tetrachloride and Toluene in MW-4, MW-12 and MW-17. The distribution of these three wells suggests that the isolated detection of Carbon Tetrachloride and Toluene in these wells is not indicative of a pervasive, persistent occurrence. Additionally, Carbon Tetrachloride and Toluene were not detected in these three wells as a result of the first background analyses (Table 6A, Appendix I).

## VII. CONCLUSIONS

### A. Parameter Distribution

The analytical results obtained from the second quarter assessment background monitoring event are similar to the results obtained from the first quarter background event. The analytical results continue to indicate that the detection of target parameters in the Watauga County Landfill monitoring network is primarily confined to those monitoring stations which like the landfill are located south of the proposed U.S. Route 421 Bypass (Figure 2; Appendix I).

The relocation of five (5) of the assessment monitoring wells (MW-12, MW-13, MW-14, MW-15, and MW-18), as originally proposed in the Assessment Plan (DAA, September 3, 1993), was necessary due to the proposed rerouting of U.S. Route 421. The construction right-of-way for the proposed bypass would have directly impacted the original locations for these five wells, likely requiring their premature abandonment. Four of these wells were relocated north of the proposed bypass (MW-13, MW-14, MW-15, and MW-18) and one well was relocated south of the proposed bypass (MW-12).

The second quarter analytical results indicate no significant detections in the four monitoring wells relocated north of the proposed bypass, except for the anomalous detection of Methylene Chloride in MW-18. Conversely, the recent analytical results reveal five target parameters detected above the method CRQL in MW-12, relocated south of the proposed bypass. The analytical results indicate the northern edge of the occurrence of assessment target parameters in the groundwater 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 reported only for the saddle between the landfill and the Rocky Mountain Heights Subdivision and the west and north drainages below the landfill.

In the west drainage, the detection of target parameters above groundwater standards is observed in both the soil and bedrock aquifer media, extending from the landfill to the proposed bypass. Additionally, organic analyses performed on the piezometer network on November 16-18, 1992, indicate the target parameters are confined to the trough of the west drainage.

In the north drainage, the detection of target parameters above groundwater standards is primarily observed in the bedrock aquifer medium. Except for the anomalous detection of Methylene Chloride in MW-16, no target parameters were detected above the EPA MCL in the two monitoring wells accessing the soil aquifer medium in the north drainage. The levels of the target parameters detected in the two monitoring wells accessing the bedrock aquifer medium indicate the detected target parameters have preferentially migrated to deeper fracture zones within the bedrock.

The second quarter analytical results obtained from the leachate sample (L1) indicate the presence of one organic target parameter, Chloroethane. The volume of leachate production was insufficient to allow for the collection of a leachate sample for metal analysis.

The analytical results obtained from the sampling of the spring located in the Rocky Mountain Heights subdivision, at the head of the drainage adjacent to the Carroll residence well (well reference no. 12), indicated the presence of no organic target parameters. The common metal target parameters, Barium and Iron, although present, were not detected above normal, background levels.

As a result of the second quarter sampling event, several different non-target organic compounds were detected in the shallow monitoring well located below the Nissan-Mazda septic field (MW-11) that were not detected in the remainder of the monitoring well network. As a result of the first quarter sampling event, several different non-target organic compounds were detected in the deep rather than shallow monitoring well located below the Nissan-Mazda septic field (MW-12), as well as along the saddle between the landfill and the Rocky Mountain Heights subdivision (MW-9).

The difference in the non-target compounds detected in monitoring wells MW-9, MW-11, and MW-12 between the first and the second quarter sampling events may be the result of the different analytical procedures employed. During the first sampling event, these wells were initially designated as boundary wells and were analyzed utilizing LLRA analytical procedures (SW-846 Method #8021 for organic target parameters). During the second sampling event, these wells were reclassified as core wells and were analyzed utilizing CLP analytical procedures. After completion of the initial four background monitoring events, all the wells in the assessment monitoring well network will be analyzed for the complete EPA Appendix II list of parameters utilizing LLRA analytical procedures again.

## **B. Target Parameter Summary**

The detection of PCE, TCE, and cis-1,2-DCE was primarily reported within the west drainage and southern saddle.

The detection of 1,1,1-TCA, 1,1-DCE, Dichlorodifluoromethane, and Methylene Chloride was observed in both the west and the north drainages as well as the southern saddle, 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-DCA was observed in more monitoring wells throughout the site than any other target parameter. 1,1-DCA was observed at the highest concentrations in the nested well pair located at the property boundary of the Bolick site.

Benzene was not detected above the method CRQL in any monitoring well or surface water sampling location. Higher estimated concentrations (but below the CRQL) of Benzene are preferentially distributed adjacent to the disposal area. Lower estimated concentrations are randomly distributed throughout the core of the site.

Trans-1,3-Dichloropropene was not detected above or estimated below the method LOQ in any second event sampling locations in the monitoring network.

Vinyl Chloride was only estimated (detected below the CRQL) in three monitoring wells, centrally located in the west drainage and nearest to the waste disposal area.

Chloroethane was the only organic target parameter to be detected in the leachate sample. The detection of Chloroethane, although common, was not observed at significantly elevated levels or observed to indicate a defined distribution throughout the core of the site.

### C. Continuing Investigations

As a result of the first background sampling event, three areas were identified as not fully characterized by the existing monitoring network. The results obtained from the second background monitoring event are similar to the first event and do not significantly alter the current assessment of these three areas. As described below, these three areas will continue to be evaluated during ongoing groundwater investigations.

#### West Drainage

As detailed in the Assessment Plan Activity Report (DAA, July 29, 1994), the west drainage adjacent to the landfill trends parallel to the orientation of two lineament sets observed at the site. Upper reaches of the west drainage trend parallel to mineral layering, lineation, and foliation in the host bedrock as well as parallel to the general northwest trending contact between the amphibolite/hornblende gneiss-mica schist and gneiss assemblages and the "mixed rocks" assemblage (N55°W). Upon reaching an area where the amphibolite/hornblende gneiss is not stratigraphically overlain by the mica schist and gneiss (inferred from drilling of MW-18 as well as the distribution of residual soil distributions depicted on the Watauga County Soil Survey), the drainage trends N10°E, parallel to bedrock fracture and joint lineations.

The original proposed locations for MW-13 and MW-18 were at the junction of the N55°W and N10°E lineament sets. MW-13 and MW-18 were relocated along the N10°E lineament set to account for the flow direction of the surface water drainage. Trace level detections observed in the BREMCO potable well (Potable Well Analysis Summary Table, Appendix IV) indicate the possibility that deeper groundwater flow within the bedrock may follow the N55°W lineament set. Therefore, the area between the proposed bypass and the BREMCO potable well is one area that will continue to be evaluated during ongoing groundwater investigations.

#### North Drainage

The recent analytical results indicate elevated levels above groundwater standards for the target parameters in the northern drainage below the landfill at the deep bedrock monitoring well, MW-2. Downgradient of this point 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, before reaching the apex of the watershed. Therefore, the area between the nested well pair, MW-14 and MW-15, and the Chevrolet Dealership will continue to be evaluated during ongoing groundwater investigations. The absence of volatile organic parameters detected at the Chevrolet Dealership's potable well suggests that there is no impact at the dealership's well location.

#### Southern Saddle

The analytical results obtained from the monitoring well installed along the saddle between the landfill and the Rocky Mountain Heights Subdivision (MW-9) indicate that the organic parameters observed in the Carroll residence potable well have also been found in MW-9. To examine potential flow pathways not currently investigated by the Residential and Business potable well sampling program (described in the Assessment Plan and Activity Report and summarized herein in Appendix IV), the area directly downgradient and south of the Carroll property will be evaluated for additional groundwater investigations. A residential well does not currently exist immediately downgradient of the Carroll property. To further investigate the parameter distributions across the saddle from the Carroll property, the area between the landfill and MW-9 will also be evaluated for additional groundwater investigations.

## D. Closing

### Third Quarterly Assessment Background Monitoring Event

The third quarterly assessment background monitoring event is scheduled to be performed by Draper Aden Associates in January, 1995. Revisions to the network of core and boundary assessment wells for the second background monitoring event that resulted in the upgrading of six of the eleven recently installed monitoring wells to "core" status (MW-8, MW-9, MW-10, MW-11, MW-12, and MW-17), will remain unchanged. As indicated in the Assessment Monitoring schedule (Table 1, Appendix I), core assessment wells and surface water monitoring points will be analyzed using CLP analytical methods and boundary assessment wells will be analyzed utilizing LLRA analytical methods for the third assessment background monitoring event.

As per NCDEHNR Solid Waste Section recommendations, three shallow monitoring wells installed to monitor the Boone Nissan-Mazda dealership's septic field (SF1, SF2, SF3; Figure 1, Appendix I) will be included in the third quarterly background monitoring event. These three monitoring wells were installed by the dealership in November, 1988, at the direction of the NCDEHNR Division of Environmental Management, to monitor the effectiveness of the septic tank and sand fields that filter the wash bay and repair garage wastewater from the dealership. The dealership recently connected to the Town of Boone's wastewater system and the septic tank is no longer in service.

To further investigate the trace level detections observed in the BREMCO potable well (Potable Well Analysis Summary Table, Appendix IV.), the spring located directly NW of the BREMCO well (Figure 1, Appendix I) will also be sampled during the third quarterly background sampling event. Both the spring and the dealership's septic field monitoring wells will be analyzed using CLP analytical methods.

### Residential and Business Potable Well Sampling Program

Several potable wells were recently sampled between November, 1994 and January, 1995 under the Residential and Business potable well sampling program. Included in the recent potable well sampling were three previously unsampled residential wells, located downgradient and south of the Carroll property and southern saddle, adjacent to the main tributary within the Rocky Mountain Heights subdivision. Two other wells located in the Rocky Mountain Heights subdivision, immediately downgradient and strike from the Carroll residence and the southern saddle, that have previously shown trace level detections (well reference no.s 14 and 24) were also recently resampled. The BREMCO potable well (well reference no. 5), located downgradient of the west drainage, was also resampled. The analytical results from this recent potable well sampling will be available and presented in the next third quarter assessment monitoring results report.

The ongoing potable well 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 network. Duplicate sampling will indicate whether the organics detected are a persistent occurrence. The two potable wells with parameter levels previous detected above the EPA MCL, the Nissan-Mazda dealership well (well reference no. 4) and the Carroll residence well (well reference no 12), will also be periodically sampled.

The results of the potable well sampling program will assist ongoing groundwater investigations within areas not fully characterized by the existing monitoring well network. Appropriate additional groundwater investigations will be conducted upon consultation and approval from the NCDEHNR Solid Waste Section.

**APPENDIX I**  
**TABLES AND FIGURES**

Table 1

**Watauga County Landfill  
Groundwater and Surface Water  
Assessment Monitoring Schedule**

<b>GROUNDWATER MONITORING</b>	<b>1st Year Quarterly Sampling Event</b>				<b>2nd Year Semi-Annual Sampling Events</b>	
<b>"CORE" ASSESSMENT WELLS</b>						
Assessment Monitoring Analytes (ie: 40 CFR Part 258 Appendix II List)	-	-	-	-	-	-
Target Analyte Monitoring Analytes	CLP Methods	CLP Methods	CLP Methods	CLP Methods	CLP Methods	CLP Methods
<b>"BOUNDARY" ASSESSMENT WELLS</b>						
Target Analyte Monitoring Analytes	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods	LLRA Methods	CLP Methods
<b>SURFACE WATER MONITORING</b>						
Target Analyte Monitoring Analytes	CLP Methods	-	CLP Methods	-	CLP Methods	CLP Methods

CLP - EPA Contract Laboratory Program Methods  
LLRA - Low Level Risk Assessment Screening Methods (EPA SW-846)

Watauga County Landfill  
 Watauga County, North Carolina  
 Upgradient Well: MW-1  
 02/16/95

Table 2A  
 Second Quarter Background  
 Assessment Target Parameter Analytical Results  
 Core Groundwater Monitoring Wells - Inorganic and Organic Analyses  
 Contract Laboratory Program (CLP) Statement of Work (SOW)

Parameter	Event	Results ug/L (ppb)												Trip Blank(3)	NCS (ug/L)	MCL (ug/L)
		MW-1	MW-2	MW-3	MW-4	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-17				
METALS, TOTAL																
Barium, Total	9/27/94	149	204	119	23.5	502	86.9	632	113	153	101	90.4	1.5	2000	2000	
Iron, Total	9/27/94	1390	140	9320	71.8	9170	418	42	3100	3.8	16	149	12.2	300*	300*	
Cadmium, Total	9/27/94	4.3	4.6	4.6	4.6	4.3	4.3	4.6	4.6	4.3	4.6	4.6	4.6	5	5	
Mercury, Total	9/27/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.1	2	
ORGANICS																
Benzene	9/27/94	10	9	2	2	12	5	4	83	10	10	2	10	1	5	
Chloroethane	9/27/94	10	170	8	18	10	7	18	83	10	10	7	10	-	-	
Dichlorodifluoromethane	9/27/94	10	10	4	10	25	2	9	83	10	4	4	10	0.19	-	
1,1-Dichloroethane	9/27/94	10	110	200	10	110	70	23	84	27	130	230	10	700**	-	
1,1-Dichloroethene	9/27/94	10	210	6	10	25	4	10	160	10	5	3	10	7	7	
1,2-Dichloroethene(Total)	9/27/94	10	170	61	10	380	33	2	83	8	47	120	10	70	70	
trans-1,3-Dichloropropene	9/27/94	10	170	14	10	25	10	10	83	10	10	14	10	-	-	
Methylene Chloride	9/27/94	10	490	14	13	25	4	73	160	10	28	58	10	5	5	
Tetrachloroethene	9/27/94	10	170	53	10	26	33	5	12	9	36	84	10	0.7	5	
Trichloroethene	9/27/94	10	170	23	10	71	15	6	83	3	14	54	10	2.8	5	
1,1,1-Trichloroethane	9/27/94	10	1900	35	10	25	6	18	1830	5	24	16	10	200	200	
Vinyl Chloride	9/27/94	10	170	3	10	10	5	10	83	10	10	14	10	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 CRQL for Organics  
 J Denotes an estimated value  
 CRQL Contract Required Quantification Limit  
 \* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron  
 \*\* Denotes a proposed NCS  
 - Denotes Not Available or Not Sampled  
 Shading denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.  
 NOTE: 1) Well MW-5 was not sampled for the 9/27-30/94 event.  
 2) 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 OLMO1.9 (3/90).  
 3) Trip Blank for Samples MW-2, MW-3, MW-4, MW-9, MW-10, MW-12, MW-15, MW-16, MW-17, MW-18, Mt. Spring, and L1(For Organics Only)

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

Table 2B  
Second Quarter Background  
Assessment Target Parameter Analytical Results  
Boundary Groundwater Monitoring Wells - Inorganic and Organic Analysis  
Contract Laboratory Program (CLP) Statement of Work (SOW)

02/16/95

Parameter	Event	Results ug/L(ppb)										MT. SPRING	Trip Blank(3)	NCS (ug/L)	MCL (ug/L)	
		MW-7	MW-13	MW-14	MW-15	MW-16	MW-18	L1								
METALS, TOTAL																
Barium, Total	9/27/94	698	59.7	17.4	79	70.6	78.7	-	-	5.5	0.4	U	2000	2000		
Iron, Total	9/27/94	19200	450	10.5	554	117	12.2	U	-	31.4	10.5	U	300*	300*		
Cadmium, Total	9/27/94	4.3	U	4.3	U	4.6	U	U	-	4.3	U	U	5	5		
Mercury, Total	9/27/94	0.2	U	0.2	U	0.2	U	U	-	0.2	U	U	1.1	2		
ORGANICS																
Benzene	9/27/94	3	J	14	U	10	U	2	J	1	U	U	10	U	1	5
Chloroethane	9/27/94	16	U	14	U	10	U	10	U	10	U	13	U	U	-	-
Dichlorodifluoromethane	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	U	0.19	-
1,1-Dichloroethane	9/27/94	1	J	14	U	10	U	10	U	10	U	U	U	U	700**	-
1,1-Dichloroethene	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	U	7	7
1,2-Dichloroethene (Total)	9/27/94	3	J	14	U	10	U	10	U	10	U	U	U	U	70	70
trans-1,3-Dichloropropene	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	U	-	-
Methylene Chloride	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	U	5	5
Tetrachloroethene	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	U	0.7	5
Trichloroethene	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	U	2.8	5
1,1,1-Trichloroethane	9/27/94	10	U	14	U	5	J	10	U	10	U	U	U	U	200	200
Vinyl Chloride	9/27/94	10	U	14	U	10	U	10	U	10	U	U	U	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)  
CRQL Contract Required Quantification Limit  
U Denotes not detected above Instrument Detection Limit(IDL) for inorganics and not detected above 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  
0.019 denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.  
NOTE: 1) Well MW-5 was not sampled for the 9/27-30/94 event.  
2) 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 OLMO1.9 (9/90).  
3) Trip Blank for samples MW-1, MW-6, MW-7, MW-8, MW-11, MW-13, and MW-14.



**Watauga County Landfill**

Watauga County, North Carolina

Upgradient Well: MW-1

**TABLE 4A  
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

STATIC WATER LEVEL			
DATE			
6/20/94	38.00	7.88	18.43
9/27/94	39.69	7.51	17.42
			13.48
			10.45
			44.12
			43.99
			23.03
			30.73
			17.68
			17.38
			59.35
			57.79

GROUNDWATER ELEVATION			
DATE			
6/20/94	3303.80	3145.06	3164.69
9/27/94	3302.11	3145.43	3165.70
			3139.04
			3142.07
			3221.92
			3222.05
			3250.50
			3242.80
			3222.09
			3222.39
			3301.44

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

STATIC WATER LEVEL			
DATE			
6/20/94	8.18	13.35	11.04
9/27/94	8.09	13.22	10.78
			19.66
			19.57
			7.94
			7.89
			11.92
			11.82
			5.32
			5.68
			17.93
			17.83
			17.86

GROUNDWATER ELEVATION			
DATE			
6/20/94	3195.69	3146.25	3148.11
9/27/94	3195.78	3146.38	3148.37
			3100.06
			3100.15
			3112.06
			3112.11
			3137.40
			3137.04
			3108.73
			3108.83
			3165.69
			3165.79
			3101.70
			3101.77

1) ALL MEASUREMENTS IN FEET.

2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.

3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.

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

TABLE 4B  
GROUNDWATER LEVEL DATA

REFERENCE ELEVATION						
	PZ-13	PZ-14	PZ-17	PZ-18A	PZ-22	PZ-23
GROUND	3195.05	3214.80	3217.62	3233.95	3205.6	3221.74
MEASURING POINT	3198.33	3217.80	3220.79	3236.86	3208.84	3225.27

STATIC WATER LEVEL		
DATE		
6/20/94	12.75	17.26
9/27/94	12.29	16.64
	14.47	16.80
	14.06	16.47
	17.30	17.77
	14.29	13.99
	24.68	23.50

GROUNDWATER ELEVATION			
DATE			
6/20/94	3185.58	3200.54	3206.32
9/27/94	3186.04	3201.16	3206.73
	3219.56	3219.55	3219.09
	3194.55	3194.85	3201.77

- 1) ALL MEASUREMENTS IN FEET.
- 2) ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.
- 3) MEASURING POINT (M.P.) IS FROM THE TOP OF WELL CASING.

Watauga County Landfill  
Watauga County, North Carolina  
Upgradient Well: MW-1  
02/16/95

Table 5A  
Cumulative Assessment Target Parameter Analytical Results  
Core Groundwater Monitoring Wells

Parameter	Event	Results ug/(ppb)											Trip Blank	Analysis Type	NCS (ug/L)	MCL (ug/L)				
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11					MW-12	MW-17		
Metals: Total																				
Barium, Total	6/20/94	203	199	123	24.2	652	281	710	109	117	101	117	101	117	117	4.0	CLP	2000	2000	
	9/27/94	149	204	119	23.5	502	86.9	632	113	153	101	153	101	153	101	1.5	U	2000	2000	
Iron, Total	6/20/94	409	24.4	9950	24.4	24900	16100	7060	5460	337	J	1800	J	320	24.4	U	CLP	300*	300*	
	9/27/94	1390	140	9320	71.8	9170	418	42	3100	3.8	U	16	U	149	12.2	U	CLP	300	300	
Cadmium, Total	6/20/94	6.0	4.5	5.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	U	CLP	5	5
	9/27/94	4.3	4.6	4.6	4.6	4.3	4.3	4.6	4.6	4.3	4.6	4.3	4.6	4.6	4.6	4.6	U	CLP	5	5
Mercury, Total	6/20/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	U	CLP	1.1	2
	9/27/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	U	CLP	1.1	2
Organics																				
Benzene	6/20/94	10	120	10	10	9	0.72	J	0.40	J	5.30	U	5.30	U	5.30	U	CLP/LLR	1	5	
	9/27/94	10	9	2	2	12	5	J	4	J	10	U	10	U	10	U	CLP	1	5	
Chloroethane	6/20/94	10	120	6	10	8	9.44	J	56.78	J	9.29	U	1.16	J	20.23	10	U	CLP/LLR	-	-
	9/27/94	10	170	8	18	10	7	J	18	10	10	U	10	U	5	10	U	CLP	-	-
Dichlorodifluoromethane	6/20/94	10	120	7	10	25	2.26	J	13.92	J	46.64	U	1.88	J	9.83	10	U	CLP/LLR	0.19	-
	9/27/94	10	10	4	10	25	2	J	9	J	10	U	10	U	4	10	U	CLP	0.19	-
1,1-Dichloroethane	6/20/94	10	75	160	10	97	35.33	J	13.63	J	28.62	J	25.23	J	82.77	10	U	CLP/LLR	700**	-
	9/27/94	10	110	200	10	110	70	23	84	27	84	27	130	230	130	10	U	CLP	700**	-
1,1-Dichloroethene	6/20/94	10	170	5	10	25	0.30	J	9.75	U	34.29	U	9.75	U	1.15	10	U	CLP/LLR	7	7
	9/27/94	10	210	6	10	25	4	J	10	U	160	U	10	U	5	10	U	CLP	7	7
1,2-Dichloroethene(Total)	6/20/94	10	120	37	10	330	28.90	U	0.95	J	9.49	U	5.05	J	28.13	10	U	CLP/LLR	70	70
	9/27/94	10	170	61	10	390	90	U	2	J	10	U	8	J	47	10	U	CLP	70	70
trans-1,3-Dichloropropene	6/20/94	10	120	10	10	25	24.49	U	24.49	U	24.49	U	24.49	U	24.49	10	U	CLP/LLR	-	-
	9/27/94	10	170	10	10	25	10	U	10	U	10	U	10	U	14	10	U	CLP	-	-
Methylene Chloride	6/20/94	8	120	6	10	11	36.20	U	140.1	U	36.20	U	36.20	U	8.58	10	U	CLP/LLR	5	5
	9/27/94	10	490	14	13	25	4	J	73	180	180	10	28	U	58	10	U	CLP	5	5
Tetrachloroethene	6/20/94	10	120	44	10	6	7.55	J	2.15	J	1.30	J	7.47	J	22.78	10	U	CLP/LLR	0.7	5
	9/27/94	10	170	53	10	28	33	U	5	J	12	U	9	U	58	10	U	CLP	0.7	5
Trichloroethene	6/20/94	10	120	15	10	21	21.20	U	21.20	U	21.20	U	21.20	U	5.74	10	U	CLP/LLR	2.8	5
	9/27/94	10	170	25	10	21	11	U	6	J	10	U	3	J	14	10	U	CLP	2.8	5
1,1,1-Trichloroethane	6/20/94	10	1800	31	10	25	2.42	J	11.89	J	130.1	J	4.83	J	16.79	10	U	CLP/LLR	200	200
	9/27/94	10	3000	35	10	25	6	J	18	180	180	5	J	24	16	10	U	CLP	200	200
Vinyl Chloride	6/20/94	10	120	10	10	10	6.60	U	6.60	U	6.60	U	6.60	U	6.60	10	U	CLP/LLR	0.015	2
	9/27/94	10	170	3	10	10	5	U	10	10	10	10	10	10	14	10	U	CLP	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 CRQL for Organics (CLP SOW Only).  
J Denotes an estimated value  
CRQL Contract Required Quantification Limit  
\* Denotes a Secondary Maximum Contaminant Level (SMCL) for Total Iron  
\*\* Denotes a proposed NCS  
- Denotes Not Available or Not Sampled  
- denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.

Note: 1) 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.  
2) LLRA analytical methods utilize EPA SW-846 Method #6021  
3) For CLP, 1,2-Dichloroethene was reported as total concentration; for LLRA concentration was reported for cis-isomer.  
4) For the 6/20/94 event, monitoring wells MW-1, MW-2, MW-3, MW-4, and MW-6, analyses were performed by using CLP analytical methods. The remainder were analyzed using LLRA analytical methods.

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

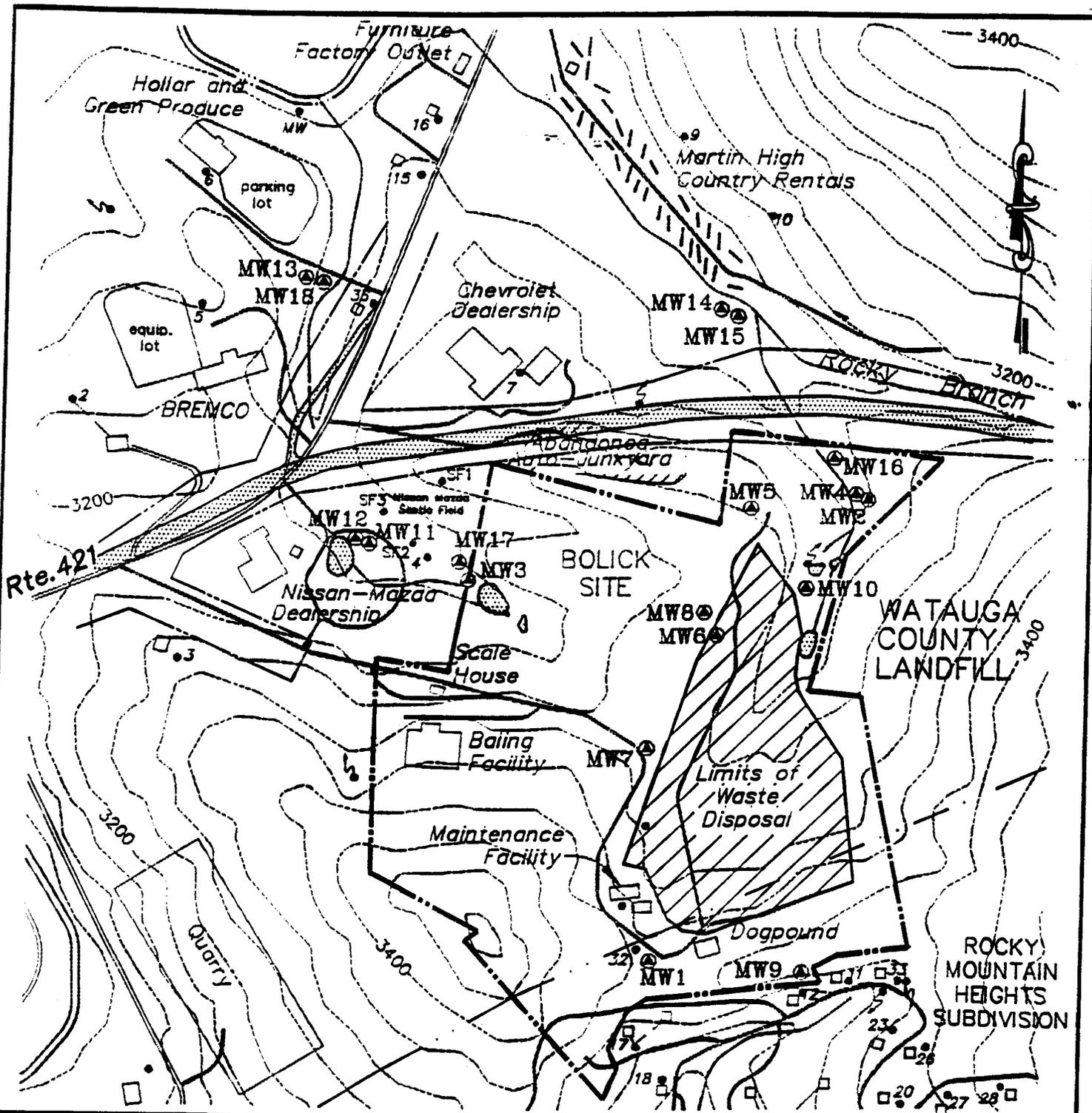
Table 5B  
Cumulative Assessment Target Parameter Analytical Results  
Boundary Groundwater Monitoring Wells and  
Surface Water Sampling Locations

02/16/95

Parameter	Event	MW-7	MW-13	MW-14	MW-15	MW-16	MW-18	METALS					S5	L1	Mt. Spring	Trip Blank	Analysi Type	NCS (ug/L)	MCL (ug/L)
								S1	S2	S3	S4								
Barium, Total	6/20/94	439	54.2	18.4	94.9	66.8	73.6	133	755	366	94.1	197	-	-	-	0.6	U	2000	2000
	9/27/94	698	59.7	17.4	79	70.6	78.7	-	-	-	-	-	-	-	5.5	0.4	CLP	2000	2000
Iron, Total	6/20/94	15200	283	100	2110	78.6	24.4	11300	30800	8600	1040	26400	-	-	-	24.4	U	300*	300*
	9/27/94	19200	450	3.8	554	117	12.2	-	-	-	-	-	-	-	31.4	10.5	CLP	300*	300*
Cadmium, Total	6/20/94	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	-	4.5	U	5	5
	9/27/94	4.3	4.3	4.3	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.3	4.3	U	5	5
Mercury, Total	6/20/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-	0.2	U	1.1	2
	9/27/94	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	U	1.1	2
ORGANICS																			
Benzene	6/20/94	0.42	5.30	5.30	5.30	5.30	5.30	10	3	10	1	10	10	10	-	5.30	U	1	5
	9/27/94	3	10	10	10	2	1	J	-	-	-	-	10	10	10	10	U	CLP	1
Chloroethane	6/20/94	7.33	9.29	9.29	9.29	9.29	9.29	10	56	10	10	11	10	10	-	9.29	U	-	-
	9/27/94	16	10	10	10	10	10	U	-	-	-	-	13	10	10	10	U	CLP	-
Dichlorodifluoromethane	6/20/94	46.64	46.64	46.64	46.64	46.64	46.64	10	4	10	10	10	10	10	-	46.64	U	0.19	-
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	-
1,1-Dichloroethane (1,1-DCE)	6/20/94	10.42	0.99	43.10	0.26	43.10	43.10	1	23	10	59	2	10	10	-	43.10	U	700**	-
	9/27/94	1	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	700**
1,1-Dichloroethene (1,1-DCE)	6/20/94	9.75	9.75	9.75	9.75	9.75	9.75	10	10	10	10	10	10	10	-	9.75	U	7	7
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	7
cis-1,2-Dichloroethene (cis-1,2-DCE)	6/20/94	0.97	9.49	9.49	9.49	9.49	9.49	10	4	10	58	10	10	10	-	9.49	U	70	70
	9/27/94	3	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	70
trans-1,3-Dichloropropene	6/20/94	24.49	24.49	24.49	24.49	24.49	24.49	10	10	10	10	10	10	10	-	24.49	U	40	40
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	-
Methylene Chloride	6/20/94	38.20	36.20	36.20	36.20	36.20	36.20	6	9	3	1	8	10	10	-	36.20	U	5	5
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	5
Tetrachloroethene (PCE)	6/20/94	0.88	7.84	0.24	7.84	7.84	7.84	10	10	10	10	10	10	10	-	7.84	U	0.7	0.7
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	0.7
Trichloroethene (TCE)	6/20/94	21.20	21.20	21.20	21.20	21.20	21.20	10	1	10	13	10	10	10	-	21.20	U	2.8	2.8
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	2.8
1,1,1-Trichloroethane (1,1,1-TCA)	6/20/94	30.11	30.11	30.11	0.08	30.11	30.11	10	2	10	3	10	10	10	-	30.11	U	200	200
	9/27/94	10	10	10	5	10	10	U	-	-	-	-	10	10	10	10	U	CLP	200
Vinyl Chloride	6/20/94	6.60	6.60	6.60	6.60	6.60	6.60	10	10	10	10	10	10	10	-	6.60	U	0.015	0.015
	9/27/94	10	10	10	10	10	10	U	-	-	-	-	10	10	10	10	U	CLP	0.015

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(DL) for Inorganics(CLP SOW only) and not detected above LOQ for Organics(LLRA Method only)  
 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  
 [shaded] denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.  
 [shaded] denotes parameter results that exceed U.S. EPA Maximum Contaminant Levels.  
 Note: 1) 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.  
 2) LLRA analytical methods utilize EPA SW-846 Method #8021

Drawing Under Seperate Cover



3200 Existing Ground  
 Proposed Right-of-Way  
 Proposed Road Improvements

# PROPOSED ROUTE 421 BYPASS MAP

 <p><b>Draper Aden Associates</b> CONSULTING ENGINEERS Blacksburg, Va. - Richmond, Va. - Nashville, Tenn.</p>	<p>JOB No. 6520-14</p>	<p>DATE: 10 JUN 94</p>	<p>SCALE: 1"=600'±.</p>	<p>FIGURE 2</p>
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**APPENDIX II**  
**FIELD NOTES**

STANDARD FIELD PROTOCOL - INITIAL ACTIVITIES

Project Watauga County Landfill Permit #95-02 Date 9-27-94  
 Sampling Sequence see below Weather/Temperature Sunny, breezy, tan  
 Samplers J. P. Park / Eric Rudin 55-75°F 9-27-94  
 Static Water Level measurement equipment Solinst 1369  
 procedure Immersion

Well evacuation equipment Dedicated pump  
 procedure Acceptable pump rates based on groundwater recharge rates

Sample withdrawal equipment dedicated pump  
 procedure sample rate  $\leq$  0.1 liter per minute per GMP

Sample filtration equipment None  
 procedure \_\_\_\_\_

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

- CLP VSA 40ml amber bottle (glass) - HCl - pre-preserved
- CLP Metaxs 1 liter glass amber bottles - field preserved w/ HNO<sub>3</sub>
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Internal temperature of shipping containers at outset of sampling

Room Temperature  $\leq$  4° C prior to shipment

Temperature equipment Corning Checkmate 90 (DAA-01)  
 calibration procedure external  
 measurement procedure immersion

pH equipment Corning Checkmate 90 (DAA-01)  
 calibration procedure 7 and 10 buffers  
 measurement procedure immersion

Conductivity equipment Corning Checkmate 90 (DAA-01)  
 calibration procedure air  $\rightarrow$  1413  $\mu$ S cond. std.  
 measurement procedure immersion

Conductivity calibration measurements/time air std, 0.0 / 1413  $\mu$ S - calibrated each day

Sampler signatures (date/time) J. P. Park 9-27-94 1730

Sample sequence:

- MW1, MW6, MW11 (9-27-94)
- MW7, MW8, MW13, MW14, LI (leachate), MW2, MW17
- MW9, Rocky Mountain Heights Spring, MW18, MW15, MW10, MW16, MW4, MW12 (9-29-94)
- MW3 (9-30-94)

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-1

date 9-27-94

time 5:08

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 39.69 (in feet)  
 Total depth of well = TD = 76.65 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) =$  36.96 (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.653 \text{ gal/ft.}$   
 = 24.1 gallons

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 = [  $L_c(\text{ft.})$ , Not to exceed 37 feet ] \* 0.522 gal/ft.  
 = 19.3 gal

Unit Well Volume =  $V_w$  (Gallons) = (  $V_c + V_f$  ) = 43.4 gal

Minimum Purge Volume (Gallons) =  $3 * V_w$  = 130.2 gal

Description of water before purging clear

Measurements collected during purging:

Time	Temperature	pH	Conductivity	Pumping Rate	
1. 1528	13.7°C	7.34	132.1 $\mu\text{S}$	$\approx 3 \text{ gpm}$	(24 gal purge)
2. 1532	12.9°C	7.39	127.2 $\mu\text{S}$	$\approx 3 \text{ gpm}$	(52 gal)
3. 542	13.6°C	7.26	126.7 $\mu\text{S}$	$\approx 3 \text{ gpm}$	(63 gal)
4. 1556	2.8°C	6.97	98.0 $\mu\text{S}$	$\approx 3 \text{ gpm}$	(100 gal)
5. 1603	12.3°C	6.62	102.3 $\mu\text{S}$	$\approx 3 \text{ gpm}$	(120 gal)

Total volume of water purged ..... + 142 gal

Description of water after purging clear  
 6. 1606 12.7°C 6.63 119.4  $\mu\text{S}$   $\approx 3 \text{ gpm}$  (140 gal)

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	14.9°C	6.75	31	111.7 $\mu\text{S}$	1620
2.	15.2°C	6.65	21	103.7 $\mu\text{S}$	1623
3.	15.0°C	6.48	29	104.8 $\mu\text{S}$	1626
4.	15.1°C	6.42	29	105.1 $\mu\text{S}$	1629

Misc Field Observations sampled @ 1615  
None noted

Sampler signatures (date/time) Jeff Kach 9-27-94 1640

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-2 date 9-28-94 time 15

Condition of well GOOD - had in poor condition

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 7.51' (in feet)  
 Total depth of well = TD = 177.50 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) =$  169.99' (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 27.7 gal.

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 $= [L_c(\text{ft.}), \text{ Not to exceed } 17.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 8.9 gal.

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f)$  = 36.6 gal  
 Minimum Purge Volume (Gallons) =  $3 * V_w$  = 109.8 gal

Description of water before purging clear

Measurements collected during purging:

*1625 began purging  
+ 20 min*

Time	Temperature	pH	mV	Conductivity	Pumping Rate	
1. 1625	13.5°C	9.52	-125	267 $\mu\text{S}$	4 gpm	5 gal
2. 1638	13.3°C	9.30	-105	254 $\mu\text{S}$	4 gpm	40 gal
3. 1655	14.0°C	8.95	-94	266 $\mu\text{S}$	3 gpm	78 gal
4. 1705	13.5°C	8.52	-74	257 $\mu\text{S}$	3 gpm	103 gal
5. 1710	12.8°C	8.33	-69	257 $\mu\text{S}$	3 gpm	115 gal

Total volume of water purged .....  $\approx 134$  gallons

Description of water after purging clear

6. 1715 13.0°C 8.53 -74 257  $\mu\text{S}$  3 gpm 120 gal

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	13.1°C	8.28	-67	246 $\mu\text{S}$	1720
2.	13.1°C	8.34	-65	246 $\mu\text{S}$	1722
3.	13.1°C	8.27	-67	243 $\mu\text{S}$	1724
4.	12.6°C	8.38	-66	252 $\mu\text{S}$	1726

*Sampled at 1730*

Misc. Field Observations None

Sampler signatures (date/time) J. Blank 1745

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-3

date 7-30-94

time 0820

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.42 (in feet)  
 Total depth of well = TD = 39.60 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) =$  22.18 (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 3.6 gal

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 = [  $L_c(\text{ft.})$ , Not to exceed 12.0 ft. ] \* 0.522 gal/ft.  
 = 6.3 gal

Unit Well Volume =  $V_w$  (Gallons) = (  $V_c + V_f$  ) = 9.9 gal

Minimum Purge Volume (Gallons) =  $3 * V_w =$  29.7 gal

Description of water before purging very silty

Measurements collected during purging:

*0835 began pumping*

Time	Temperature	pH	mV	Conductivity	Pumping Rate
1. <u>0840</u>	<u>11.9 °C</u>	<u>10.23</u>	<u>-53</u>	<u>188.4 uS</u>	<u>1.0 gpm</u>
2. <u>0846</u>	<u>12.1 °C</u>	<u>7.88</u>	<u>-31</u>	<u>166.0 uS</u>	<u>1.0 gpm</u>
3. <u>0852</u>	<u>12.3 °C</u>	<u>7.50</u>	<u>-17</u>	<u>165.0 uS</u>	<u>1.0 gpm</u>
4. <u>0858</u>	<u>12.3 °C</u>	<u>6.69</u>	<u>17</u>	<u>169.1 uS</u>	<u>1.0 gpm</u>
5. <u>0904</u>	<u>12.4 °C</u>	<u>6.67</u>	<u>21</u>	<u>164.4 uS</u>	<u>1.0 gpm</u>

*5 gal  
12 gal  
18 gal  
25 gal  
31 gal*

*-5.5  
n*

Total volume of water purged ..... + 36 gal

Description of water after purging slightly silty

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	<u>13.0</u>	<u>6.46</u>	<u>32</u>	<u>171.9 uS</u>	<u>0905</u>
2.	<u>13.5</u>	<u>6.31</u>	<u>35</u>	<u>173.0 uS</u>	<u>0907</u>
3.	<u>13.7</u>	<u>6.36</u>	<u>33</u>	<u>174.1 uS</u>	<u>0909</u>
4.	<u>13.9</u>	<u>6.24</u>	<u>37</u>	<u>174.9 uS</u>	<u>0911</u>

*sampled at 0915*

Misc. Field Observations none

Sampler signatures (date/time) *J. [Signature]* 9-30-94 0920

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-4 date 2-29-94 time 1445

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 10.45' (in feet)  
 Total depth of well = TD = 29.40 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) =$  18.95' (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 3.1 gal.

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 $= [L_c(\text{ft.}), \text{ Not to exceed } 11.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 5.74 gal.

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f)$  = 8.8 gal  
 Minimum Purge Volume (Gallons) =  $3 * V_w$  = 26.4 gal

Description of water before purging clear

Measurements collected during purging:

453 began  
purging  
5 min

Time	Temperature	pH	mV	Conductivity	Pumping Rate	
1. 1455	13.2°C	8.03	-48	67.9	1.0 gpm	2 gal
2. 1504	11.9°C	7.43	-6	54.5	1.0 gpm	11 gal
3. 1513	11.8°C	7.22	-5	58.5	1.0 gpm	20 gal
4. 1522	11.8°C	7.16	-4	60.9	1.0 gpm	27 gal

Total volume of water purged ..... 31 gallons  
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	12.2°C	7.08	-3	58.0	1524
2.	12.2°C	6.89	2	57.6	1526
3.	12.4°C	6.84	2	55.4	1529
4.	12.4°C	6.79	2	56.0	1530

Misc. Field Observations Sampled MW4 - 1530  
none

Sampler signatures (date/time) JTP/PSH 2-29-94 1540

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-5 - Not sampled date \_\_\_\_\_ time \_\_\_\_\_

Condition of well Well dry

Reference Point - Top of Well Casing:

Total Depth to water = DTW = \_\_\_\_\_ (in feet)

Total depth of well = TD = 73.00 (in feet)

Water column length =  $L_c(\text{ft.}) = (TD - DTW) =$  \_\_\_\_\_ (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
= \_\_\_\_\_

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
= [  $L_c(\text{ft.})$ , Not to exceed 12.0 ft. ] \* 0.624 gal/ft.  
= \_\_\_\_\_

Unit Well Volume =  $V_w$  (Gallons) = (  $V_c + V_f$  ) = \_\_\_\_\_

Minimum Purge Volume (Gallons) =  $3 * V_w$  = \_\_\_\_\_

Description of water before purging \_\_\_\_\_

Measurements collected during purging:

	<u>Time</u>	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Pumping Rate</u>
1.	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____

Total volume of water purged ..... \_\_\_\_\_

Description of water after purging \_\_\_\_\_

Measurements collected after purging:

pH Calibration: \_\_\_\_\_

Final four (4) replicate measurements of:

	<u>Temperature</u>	<u>pH</u>	<u>Conductivity</u>	<u>Time</u>
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

Misc. Field Observations \_\_\_\_\_

Sampler signatures (date/time) *J. Laack* 9-27-94

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-6 date 9-27-94 time 1655

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 43.99 (in feet)  
 Total depth of well = TD = 58.00 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) =$  14.01 (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 2.3 gal.

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 = [  $L_c(\text{ft.})$ , Not to exceed 12.0 ft. ] \* 0.624 gal/ft.  
 = 7.5 gallons

Unit Well Volume =  $V_w$  (Gallons) = (  $V_c + V_f$  ) = 9.8 gallons  
 Minimum Purge Volume (Gallons) =  $3 * V_w =$  29.4 gallons

Description of water before purging clear - detected leachate odors

Measurements collected during purging:

<u>Time</u>	<u>Temperature</u>	<u>pH</u>	<u>mV</u>	<u>Conductivity</u>	<u>Pumping Rate</u>	<u>mV</u>
1. <u>1708</u>	<u>15.6°C</u>	<u>6.41</u>	<u>33</u>	<u>448 <math>\mu\text{S}</math></u>	<u>0.4 gpm</u>	<u>32</u>
2. <u>1711</u>	<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>	<u>dry</u>	<u>        </u>
3. <u>1725</u>	<u>15.0°C</u>	<u>6.09</u>	<u>45</u>	<u>417 <math>\mu\text{S}</math></u>	<u>0.6 gpm</u>	<u>45</u>
4. <u>1735</u>	<u>15.8°C</u>	<u>6.12</u>	<u>43</u>	<u>406 <math>\mu\text{S}</math></u>	<u>0.5 gpm</u>	<u>44</u>
5. <u>1739</u>	<u>6.0°C</u>	<u>6.22</u>	<u>41</u>	<u>403 <math>\mu\text{S}</math></u>	<u>0.5 gpm</u>	<u>43</u>

*1705 began pumping*  
*after 1.25*  
*after 3.0*  
*after 6.5*  
*after 5.0*  
*after - 5.0*

Total volume of water purged ..... ~ 9.0 gallons

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

<u>Temperature</u>	<u>pH</u>	<u>mV</u>	<u>Conductivity</u>	<u>Time</u>
1. <u>16.5 °C</u>	<u>6.16</u>	<u>43</u>	<u>394 <math>\mu\text{S}</math></u>	<u>1744</u>
2. <u>16.5 °C</u>	<u>6.18</u>	<u>43</u>	<u>407 <math>\mu\text{S}</math></u>	<u>1746</u>
3. <u>16.6 °C</u>	<u>6.11</u>	<u>45</u>	<u>399 <math>\mu\text{S}</math></u>	<u>1748</u>
4. <u>16.6 °C</u>	<u>6.11</u>	<u>45</u>	<u>398 <math>\mu\text{S}</math></u>	<u>1750</u>

Sampled at 1750

Misc. Field Observations leachate odors detected during purging

Sampler signatures (date/time) J. K. [Signature] 9-27-94 1805

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-7 date 9-27-94 time 1253

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 30.73 (in feet)  
 Total depth of well = TD = 50.00 51.95 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) =$  21.22' (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 3.46 gallons

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.624 \text{ gal/ft.}$   
 = 7.49 gallons

Unit Well Volume =  $V_w \text{ (Gallons)} = (V_c + V_f) =$  10.95 gallons  
 Minimum Purge Volume (Gallons) =  $3 * V_w =$  32.9 gallons

Description of water before purging CLEAR

Measurements collected during purging:

1253 began bailing

Time	Temperature	pH	Conductivity	Pumping Rate
1. <u>1325</u>	<u>12.9° C</u>	<u>6.90</u>	<u>1195 <math>\mu\text{S}</math></u>	<u>bail - 4.5 gallons total</u>
2. <u>1333</u>	<u>13.1° C</u>	<u>6.99</u>	<u>1256 <math>\mu\text{S}</math></u>	<u>bailed - 5.0 gallons total</u>
3. <u>1339</u>	<u>12.9 °C</u>	<u>6.90</u>	<u>1305 <math>\mu\text{S}</math></u>	<u>5.5 gal. total</u>
4. _____	_____	_____	_____	<u>dry after 5.5 gal - no</u>

Total volume of water purged ..... 5.5 gallons with 0.1 gal.  
 Description of water after purging clear - slightly oily

Measurements collected after purging:

pH Calibration: 7 and 10

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____

*could not get replicate measurements or sample full liter of water total net 1.1 gal of water*

Misc. Field Observations \_\_\_\_\_

Sampler signatures (date/time) [Signature] 9-28-94 0815

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-8

date 9-27-94

time 350

Condition of well GOOD

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.38' (in feet)

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

Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{49.62'}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 3.1 gallons

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.3 gallons

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{14.4 \text{ gallons}}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{43.2 \text{ gallons}}$

Description of water before purging Clear

Measurements collected during purging:

	Time	Temperature	pH	Conductivity	Pumping Rate	
1000 began pumping  +125 minutes	1. 1406	14.8°C	7.98	713 $\mu\text{S}$	.75 gpm	
	2. 1414	15.3°C	7.38	688 $\mu\text{S}$	.25 gpm	after 4.5 gal
	3. 1420	15.2°C	7.30	654 $\mu\text{S}$	.25 gpm	after 6.5 gal
	4. 1422				dry	(dry after 8.0 gal)

Total volume of water purged ..... 3.0 gallons - 5.0 gal (9-28-94)

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	MV	Conductivity	Time
1.	12.1°C	7.51	-9	696 $\mu\text{S}$	0852 9-28-94
2.	12.8°C	6.98	8	667 $\mu\text{S}$	0900 9-28-94
3.	12.9°C	6.88	8	660 $\mu\text{S}$	0905 9-28-94
4.	13.1°C	6.88	8	662 $\mu\text{S}$	0909 9-28-94

sampled 0910

Misc. Field Observations slow recharge rate

Sampler signatures (date/time) JM [Signature] 9-28-94 0915

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-9 date 9-29-94 time 0750

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 57.79 (in feet)  
 Total depth of well = TD = 86.40 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{28.61}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 4.66 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.26 gal.

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{10.9 \text{ gallons}}$   
 Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{32.7 \text{ gal.}}$

Description of water before purging clear

Measurements collected during purging:

*0809 began pumping*

*+ 7 min.*

Time	Temperature	pH	mV	Conductivity	Pumping Rate	
1. 0821	12.7°C	7.25	7	378 $\mu\text{S}$	1.0 gpm	after 7.0 gallon
2. 0828	12.9°C	5.95	53	385 $\mu\text{S}$	1.0 gpm	after 12.0 gal.
3. 0835						(cannot get read)
4. 0845	13.1°C	6.01	47	385 $\mu\text{S}$	1.0 gpm	27 gal.
5. 0850	13.3°C	6.09	43	362 $\mu\text{S}$	.5 gpm	29 gal.
6. 0856	13.5°C	5.97	49	375 $\mu\text{S}$	.5 gpm	37 gal.

Total volume of water purged ..... > 38 gal.

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00 <sup>0808</sup> 0841 w/ 7.00 & 4.00 *recalibrate*

Final four (4) replicate measurements of:

Temperature	pH	mV	Conductivity	Time
1. 14.6°C	5.99	47	380 $\mu\text{S}$	0901
2. 14.6°C	6.01	47	384 $\mu\text{S}$	0902
3. 14.8°C	6.00	47	376 $\mu\text{S}$	0904
4. 14.6°C	5.97	49	379 $\mu\text{S}$	0905

Misc. sampled 0905 Field Observations none

Sampler signatures (date/time) *[Signature]* 9-29-94 0920

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-10 date 9-23-94 time 1520

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 8.09 (in feet)

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

Water column length =  $L_{c(ft.)} = (TD-DTW) = \underline{61.94}$  (in feet)

Volume of water in well casing =  $V_{c(gal.)} = L_{c(ft.)} * 0.163 \text{ gal/ft.}$   
 = 10.1 gal.

Volume of water in filter pack =  $V_{f(gal.)} = [L_{c(ft.)}, \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.3 gal

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{16.4 \text{ gal}}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{49.2 \text{ gal}}$

Description of water before purging clear

1530 *began sampling* Measurements collected during purging:

	Time	Temperature	pH	mV	Conductivity	Pumping Rate	
	1. 1535	14.1 °C	9.39	-112	148.0 $\mu\text{S}$	.75 gpm	= 3.5 gal.
	2. 1541	14.2 °C	8.81	-78	141.7 $\mu\text{S}$	.75 gpm	≈ 6.0 gal
	3. 1550	16.5 °C	8.31	-60	150.1 $\mu\text{S}$	(dry @ 9.0 gal) .75 gpm	
+ 10 min.	4. 1308	14.0 °C	8.75	-71	162.3 $\mu\text{S}$	0.5 gpm (10 gal total)	← dry

Total volume of water purged ..... 9.0 gallons + 4 gal. = 13 gal.

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00 (both tags)

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time	
1.	16.7 °C	8.61	-68	147.4 $\mu\text{S}$	1320	dry @ 3.5 purged
2.	16.5 °C	8.63	-69	145.1 $\mu\text{S}$	1323	
3.						dry
4.						

Misc. Field Observations none

Sampler signatures (date/time) JPL 9-29-94 1335

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-11 date 9-27-94 time 1310

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 13.22 (in feet)

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

Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{12.58}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 2.05 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.045 \text{ gal/ft.}$   
 = 12.54

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{14.59}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{43.8 \text{ gal}}$

Description of water before purging clear

Measurements collected during purging:

*1810 began pumping*

Time	Temperature	pH	Conductivity	Pumping Rate	mV	
1. <u>1322</u>	<u>15.2°C</u>	<u>6.06</u>	<u>123.5 μS</u>	<u>2 gpm</u>	<u>49</u>	<i>after 3.0g</i>
2. <u>1828</u>	<u>14.4°C</u>	<u>5.65</u>	<u>126.7 μS</u>	<u>2 gpm</u>	<u>64</u>	<i>after ≈ 22</i>
3. <u>1836</u>	<u>14.7°C</u>	<u>5.96</u>	<u>129.7 μS</u>	<u>2 gpm</u>	<u>55</u>	<i>after ≈ 42</i>
4. <u>1842</u>	<u>15.0°C</u>	<u>6.07</u>	<u>122.9 μS</u>	<u>2 gpm</u>	<u>54</u>	<i>after 52g</i>

*3 minutes*

Total volume of water purged ..... +52 gal.

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	<u>15.2°C</u>	<u>5.94</u>	<u>55</u>	<u>118.5 μS</u>	<u>1845</u>
2.	<u>15.3°C</u>	<u>6.05</u>	<u>49</u>	<u>120.5 μS</u>	<u>1846</u>
3.	<u>15.7°C</u>	<u>5.99</u>	<u>56</u>	<u>121.0 μS</u>	<u>1848</u>
4.	<u>15.6°C</u>	<u>6.01</u>	<u>56</u>	<u>122.1 μS</u>	<u>1850</u>

*sampled 1750*  
 Misc. Field Observations none

Sampler signatures (date/time) J. Black 9-27-94 1900

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-12 date 9-29-94 time 1545

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 10.78 (in feet)

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

Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{61.97}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 10.1 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.26 gal

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{16.36}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{49.1 \text{ gal.}}$

Description of water before purging clear

Measurements collected during purging:

*1552 began purging*

*+ 15 min*

	Time	Temperature	pH	mV	Conductivity	Pumping Rate	
	1. 1555	14.6 °C	7.24	-3	186.6 $\mu\text{S}$	2.0 gpm	6 gal.
	2. 1603	13.9 °C	7.01	0	189.0 $\mu\text{S}$	2.0 gpm	21 gal
	3. 1611	14.2 °C	6.98	3	184.9 $\mu\text{S}$	2.0 gpm	39 gal
	4. 1616	14.1 °C	6.81	12	190.1 $\mu\text{S}$	2.0 gpm	50 gal

Total volume of water purged ..... + 56 gallons  
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	15.1 °C	7.06	0	189.8 $\mu\text{S}$	1619
2.	14.9 °C	6.88	9	190.1 $\mu\text{S}$	1621
3.	14.9 °C	6.76	13	186.5 $\mu\text{S}$	1622
4.	14.7 °C	6.76	13	181.3 $\mu\text{S}$	1624

*sampled MW12 at 1630*  
 Misc. Field Observations none

Sampler signatures (date/time) *J. J. [Signature]* 9-29-94 1640

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-13 date 9-28-94 time 0930

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 19.57' (in feet)

Total depth of well = TD = 31.65 (in feet)

Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{12.08'}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
= 1.97 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.045 \text{ gal/ft.}$   
= 12.54 gal

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{14.51 \text{ gal}}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{43.5 \text{ gal}}$

Description of water before purging clear - slightly silty

Measurements collected during purging:

0937 began pumping  
+ 3 min!

Time	Temperature	pH	mV	Conductivity	Pumping Rate	
1. 0938	11.9°C	7.11	-2	68.1 uS	.5 gpm	after .5 gal.
2. 0944	12.7°C	7.35	-3	27.6 uS	.5 gpm	after 3 gal
3. 1017	12.4°C	7.15	-3	30.9 uS	1 drop 12 min. .5 gpm	after 13 gal
4. 1028	12.3°C	7.19	-4	26.2 uS	.5 gpm	after 17 gal

Total volume of water purged ..... ~ 13 gallons

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	13.9°C	6.52	28	26.7 uS	1032
2.	13.9°C	6.47	29	26.2 uS	1034
3.	13.9°C	6.40	30	25.9 uS	1035
4.	13.9°C	6.42	30	26.9 uS	1036

Sampled 1035'  
Misc. Field Observations None

Sampler signatures (date/time) J. [Signature] 9-28-94 1045

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-14 date 9-28-94 time 1055

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 7.89' (in feet)  
 Total depth of well = TD = 71.00 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{63.11'}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 10.3 gal.

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 1.567 \text{ gal/ft.}$   
 = 18.8 gal.

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{29.1 \text{ gal.}}$   
 Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{87.3 \text{ gal.}}$

Description of water before purging clear

Measurements collected during purging:

1102 began pumping

+16 min

	Time	Temperature	pH	mV	Conductivity	Pumping Rate	
1.	1115	12.1°C	9.75	-119	127.3 $\mu\text{S}$	3 gpm	after 36 gal
2.	1120	11.8°C	9.98	-93	105.3 $\mu\text{S}$	3 gpm	after 48 gal
3.	1125	11.8°C	8.26	-53	75.5 $\mu\text{S}$	3 gpm	after 60 gal
4.	1132	11.9°C	7.06	-4	78.1 $\mu\text{S}$	2 gpm	after 77 gal
	1142	12.6°C	7.05	-3	70.7 $\mu\text{S}$	1.5 gpm	after 82 gal

Total volume of water purged ..... ~94 gal.

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	12.9°C	7.14	-6	75.3 $\mu\text{S}$	1147
2.	12.9°C	7.27	-10	70.1 $\mu\text{S}$	1149
3.	12.9°C	7.29	-11	71.9 $\mu\text{S}$	1151
4.	13.0°C	7.19	-8	71.4 $\mu\text{S}$	1153

Sampled 1155

Misc. Field Observations None

Sampler signatures (date/time) J.P. [Signature] 9-28-94 1200

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-15

date 7-29-94

time 1100

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 11.82' (in feet)  
 Total depth of well = TD = 178.00 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{166.18'}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 27.1 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 13.0 \text{ ft.}] * 1.522 \text{ gal/ft.}$   
 = 19.8 gal

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{46.9 \text{ gal}}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{140.7}$

Description of water before purging clear - slightly dirty

Measurements collected during purging:

*1108 began purging*

Time	Temperature	pH	mV	Conductivity	Pumping Rate
1. 1111	13.1°C	8.08	-49	158.2 mS	2.5 gpm
2. 1147	13.6°C	7.99	-46	191.1 mS	(24 gal) .5 gpm
3. 1204	14.6°C	8.03	-47	149.0 mS	(28 gal) .5 gpm
4. 1211	14.5°C	8.14	-54	145.0	(32 gal) .5 gpm

*4 gal (110) well dry after 20g  
(1212) dry after 33 g*

*+ 15 min*

Total volume of water purged ..... + 44 axilons

Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	Conductivity	Time
1.	14.6 °C	8.41	146.4 mS	1222
2.	14.6 °C	8.51	144.1 mS	1224
3.	14.4 °C	8.40	140.1 mS	1226
4.	13.8 °C	8.48	146.0 mS	1228

*Sampled 1235*

Misc. Field Observations none

Sampler signatures (date/time) *Jill Wade* 9-29-94 - 1245

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-16 date 9-29-94 time 1400

Condition of well Good

Reference Point - Top of Well Casing:  
 Total Depth to water = DTW = 5.68 (in feet)  
 Total depth of well = TD = 26.80 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{21.12}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 3.44 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.26 gal.

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{9.7 \text{ gal}}$   
 Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{29.1 \text{ gal}}$

Description of water before purging clear

Measurements collected during purging:

*1405 began purging*

	Time	Temperature	pH	mV	Conductivity	Pumping Rate	
	1. 1407	15.0°C	8.09	-48	197.0 $\mu\text{S}$	1.5 gpm	3 gal
	2. 1412	12.5°C	7.34	-14	195.6 $\mu\text{S}$	1.5 gpm	10 gal
	3. 1419	12.4°C	7.12	-2	192.3 $\mu\text{S}$	1.5 gpm	20 gal
<i>+ 5 min</i>	4. 1424	12.3°C	7.09	-2	193.0 $\mu\text{S}$	1.5 gpm	25 gal

Total volume of water purged ..... + 36 gal  
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	12.6°C	6.96	3	199 $\mu\text{S}$	1427
2.	12.5°C	6.98	3	198.1 $\mu\text{S}$	1429
3.	12.7°C	6.94	3	195.7 $\mu\text{S}$	1431
4.	12.7°C	6.90	2	192.0 $\mu\text{S}$	1433

*Sampled 1435*  
 Misc. Field Observations none

Sampler signatures (date/time) J. [Signature] 9-29-94 1455

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-17

date 9-28-94

time 1745

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.83 (in feet)

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

Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{76.71}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 12.5 gal

Volume of water in filter pack =  $V_f(\text{gal.}) =$   
 $= [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.3 gal

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{18.8 \text{ gal}}$

Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{56.4 \text{ gal}}$

Description of water before purging clear

Measurements collected during purging:

1753  
 began purging  
 + (19 min)

Time	Temperature	pH	mV	Conductivity	Pumping Rate	Volume
1. 1756	13.4°C	7.44	-18	401 $\mu\text{S}$	1.0 gpm	4 gal
2. 1808	13.6°C	7.42	-17	451 $\mu\text{S}$	1.0 gpm	10 gal
3. 1818	14.1°C	7.09	0	340 $\mu\text{S}$	1.0 gpm	16 gal
4. 1827	13.9°C	6.76	13	285 $\mu\text{S}$	1.0 gpm	19 gal
5. 1828	13.8°C	6.98	2	463 $\mu\text{S}$	1.0 gpm	23 gal

Total volume of water purged .....  $\approx 26$  gallons

Description of water after purging clear

6. 1847 13.5°C 7.27 -12 412  $\mu\text{S}$  .25 gpm 23.5 gal

Measurements collected after purging:

7. 1853 13.5°C 7.17 -7 423  $\mu\text{S}$  .25 gpm 25 gal

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

Temperature	pH	mV	Conductivity	Time
1. 13.7 °C	6.99	5	415 $\mu\text{S}$	1855
2. 13.9 °C	6.66	18	407 $\mu\text{S}$	1856
3. 14.0 °C	6.61	22	409 $\mu\text{S}$	1858
4. 14.1 °C	6.60	22	402 $\mu\text{S}$	1859

Misc. Field Observations Sampled at 1900 None

Sampler signatures (date/time) JFB 1905 9-28-94

**ASSESSMENT MONITORING WELL SAMPLE COLLECTION FORM**

Project: Watauga County Landfill Permit #95-02

Well # MW-18 date 9-29-94 time 0950

Condition of well Good

Reference Point - Top of Well Casing:

Total Depth to water = DTW = 17.86' (in feet)  
 Total depth of well = TD = 73.20 (in feet)  
 Water column length =  $L_c(\text{ft.}) = (TD-DTW) = \underline{55.34'}$  (in feet)

Volume of water in well casing =  $V_c(\text{gal.}) = L_c(\text{ft.}) * 0.163 \text{ gal/ft.}$   
 = 9.02 gal

Volume of water in filter pack =  $V_f(\text{gal.}) = [L_c(\text{ft.}), \text{ Not to exceed } 12.0 \text{ ft.}] * 0.522 \text{ gal/ft.}$   
 = 6.26 gal

Unit Well Volume =  $V_w$  (Gallons) =  $(V_c + V_f) = \underline{15.28 \text{ gal.}}$   
 Minimum Purge Volume (Gallons) =  $3 * V_w = \underline{45.8 \text{ gal.}}$

Description of water before purging clear

Measurements collected during purging:

0950 began purging

Time	Temperature	pH	mV	Conductivity	Pumping Rate
1. 1003	12.2 °C	10.17	-141	90.7 $\mu\text{S}$	2.0 gpm
2. 1013	12.2 °C	9.47	-110	121.6 $\mu\text{S}$	1.0 gpm
3. 1023	12.1 °C	9.15	-96	88.4 $\mu\text{S}$	1.0 gpm
4. 1030	12.30 °C	9.10	-90	94.4 $\mu\text{S}$	0.5 gpm

+ 14 min.

after ~ 14 gal  
after 30 gal  
after 40 gal  
after 46 gal

Total volume of water purged ..... + 53 gal.  
 Description of water after purging clear

Measurements collected after purging:

pH Calibration: 7.00 and 10.00

Final four (4) replicate measurements of:

	Temperature	pH	mV	Conductivity	Time
1.	12.8 °C	8.50	-66	91.1 $\mu\text{S}$	1034
2.	12.9 °C	8.46	-64	88.9 $\mu\text{S}$	1036
3.	13.0 °C	8.23	-51	83.7 $\mu\text{S}$	1039
4.	12.9 °C	8.16	-40	86.7 $\mu\text{S}$	1041

Sampled 1045  
 Misc. Field Observations None

Sampler signatures (date/time) J. P. Ash 9-29-94 1055

STANDARD FIELD PROTOCOL - FINAL ACTIVITIES

Project: Watauga County Landfill Permit #95-02 Date: 9-30-94

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

Sample destination Compuchem Environmental Corp. Triangle Park NC

Method of transportation Federal Express - Overnight - air

Sampler signatures (date/time) J. J. Kach 9-30-94 1200

JSP 5-9A (BOOK 1) JN 6520-70 DATE 9-27-94

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Washington Co. LE DNR Assessment  
Sampling Event

Personnel: JES Peck and F Rudin (DAA)

0545 - loaded truck  
0650 - left DAA office  
= arrived at County Administrator's office in Barre, VT = met with Jim Rutledge - authorized us to store some bice ice blocks in their freezer.

= checked in Hamble Inn in Barre  
11-200 - 888-6867 - confirmation No. 8151524

1010 - arrived at land fill - met w/ Mark Cambal  
land fill manager

Weather: Sunny, breezy - temp 72°F clear day  
0110 - banded ice blocks at Animal Shelter for  
looking for koalaite dust of animal skulls  
birds - near power poles adjacent to fill  
area - Evidence of recent rain on 9/29  
nothing in arena. No signs of landfills  
detected (odor) of fresh animal waste  
bice functions - viable chole cells.

1145 - called for koalaite below land dump  
area - adjacent to fire storage bldg.  
evidence of digging shed on small area  
puddle on North corner of U118  
koalaite evidence - in area

1100 check Rocky Mountain Heights Spring -  
 Spring has slight flow, no subs. U  
 contamination: Will attempt to sample  
 later in the week  
 Cleared out weeds around MUD9 -  
 no access road. Will carry gear to site  
 site when sampling  
 1110 Area around surface collection site  
 55 (June '94 event). Flowing H<sub>2</sub>O, lots of metals  
 slightly yellowed H<sub>2</sub>O. Lots of metals  
 parts around area.  
 1120 S2 area - Hole flowing from 2136"  
 pipes - heavy flow - extreme Fe<sub>2</sub>O<sub>3</sub>  
 dissolution - soil stained - heavy  
 leach the smaller. Gas bubbling near  
 the 3 pipes - evidence of underground  
 gas. Silt in the area stained brown.  
 1122 road to MUD3, 4, 14, 14, 15 washed out  
 will ask LF to grade road for us  
 1134 S3, 9, water in case structure discolored  
 10 trace metal adv. Soil discolored.  
 1144 asked Mark Combs to core site  
 done at MUD9 and road to MUD2, 1.  
 1144 LF, 14, 15  
 1154 S4 area - flowing H<sub>2</sub>O - slight  
 discoloration of H<sub>2</sub>O and on rocks

1206	PZ 1B	TP	5.195'
		DTW	6.47'
1208	PZ 1BA	TP	21.97'
		DTW	17.77'

(North well casing to give  
 conductivity record for PZ)

1216	PZ 1C	TP	29.31'
		DTW	13.94'
1226	PZ 1D	TP	28.77'
		DTW	12.29'
1232	PZ 2A	TP	39.68'
		DTW	23.55'
1239	PZ 1A	TP	28.73'
		DTW	15.64'
1243	PZ 1T	TP	22.46'
		DTW	14.06'
1253	MUD7	TP	30.70'
		DTW	15.95'

1307  
 1308

should pull in 33 meters  
 calibrated 100' meter with 7.00 110.00

- PZ - in order that holes is safety holes
- callibrated meter by 110.00 and 100 meters
- based on readings from same year data
- callibrated conductivity 11/14/13 75 sili
- will check before each well and
- change bases / each well - can't
- will be allowed
- 40m balls, 100m balls, 150m balls
- will be allowed

1315 changed buffers / conductivity - hd. - began calibration after 5:10 of new KCl soln. - meter cal. bracket at 17.9°C o.k.  
 pH 6.90  
 temp 12.9°C  
 cond. 1195  $\mu$ S  
 pH 6.99 temp 13.1°C cond. 1256  $\mu$ S  
 pH 6.90 temp 12.9°C cond. 1308  $\mu$ S  
 total slum purged 5.5 gal more - H<sub>2</sub>O  
 clear li. slightly silty. 3 successive  
 pH/cond. readings are within +/- 0.107.  
Will sample tomorrow by 1300 hours.  
 MWSB - will pump today - sample tomorrow (pump recharged)  
 TD 67.00' DIW 17.38'  
 calibrated pH/cond meter - should purge 47.2 gallons - expected 1.5 gal dry.  
 began purging at 7.25 gpm  
 pH 7.28 temp 14.9°C cond 710  $\mu$ S  
 pH 7.28 temp 15.3°C cond. 683  $\mu$ S  
 reduced pump rate to 0.25 gpm at 1406  
 gallons purged per 6.5 gallons for this set of measurements  
 pH 7.30 temp 15.20°C cond. 654  $\mu$ S  
 well dry after 8.0 gallons purged  
 will sample tomorrow by 1330 hours

1325 1314 STD 70 = get 1.2 / gms / 100 ml  
 1410 surface check on site  
 1325 MWSB 70.65' DIW 39.1 gpm  
 to purge 150.2 gallons (small volumes)  
 wait 9.5 minutes before sample  
 2 hrs successive pH / cond. readings  
 (15 sec / FE of H<sub>2</sub>O)  
 3000 gallons (total)  
 1320 pump  
 1321 2 hrs successive pH / cond. meter w/ new buffers  
 1322 pH 7.34 temp 15.7°C cond. 1321  $\mu$ S  
 off for 24 gal purged  
 1323 pH 7.39 temp 15.7°C cond. 1270  $\mu$ S  
 after 52 gal purged  
 1324 pH 7.6 temp 15.0°C cond. 1267  $\mu$ S  
 after 68 gal purged  
 Sample bottle - D.  
 VOA's MWSB 3347020 Agilab 212  
 1356 pH 6.97 2.52 cond. 680  $\mu$ S  
 after 100 gallons  
 Total meals buffer 3.0  
 MWSB 3347020 Agilab 212  
 MWSB 3347020 Agilab 212

1603 pH 6.62 12.5°C sand 102.3 gms  
 for 120 gallons purged

1606 pH 6.63 12.7°C sand 119.4 gms  
 for 140 gallons  
 reduce flow to 0.4 gpm will purg  
 at this rate before sampling for  
 9.5 minutes

1615 Sampled MW1, MW1, MW1 MS, MW1 MSD VOA's  
 MW1, MW1 MS/SD total metals  
 replicate measurements

pH	temp	mV	cond
6.35	14.9°C	31	1117 $\mu$ S
6.65	15.2°C	21	1037 $\mu$ S
6.48	15.0°C	29	1048 $\mu$ S
6.92	15.1°C	29	1051 $\mu$ S

verified pH  $\rightarrow$  below 2.0

1610 last MW1

1645 checked to see if road has been  
 cleared - road is complete

1652 MW6 TD 98.00 DTN 43.99'

1700 calibrated pH meter w/ new 710 buffers

1705 began pumping at 0.4 gpm  
 electrical leachate odors

1708 pH 6.41 mV 32 temp 15.6°C sand 140 gms  
 after  $\approx$  1.25 gallons

1711 dry after 3.0 gallons

1715 what with MW5 to check if it's dry waste  
 MW6 Leachate  
 1720 MW5 dry - no sampling  
 1725 MW6 pumping - MW6 again at 0.4 gpm  
 1730 pH 6.09 temp 15.0°C  
 mV 45 cond 1117  $\mu$ S  
 1735 3.5 gallons purged  
 pH 6.18 temp 15.5°C  
 mV 44 cond 1062  $\mu$ S  
 1740 5.0 gallons  
 1745 pH 6.22 temp 16.0°C  
 mV 43 cond 1113  $\mu$ S  
 offer 0.4 gpm  
 Buff 2.2 gms  
 1750 VOA's MW6 U31820 AP19100  
 MW6 321020 AP19100  
 1755 MW6 H31820 AP55300  
 1760 volume purged = 10 gallons  
 sand left MW6 - pH below 2 - KSEN  
 1765 pH meter - total metals  
 after 1.5 gpm - MW6 - 100%  
 1770 2.25 gpm 100%  
 1775 will pump 4.5 gpm  
 1780 H31820 100%  
 H31820 100%  
 before sample 11.7

(1, 14)

1817 calibrated pH meter w/ 7 10 new buffers  
 1818 began purging @ 2 gpm  
 pH 6.06 temp. 15.2°C  
 1822 mV 49 cond. 121.5 µS  
 after 3 gallons  
 1823 pH 5.65 temp 14.4°C  
 mV 64 cond. 126.7 µS  
 after 22 gallons  
 1836 pH 5.96 temp 14.7°C  
 mV 55 cond 129.7 µS  
 after = 42 gallons

Bottle I.D.s lot # SN  
 v.o.a's MW11 B314700 A0190617  
 MW11 B314700 A0190660  
 Metab. MW11 H 318200 A0553270  
 pH 6.07 temp. 15.0°C  
 mV 54 cond. 122.9 µS  
 after ≈ 52 gal.  
 reduced flow to c. 1 gpm  
 Replicate Measurements  
 1844 pH 5.94 mV 55 temp 15.2°C cond 118.5 µS  
 1846 pH 6.05 mV 49 temp. 15.3°C cond 120.5 µS  
 1848 pH 5.99 mV 56 temp. 15.7°C cond 121.0 µS  
 1850 pH 6.01 mV 56 temp. 15.6°C cond 122.1 µS  
 Sampled MW11 total vol. purged 56 gal. (1/15)  
 buff site

5515-14 Book 11 JN 6520-20 DATE 9-28-14 (1-15)

11/1/14 C. U.F. 2nd Assessment Event  
 TSP/OP  
 0715 must get 3.10 = v.o.a. 11/15/14  
 0750 call up back at meter w/ 7 10 new buffers  
 mV 49 cond. 121.5 µS  
 W. Haller Temp. 0.50 99.0°F with (wind) direction  
 0815 sample MW11  
 Bottle I.D.s lot # SN  
 v.o.a's MW11 B314700 A0190650  
 MW11 B314700 A0190700  
 Metab. MW11 H318200 A0553288  
 pull out and weigh 11.0 g sample - used  
 about 1/3 of a liter of filtered water  
 for purging  
 0838 MW11 - will sample MW11 Bill  
 0850 - purged @ 1.5 gpm for minutes before  
 sampling  
 Replicate Measurements  
 0852 pH 5.94 temp 12.0°C  
 mV 54 cond 118.5 µS  
 0900 pH 6.05 temp 12.0°C  
 mV 49 cond 120.5 µS  
 0905 pH 5.99 temp 12.0°C  
 mV 56 cond 121.0 µS  
 0910 pH 6.01 temp 12.1°C  
 mV 56 cond 122.1 µS

0981 pH 6.8 temp 13.1°C after 5 gal  
 MV 8 cond 662.5  
 sample MW38 temp. pres. (6.14 dig) 13 gal  
 buffer I.D.S. 6.45 5.7

0910 VOA's  
 B3147020 A 0170635  
 B3147020 A 0170706  
 H310200 A 0153267

Metals  
 tested pH = 2.0 in 1st. no. of  
 0927 MW13 - TD 3.65' DTW 19.57'  
 calibrated pH meter w/ new buffers  
 0937 began sampling at 5 gpm  
 0938 pH 7.11 mV -2 temp 11.9°C cond. 68.145  
 0944 pH 7.35 mV -8 temp 12.7°C cond. 27.645

well working at same as previous int  
 of 0.5 gpm - will increase rate  
 to 1.0 gpm

dry after 12 gallon at 0.5 gpm 13 gal.  
 began purge 0 temp 2.1°C cond. 30.945  
 1017 pH 7.15 mV -3 temp 14.3°C cond. 26.215  
 1020 pH 7.19 mV -4 temp 17 gallon cured

after 17 gallon cured  
 Replicate Measurements

pH	mV	temp	cond
6.52	28	13.9°C	26.745
6.47	29	13.9°C	26.245
6.40	30	13.9°C	25.945
6.42	30	13.9°C	26.945

1075 sample MW 3 - RED WATER 27.275  
 6.0 pH 6.0  
 VOA's  
 MW13 B3147020 A 0170635  
 MW35 B3147020 A 0170635  
 Metals  
 MW 3 H3182010 A 01553648  
 MW 4 TD DTW 71.57  
 pH 6.07 mV -3 temp 11.8°C cond. 16.515  
 1102 began sampling at 3 gpm  
 1104 calibrated pH meter w/ new buffers  
 1115 pH 7.15 mV -19 temp 11.8°C cond. 16.735  
 after 26 gal  
 1120 pH 6.96 mV -33 temp 11.8°C cond. 16.515  
 after 4.8 gal  
 1125 pH 7.10 mV -53 temp 11.8°C cond. 16.515  
 after 60 gal  
 1132 pH 7.06 mV -59 temp 11.9°C cond. 16.735  
 after 77 gal  
 1137 began sampling at 5 gpm  
 1141 pH 7.08 mV -75 temp 11.9°C cond. 16.735  
 after 92 gal  
 1075  
 VOA's  
 MW 13 B3147020 A 0170635  
 MW 14 B3147020 A 0170635  
 Metals  
 MW 14 H3182010 A 01553648

Efficient Measurements

Time	pH	MV	Temp.	Cond.
1147	7.14	-6	12.9°C	75.3 μS
1149	7.27	-10	12.9°C	70.1 μS
1151	7.29	-11	12.9°C	71.9 μS
1153	7.19	-8	13.0°C	71.1 μS
1155	sampled MW14		total	total pt < 2.0
1210	MW7	- will	sampled	sampled
1220		- not enough H <sub>2</sub> O		
1225		went to LF office		
1240		shipping arrangements with Barbara		
1310		filled out C.O.C.'s		
1405		worked on packing		
1510		left LF for Coast Cause to FAX Janet COC's		
1515		boxed Chad Cox's for review (Janet not available)		
1516		packaged up 2 sample kits - left with Barbara to be shipped by Fed. Ex.		
1515		MW10 - evidence on surface approx 15' beneath floor - very oily sludge, no odor's. Not enough flow to sample, however. No method of collection.		

1520	MW10	D 7203	D 7203	D 7203
1525		Prize 39.2 mg/L		
1530		Cal. 10.2 mg/L		
1535		neg. pumping MW10 @ 1150 ft		
1541		CV = 11%		
1545		Temp. 14.7°C		
1550		Cond. 14.7 μS		
1555		will attempt to collect a lead at the sample (NDA only - low volume) using a plastic spore collection system		
1555		MW10 after a good pump 16.5 μS		
1555		Cond. 16.5 μS		
1605		will sample MW10 tomorrow by 1330		
1617		MW2		
1625		collected pH meter of MW10 (1150 ft)		
1630		Temp. 12.9°C		
1635		Cond. 12.9 μS		
1640		beginning sample lead		
1645		Temp. 12.9°C		
1650		Cond. 12.9 μS		
1655		Temp. 13.3°C		
1700		Cond. 13.3 μS		



0105	sampled at MW9	total filtered = 3000	
	PH = 7.0	for view of details	
	PH	7.0	cond
	5.79	14.6	280.75
	6.01	14.6	280.75
	6.00	14.8	276.25
	5.11	14.2	317.75
0170	sampled Backy	mountain He. into sp. 20	
	PH = 7.0	14.6	280.75
	PH	7.0	280.75
	5.79	14.6	280.75
	6.01	14.6	280.75
	6.00	14.8	276.25
	5.11	14.2	317.75
0150	MW18	temp 13.0°C	385 ms
0155	calibrated PH meter w/	100-110 00	
0156	bottom pump, set at 2.0 gpm		
0157	PH = 7.0	14.6	280.75
0158	PH = 7.0	14.6	280.75
0159	PH = 7.0	14.6	280.75
0160	PH = 7.0	14.6	280.75
0161	PH = 7.0	14.6	280.75
0162	PH = 7.0	14.6	280.75
0163	PH = 7.0	14.6	280.75
0164	PH = 7.0	14.6	280.75
0165	PH = 7.0	14.6	280.75
0166	PH = 7.0	14.6	280.75
0167	PH = 7.0	14.6	280.75
0168	PH = 7.0	14.6	280.75
0169	PH = 7.0	14.6	280.75
0170	PH = 7.0	14.6	280.75

1900	Sampled MW17	PH's < 2.0 car	
1910	NOA's and fuel metals		
	left site		
	Wahnege Calif - 2nd event	3rd day 9-27-74	
0145	arrived on site	Temp ~ 50°F	- clear sunny
0150	MW9	TD 86.40' DTW	57.79' 151 ft
	MW9	32.8 gallons per gal (+ min)	
	calibrated meter	/ near 7.10 V	141.8 ms = 1.1
	begin pumping MW9 at	1.0 gpm	
0821	PH 7.25 mV - 7	temp 12.7°C	cond. 378 ms
0828	after 7.0 gallons	PH 5.95 mV 53	temp 12.9°C
0835	after 12.0 gallons	PH - mV -	temp - °C
	PH 6.01 mV 47	temp - °C	cond - ms
0845	PH 6.01 mV 47	temp 13.0°C	cond 385 ms
0850	PH 6.00 mV 43	temp 13.0°C	cond 362 ms
0856	PH 5.97 mV 49	temp 13.5°C	cond 375 ms

0856	PH 5.97 mV 49	temp 13.5°C	cond 375 ms
	after 33 gal		
	PH 5.97 mV 49		
	after 21 gal		
	PH 6.00 mV 43		
	after 27 gal		
	PH 6.01 mV 47		
	temp 13.0°C		
	cond 385 ms		
	temp 13.5°C		
	cond 375 ms		
	temp 13.0°C		
	cond 362 ms		
	temp 13.5°C		
	cond 375 ms		



1310	reduced flow to < .1 L/min	reduces flow to < .1 L/min	replicate measurement
1320	pH 8.61	mV -68	temp (°C) 16.7°
1323	pH 8.63	mV -69	cond. (µs) 147.4
1330	sampled MW16	could not get enough replicates (pH < 2.0)	
1345	H <sub>2</sub> O for last test s.c. to get more ice		
1358	MW 16	TD 26.80 DTW 5.68'	
1405	began purging at 1.5 gal	purge 27 gal. (+ 5 min)	
1417	pH 8.09	temp 15.0 °C	cond. 192.0 µs
1412	pH 7.34	temp 11 °C	cond. 175.6 µs
1419	after 10 gal. mV -2	temp 2.4 °C	cond. 102.3 µs
1424	after 20 gal. mV -2	temp 2.3 °C	cond. 193.0 µs
	25 gal. bottle ID's	lot #	SIS
	VOA's MW16	B3147420	A0116723
	MW16	B3147420	A0170622
	Metals MW16	H318216	A0553391
1426	reduces flow to < .1 L/min	reduces flow to < .1 L/min	replicate measurement

1427	pH 6.96	temp 12.4 °C	cond. 111
1429	pH 6.95	temp 12.2 °C	cond. 111
1431	pH 6.94	temp 12.7 °C	cond. 111
1434	pH 7.90	temp 12.7 °C	cond. 111
1435	sampled MW 16	temp 12.7 °C	cond. 111
1435	sampled MW 16	temp 12.7 °C	cond. 111
1451	collected water at MW	TD 21.80 DTW 10.33	
1452	begin purging at 1.5 gal	TD 21.80 DTW 10.33	
1455	pH 8.53	mV -48	temp 13.2 °C
1504	after 11 gal. mV -5	temp 11.8 °C	cond. 150.3 µs
1513	after 20 gal. mV -5	temp 11.8 °C	cond. 150.3 µs
1522	after 27 gal. mV -5	temp 11.8 °C	cond. 150.3 µs
1523	reduced flow to < .1 L/min	temp 11.8 °C	cond. 150.3 µs
	bottle ID's	lot #	SIS
	VOA's MW16	B3147420	A150257
	MW16	B3147420	A1910524
	Metals MW16	H318216	A0553391
	reduces flow to < .1 L/min	reduces flow to < .1 L/min	replicate measurement
1524	pH 6.88	temp 12.4 °C	cond. 111
1526	pH 6.88	temp 12.4 °C	cond. 111
1530	pH 6.88	temp 12.4 °C	cond. 111
1530	sampled MW 16	temp 12.4 °C	cond. 111

1530 Sampled MW 16 - pH < 2.0 for VOA & metals



0915

sampled MW3  
total metal  
pH tested  
= 2.0

total water purged + 36 gal

0930

left LF for maintenance  
generator

0945

packing Compuchem cooler in bins  
ice/ice blocks - temperature strips  
in each cooler

1100

Fixed Janet Cox's

1110

Cox's appraised by Janet

1120

repacked coolers

1150

arrived at LF for shipment

115

left LF

General Notes:

- 1) pH/cond. meter was calibrated at field site w/ new 7.10 buffer and daily with new 14.3 upS cond. Std.
- 2) pH was tested in field on all 1130 water samples.
- 3) all work was conducted safely on time by basis and according to all procedures / guidelines.

*[Signature]*

**APPENDIX III**

Previous Landfill Groundwater Organic Analysis  
Summary Table and Data Evaluation

**WATAUGA COUNTY 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
<b>Trichloroethene (TCE)</b>	December 11, 1990	SW846 Method 8240	5			9		---	2.8	5	
	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	
<b>1,1,1-Trichloroethane (1,1,1-TCA)</b>	December 11, 1990	SW846 Method 8240	5		394	102			200	200	
	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	
<b>Tetrachloroethene (PCE)</b>	December 11, 1990	SW846 Method 8240	5		7	25			0.7	5	
	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	
<b>1,1-Dichloroethane (1,1-DCA)</b>	December 11, 1990	SW846 Method 8240	5		52	178			700 <sup>1</sup>	---	
	November 16-18, 1992	SW846 Method 8010	1		41	250		81	700 <sup>1</sup>	---	
	March 5, 1993	EPA Method 502.2	0.7		96	173.3	1.2	77	700 <sup>1</sup>	---	
	March 5, 1993	SW846 Method 8021	0.7		82	161	1.1	43.7	700 <sup>1</sup>	---	
<b>1,1-Dichloroethene (1,1-DCE)</b>	December 11, 1990	SW846 Method 8240	5		80	7			7	7	
	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	
<b>cis-1,2-Dichloroethene (cis-1,2-DCE)</b>	March 5, 1993	EPA Method 502.2	0.7	0.7	1.4	36.4		225	70	70	
	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	
Vinyl Chloride	March 5, 1993	SW846 Method 8021	0.6						5	5	
	December 11, 1990	SW846 Method 8240	10					---	.015	2	
	November 16-18, 1992	SW846 Method 8010	1			3		12	.015	2	
Dichlorodifluoromethane	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	
	December 11, 1990	SW846 8240	5			21		---	0.19	---	
Chloroethane	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	---	
Trans-1,3-Dichloropropene	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)			*		*	---	---	
	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	
Chloroform	March 5, 1993	SW846 Method 8021	0.5						1.8	75	
	December 11, 1990	SW846 Method 8240	5					---	0.19	100	
	November 16-18, 1992	SW845 Method 8010	1				2	1	0.19	100	3
1,2-Dichloropropane	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	
	December 11, 1990	SW846 Method 8240	5					---	0.56	5	
2,2-Dichloropropane	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	
1,1-Dichloropropene	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)		*	*	*	*	---	---	
Bis(2-ethylhexyl)phthalate	March 5, 1993	SW846 Method 8240	0.5	3.8					---	---	
	March 5, 1993	SW846 Method 8270	2		20				---	---	
Xylenes, Total	March 5, 1993	SW846 Method 8021	0.4					1	0.4	10	
	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	
	December 11, 1990	SW846 Method 8240	5					---	0.38	5	
1,2-Dichloroethane	November 16-18, 1992	SW846 Method 8010	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	

EPA 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, 1992 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

## Data Evaluation

The organic compounds detected in the groundwater at Watauga County Landfill are primarily dense Chlorinated solvents. The solvents have little affinity for soils and are seldom a problem in surface water because of their volatility. (EPA/600/8-83/019, May 1983). Metals concentrations detected in the groundwater are generally low or are below the analytical method detection limit, although several metals, Cadmium and Iron in particular, have been observed at levels above those established by the EPA MCL and the Secondary MCL, respectively.

Metal concentrations observed during the Assessment monitoring program will be evaluated to determine if groundwater resources are being adversely impacted by sources not directly related to the aquifer medium. The Groundwater and Surface Water Monitoring Program (SAP - Appendix I) included as an attachment to the Watauga County Assessment Plan describes the metal analysis to be conducted as part of the Assessment Plan. Cadmium, Iron, Barium, and Mercury will comprise the initial metal target analyte list for the first year of Assessment monitoring. Subsequent to complete annual Appendix II analyses conducted on the 'core' assessment monitoring well network, appropriate revisions to the target analyte list will be made.

The Groundwater and Surface Water Monitoring Program, Appendix I of the Assessment Plan, also describes the organic analysis to be conducted as part of the Assessment Plan. The following twelve "primary detected organic compounds" will initially be included in the target analyte list for the first year of Assessment monitoring. Analytical results of additional organic analytes provided by the necessary methods will also be provided. Subsequent to the complete annual Appendix II analyses conducted on the 'core' assessment monitoring well network, appropriate revisions to the target analyte list will be made.

A descriptive summary of constituents detected as a result of prior sampling and analysis is contained in the Evaluation of Existing Data contained in Section II of the Assessment Plan. Tables presenting data summaries of landfill well groundwater, potable well water, stream, and leachate analyses are also contained within Section II of the Assessment Plan. The following data evaluation explores in greater detail the organic constituents detected at the site.

Methylene Chloride was detected in the Carroll residence well water in two out of three sampling events and Vinyl Chloride was detected in the Carroll residence well water in only one out of three sampling events. Although detected on different sampling events the two compounds have also been detected in the accompanying trip blank. The concentrations of Methylene Chloride and Vinyl Chloride detected in the Carroll residence well were above the established NCS and MCL for Methylene Chloride, and above and approaching, respectively, the established NCS and MCL for Vinyl Chloride. Methylene Chloride was detected at 138.2 ppb in the June 23, 1993 sampling of the Carroll residence well water, well above the MCL of 5 ppb.

Methylene Chloride has also been detected at various levels in three (3) other domestic wells within the Rocky Mountain Heights Subdivision. Methylene Chloride was possibly detected in the Perry residence well water although the analytical result was an estimated result denoted by the analytical lab only as <0.06. Methylene Chloride was detected at significant levels in the initial sampling of two other residential wells (Shared well # 1 and the Ward well). Resampling of the Perry residence well, the Shared Well #1 and the Ward residence well resulted in the absence (non-detection) of Methylene Chloride, suggesting a laboratory contaminant source.

Dichlorodifluoromethane was detected above the established NCS in three of the potable water wells neighboring the site (i.e.: Nissan-Mazda, Carroll, and Perry residences). Again, Dichlorodifluoromethane does not have an associated MCL.

Benzene was detected above the established NCS on all three sampling events of the Carroll residence well but below the established MCL. Benzene was not detected in any other potable water well neighboring the site.

Trans-1,3-Dichloropropene was not detected in any of the sampled potable water wells neighboring the site.

Chloroethane was detected in the Carroll residence well water at concentrations greater than twenty (20) times the concentrations observed in any of the groundwater monitoring wells at the landfill. Chloroethane was also detected in the Nissan-Mazda well water greater than twice the concentrations observed in any of the groundwater monitoring wells at the landfill. Chloroethane does not have an established MCL or NCS.

In summary, parameters detected in the landfill wells and also detected in potable wells above applicable MCLs are Methylene Chloride (Carroll), TCE (Carroll/Nissan) and PCE (Carroll/Nissan).

A summary of analysis results for the organic compounds discussed above can be found in pages 2 and 3 of the attached detected organic constituent summary table. Page 2 of the summary table lists Chlorinated volatile organics detected primarily in groundwater monitoring points located along the Bolick site and page 3 lists detected Benzene and Propane derivatives.

Questionable Detected Organic Compounds

Other organic compounds identified by landfill groundwater sampling and analysis were:

- 1) Detected at trace levels approaching or at analytical minimum detection limits.
- 2) Previously known as common laboratory contaminants.
- 3) Detected only once and at only one monitoring point. and/or
- 4) Also detected in the Trip Blank.

These compounds are listed with appropriate detection addendums as referenced above are:

Chloroform	1,3,4
Bromodichloromethane	1,2
Carbon Tetrachloride	1
1,2-Dichloroethane	1
1,4-Dichlorobenzene	1
1,2-Dichloropropane	1
2,2-Dichloropropene	1
1,1-Dichloropropene	2
Bis(2-ethylhexyl)phthalate	2,4
Xylenes. Total	1,2
4,4'-DDD	1,2

2,2-Dichloropropane additionally co-elutes with cis-1,2-Dichloroethene when utilizing EPA Method 502.2. Related data sets utilizing different analytical methods suggests 2,2-Dichloropropane detection was likely the result of the presence of cis-1,2-Dichloroethane.

A summary of analysis results for the organic compounds discussed above can be found on pages 3 and 4 of the attached detected organic constituent summary table. These compounds will continue to be analyzed in Full Appendix II monitoring scheduled for "core" assessment wells.

Organic Compounds Only Detected in Potable Water Wells

Organic compounds detected in the residential and business potable water wells neighboring the site but not detected in the monitoring well network at the landfill, listed by order of decreasing occurrence and concentration are:

Parameters detected only at potable water wells	Highest concentration (ppb)	NCS/MCL (ppb; ug/L)	Location Detected
Chloromethane	1.48/<0.9	---/---	Carroll/Perry
Trichlorofluoromethane	37.1/0.4	2100/---	Carroll/Nissan
Styrene	2.8	0.014/100	Carroll/Greer
tert-Butylbenzene	1.1	---/---	Carroll/Bolick
Ethylbenzene	trace	29/700	Greer
Isopropylbenzene	0.7/0.6	---/---	Bolick rental
1,3,5-Trimethylbenzene	0.7	---/---	Bolick rental
Napthalene	0.7	---/---	BREMCO/Perry
Toluene	0.6 <sup>T</sup> /0.8 <sup>T</sup>	1000/1000	Carroll/Nissan/Greer
4-Isopropyltoluene	0.2	---/---	Carroll
alpha-Chlordane	0.4	0.027/2	Shared Well #1
gamma-Chlordane	0.3	0.027/2	Shared Well #1
sec-Butylbenzene	0.2	---/---	Shared Well #1
Tert-Butyl Methyl Ether	2.4	200/---	Carroll
Methyl Ethyl Ketone	trace	170/---	Bolick rental

The fifteen (15) organic compounds listed above are contaminants that have previously been associated with private water well systems (Sorg, Thomas, 1986). Eight (8) of the compounds only detected in the residential and business potable water wells are BTEX components and are often found as the result of activities immediately around the private well heads and/or components of the well systems. Eight (8) of the compounds were detected in the Carroll residence well with three (3) of these same compounds were also detected in the Nissan-Mazda well.

The two (2) Chlordane compounds are commonly used in Termite extermination. The chlordane compounds were detected in only one (1) well, and their occurrence is likely a result of improper application. A resampling of the chlordane contaminated well resulted in no detection of any organic compounds.

A presentation of analytical results for the fifteen (15) organic compounds discussed above can be found in the summary table for the volatile and semi-volatile constituents detected in the residential and business potable water well testing.

**APPENDIX IV**

Potable Well Organic Analysis Summary Table

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

CONSTITUENT	MARCH 5, 1993*	MARCH 16, 1993*	MARCH 24, 1993*	JUNE 23, 1993**	JULY 13, 1994**	NCS	MCL
<b>Carroll Residence (12)</b>							
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	70
cis-1,2-Dichloroethene#	1.2	0.9		<1.0		70	---
2,2-Dichloropropane#	1.2	0.9		ND		---	---
4-Isopropyltoluene	ND	0.2	NS	ND	NS	---	---
sopropylbenzene	0.6	ND		ND		---	---
Methylene Chloride	ND	43.0(XT)		ND		---	---
Styrene	2.8	0.5		138.2		5	5
Tert-Butyl Methyl Ether	ND	ND		ND		0.014	100
Tetrachloroethene	5.4(X)	4.7		2.4		200	---
Toluene	ND	0.6(T)		4.2		0.7	5
1,1,1-Trichloroethane	19.7	15.7		ND		1000	1000
Trichloroethene	7.0(X)	5.5(X)		29.4		200	200
Trichlorofluoromethane	37.1	20.2		7.0		2.8	5
Vinyl Chloride	1.7(T)	ND		ND		2100	---
p and m-Xylene	ND	ND		ND		0.015	2
o-Xylene	ND	3.4		<1.0		400	10,000
ND	ND		2.9			400	10,000
<b>Nissan-Mazda Dealership (4)</b>							
Benzene	ND				trace	1.0	5
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	13.0		NS	ND	---	---
Methylene Chloride	ND	ND			ND	---	---
Tetrachloroethene	21.8(X)				4.5	5	5
Toluene	ND				30.9	0.7	5
1,1,1-Trichloroethane	14.7	0.8(T)			ND	1000	1000
Trichloroethene	11.2(X)	18.3			22.9	200	200
Trichlorofluoromethane	0.4	9.1(X)			12.6	2.8	5
o-Xylene	0.4	ND			ND	2100	---
0.5(T)	0.5(T)				ND	400	10,000

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

(Other footnotes located on page 4)

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

CONSTITUENT	3/5/93*	3/10/93*	5/11/93**	6/23/93**	3/30/94**	4/6/94**	6/2/94**	NCS	MCL
Blue Ridge Electric Membership Company - (BREMCO) (5)									
1,1-Dichloroethane	0.7					<1.0	1.4	700	...
Naphthalene	0.6					NA	NA	...	...
1,1,1-Trichloroethane	0.2					<1.0	<1.0	200	200
Trichloroethene	0.5	NS				<1.0	<1.0	2.8	5
1,1-Dichloroethene	ND					1.0	1.9	7	7
cis-1,2-Trichloroethene	ND					<1.0	ND	70	70
Tetrachloroethene	ND					<1.0	<1.0	0.7	5
Bolick rental resident (2)									
tert-Butylbenzene	1.1					ND	ND	...	...
sopropylbenzene	0.7					ND	ND	...	...
Trichloroethene	0.5					ND	ND	...	...
1,3,5-Trimethylbenzene	0.7	NS				ND	ND	2.8	5
1,1-Dichloroethane	ND					trace	NS	700	...
1,1-Dichloroethene	ND					trace	NS	7	...
Methyl Ethyl Ketone	ND					trace	NS	7	7
Perry Residence (11)									
Dichlorodifluoromethane	2.5					ND	ND	0.19	...
Naphthalene	0.7					ND	ND	...	...
Chloromethane	<9	NS				ND	ND	...	...
Methylene Chloride	<0.6					ND	ND	5	5
Chloroform						<1.0	NS	0.19	5
Greer residence (15)									
Benzene						<1.0	NS	1.0	5
Toluene						6.4	trace	1000	1000
Tetrachloroethene	NS	ND				trace	NS	0.7	5
Ethylbenzene						trace	NS	29	700
p and m - Xylene						<1.0	NS	400	10,000
Styrene						trace	NS	0.14	100
Ward residence (24)									
Methylene Chloride						3.2	ND	5	5
1,1,1-Trichloroethane						<1.0	<1.0	200	200
Trichloroethene						trace	trace	2.8	5
Tetrachloroethene	NS	NS				ND	<1.0	0.7	5
Carbon Tetrachloride						ND	<1.0	0.3	5
1,1-Dichloroethane						ND	<1.0	700	...
Chloroform						ND	trace	0.19	5

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

(Other footnotes located on page 4)

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

CONSTITUENT	3/18/93*	3/23/93**	5/11/93**	6/23/93**	8/3/93**	8/9/93**	9/21/93	10/20/93**	3/30/94**	9/21/94**	NCS	MCL
<b>Shared Well #1 (8 Houses) (13)</b>												
sec-Butylbenzene	0.2										...	...
Carbon Tetrachloride	0.1										0.3	5
Methylene Chloride	1.5	NS									5	5
alpha-Chlordane	0.4										0.27	2
gamma-Chlordane	0.3										0.27	2
<b>Shared Well #2 (4 Houses) (14)</b>												
1,4-Dichlorobenzene	0.5										ND	...
1,1-Dichloroethene	ND										<1.0	...
1,1,1-Trichloroethane	ND	NS									<1.0	7
Chloroform	ND										200	200
<b>Slimko residence (20)</b>												
Chloroform	NS	<1.0	NS	NS	NS	NS	NS	NS	NS	NS	0.19	5
1,1,1-Trichloroethane		trace									...	200
<b>Johnson residence (32)</b>												
Chloroform	NS	NS	trace	NS	NS	NS	NS	NS	NS		0.19	5
<b>McLean residence (26)</b>												
Chloroform	NS	NS	NS	<1.0	NS	NS	NS	NS	NS		1.0	5
<b>Yates residence (30)</b>												
Chloroform	NS	NS	NS	NS	<1.0	NS	NS	NS	NS		0.19	5
<b>McClintock residence (33)</b>												
1,2-Dichloroethane	NS	NS	NS	NS	NS	NS	NS	NS	NS		0.19	5
Chloroform	NS	NS	NS	NS	NS	NS	NS	NS	NS		0.19	5
<b>Welch residence; Meadowview condominiums (38)</b>												
Chloroform	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	700	...
Chloroform	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.19	5

NOTE: All Concentrations are in ppb (ub/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*
Roten residence (3)	March 5, 1993* and July 3, 1994**
Hollar and Green Produce (6)	March 5, 1993*
Chevrolet Dealership (7)	March 5, 1993*
Vannoy residence (8)	March 5, 1993*
Martin High County Rentals #1 (9)	March 5, 1993*
Martin High County 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*
Hodges residence (19)	March 18, 1993*
Findt residence (21)	March 18, 1993*
Fusher residence (22)	March 23, 1993**
Younce residence (25)	May 11, 1993**
Medlin residence (27)	June 23, 1993**
Factor residence (28)	June 23, 1993**
Hobinson residence (29)	June 23, 1993**
Cook residence (31)	August 3, 1993**
Animal Control Office (32)	August 3, 1993**
Green residence (34)	October 20, 1993**
Shared well #3 (35)	October 20, 1993**
BREMCO residence (36)	September 21, 1993**
Brook Hollow Trailer Park (37)	October 11, 1993**

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 Consultants (CVLC) utilizing EPA Methods 502.2 (Volatiles) and 525.1 (Semi-Volatiles)

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

# denotes compound co-elutes

ND denotes no compounds detected for entire analytical scan

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 Quality Standard (DEHNR-15A NCAC 2L.0202)

MCL-EPA Primary Drinking Water Standard Maximum Containment Level